Compilation of Latin American Initiatives and the Regionalization of a University Project to Reduce the Gender Gap in IT

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Abstract

The objective of this paper is to make a compilation of Latin American initiatives of both public and private institutions that have developed activities in the last two years in favor of reducing the gender gap in IT. In addition, a compilation of the efforts carried out in Costa Rica in this line is made, in which it is expected that this will be a benchmark of actions that have been carried out at the local level. And finally, the experience of the regionalization that has been carried out in a university project is presented whose purpose is to be able to bring the concept of computational thinking to the youngest and in this way to be able to collaborate with the reduction of the gap in the IT sector and encourage more interest in this area from an early age. This experience highlights the activities carried out and the first results obtained.

Keywords

Programming, computational thinking, equity, regionalization

1. Introduction

It is a reality worldwide that there is a difference in gender equity in terms of the labor force, for example, Ruiz points out that in Costa Rica in 2014, the ICT sector labor force participation by sex was 35.9% for women and 64.1% for men [1]. On the other hand, Manpower points out in its study "Costa Rica: 10 most difficult positions for companies to fill", the IT area is ranked number 7 in level of difficulty [2].

There are different entities in Costa Rica that seek to promote this equity, the Ministry of Science, Innovation, Technology and Telecommunications (MICITT) has among its objectives to promote gender equity in training, employment and enjoyment of the products of science, technology, telecommunications and innovation As well as it has developed jointly with other instances the I Action Plan 2018-2023: National Policy for Equity between Men and Women in Training, which aims to: "To promote equity in the participation of women with respect to men in the attraction,

permanence, training, qualification, quality employment and research, in the different fields of science, technology and innovation, in order to facilitate access to and enjoyment of the scientific-technological advances" [3].

There is also support from private companies such as National Instruments, SYKES, 3M Company, Microsoft (which will be explained further on) that support these equity initiatives. This paper compiles the activities in favor of this issue in Costa Rica, as well as examples of groups, entities and companies that support activities throughout the Latin America to promote gender equity in access to technology and opportunities. In addition, the experience of the project "Creating Programming Skills in Young People in Costa Rica" is presented, as an initiative of the School of Informatics of the National University, to contribute to generate access options for students in the field of technology and to bring this knowledge to the regional branches of the National University.

This paper is structured in the following sections: ii. Initiatives in the Latin America in favor of gender equity in the IT sector, iii. IT activities in favor of gender equity in Costa Rica, iv. Project Building Programming Capacities, v. Regional Headquarters, vi. Recommendations and Conclusions.

2. Initiatives in the Latin Americas in favor of gender equity in the IT sector

For this section, a bibliographic search of initiatives that have been carried out in all the countries of the Latin America was conducted to reflect the different movements in the IT area that have been carried out in favor of gender equity This compilation shows the support that has been given in the different societies of America between public or private instances.

Table 1 presents, in alphabetical order by country, the initiatives that were found, as well as their main actors and the description of this initiative.

Table 1
Efforts in Latin America

Country	Name of the initiative	Public or Private	Description of the initiative
Argentina	Latin American Open Lecture "Matilda and Women in Engineering" (CAL Matilda) [4]	CAL Matilda represents a joint effort of three founding guiding institutions: the Council Federal Association of Engineering Deans of Argentina - CONFEDI, the Colombian Association of Engineering Schools - ACOFI and the Latin American and Caribbean Consortium of Engineering Institutions - LACCEI.	Its objective is to create an academic space for debate, reflection, collective construction of knowledge, teaching, research and activities that stimulate and promote equal rights, opportunities and spaces for women in the academic and professional environment, and for the promotion of engineering vocations in girls and young women in Latin America and the Caribbean.
Bolivia	Club STEAM[1] [5]	Private Energea – Tecnonautas Pan American Development Foundation and Boeing.PADF)	Seeks to encourage participants' interest in areas related to Science, Technology, Engineering, Arts and Mathematics.
Brazil	Encouraging Girls in Science, Engineering and Information Technology Project" [6]	It is underway at the University of Caxias do Sul.	The activity consisted of a workshop in which 21 girls between the ages of 15 and 17, students from public and private schools in the city, put their hands to work and created a mobile application.
	Meninas Digitais[7]	The Digital Girls Program was created in 2011 under the coordination of the Regional Secretariat of the Brazilian Computer Society (SBC) in Mato Grosso and, in 2015, it was institutionalized by the SBC, receiving its seal, as a program of national interest to the Computing community.	The Digital Girls Program aims to publicize the area of Computing and its technologies to arouse the interest of high school students (in its various modalities) and final years of elementary school, so that they know better the area and feel motivated to pursue a career in computing. The Program's actions are diversified: offering mini-courses and workshops; performance of dynamics; lectures with students and professionals who already work in the area sharing their experiences; holding events etc.

[1] http://tecnonautasbolivia.com/club-steam/

Chile	PROVOCA Mentoring Network [2] [8]	Public Associated Universities, Inc (AUI) in conjunction with the National Radio Astronomy Observatory (NRAO) and the National Radio Astronomy Observatory (NRAO) LeadWoman	Supporting women who decide to follow their scientific vocation and accompanying them until they reach their goal
Colombia	Latin American Open Lecture "Matilda and Women in Engineering" (CAL Matilda) [9]	CAL Matilda represents a joint effort of three founding guiding institutions: the Federal Council of Engineering Deans of Argentina - CONFEDI, the Colombian Association of Engineering Schools - ACOFI and the Latin American and Caribbean Consortium of Engineering Institutions - LACCEI.	Its objective is to create an academic space for debate, reflection, collective construction of knowledge, teaching, research and activities that stimulate and promote equal rights, opportunities.
Costa Rica	25 women in Latin American Science [10]	Private Company 3M	Seeks to recognize women scientists who are making an impact through their research.
El Salvador	DigiGirlz [11]	Private The Microsoft company	Provide young people with the opportunity to learn and develop STEM skills and equip them with the curiosity and skills that will serve them well in an increasingly digital world.
Ecuador	Partnership STEM Ecuador [12]	The Chamber of Small and Medium Enterprises of Pichincha; the Ministry of Education and the National University of Education. (UNAE)	This initiative not only generates knowledge, but also provides the youngest with skills and abilities so that they can solve problems on their own, qualities that contribute to their growth.
Guatemala	DigiGirlz [13]	Private The Microsoft company	Provide young people with the opportunity to learn and develop STEM skills and equip them with the curiosity and skills that will serve them well in an increasingly digital world.
Guyana	Guyanese Girls Code' (GGC) [14]	Public The Ministry of Public Telecommunications of Guyana, in collaboration with the National Center for Educational Resource Development	The goal of using Scratch and BBC micro: bit to introduce girls in grades 7 to 9 to ICT education.
Honduras	DigiGirlz [15]	Private The company Microsoft	Provide young people with the opportunity to learn and develop STEM skills and equip them with the curiosity and skills that will serve them well in an increasingly digital world.
Jamaica	Girls 4 Tech [16]	Public and Private MasterCard Company	The initiative seeks to guarantee women's access to a wide range of digital technology alternatives that promote their development.
Mexico	GIRL STEM CAN [3] [17]	Public/Private	Addresses the need to introduce these fields to girls in high school levels through educational opportunities outside the classroom and supported by mentors and visual materials.
Nicaragua	DigiGirlz [18]	Private The company Microsoft	Provide young people with the opportunity to learn and develop STEM skills and equip them with the curiosity and skills that will serve them well in an increasingly digital world.
Panama	25 women in Latin American Science [19]	Private Company 3M	Seeks to recognize women scientists who are making an impact through their research.
Peru	Student role model program [20]	Public The Professional School of Software Engineering of the National University of San Agustin of Arequipa	The goal was to create a community of female students who would become role models who would share their motivation for STEM with the new students and who would actively participate in the recruitment process.
Dominican Republic	e-Girl Clubs [21]	Public It was promoted by the Research Center for Women's Action. (CIPAF)	The project is aimed at girls and adolescents in the public education sector in the Dominican Republic as part of the efforts to eliminate prejudices and stereotypes that women are not "good" at mathematics or that they are not suited to "hard" scientific fields such as physics or computer science.
Uruguay	GIRLS IN ICTS CONFERENCE [22]	This event is a worldwide initiative promoted by the International Telecommunication Union (ITU) carried out since 2011, in which the Faculty of Engineering of the University of the República	On the day, 320 girls from 21 high schools were received public and private from Montevideo and the interior of the country, and three types of workshops were developed: 1) Butiá robot workshop, 2) Electrifying workshop, 3) Map your world workshop

[2] https://innovacionchilena.cl/tag/red-de-mentoras-provoca/

[3] http://ninastem.aprende.sep.gob.mx/en/demo/home_

[23] Girls in Information and Communication Technologies (ICT) day	Uruguay has been participating in this event for several years, opening the doors of the faculty, and in particular the laboratories of the Computing Institute (InCo) and the Institute of Electrical Engineering (IIE). Facultad de Ingeniería (School of Engineering) of the Universidad de la Republica, Uruguay	workshops for robotics, circuits and maps making were held for high school girls as a way to promote ICT careers in Uruguay.

Source: Own elaboration.

Table 1 shows that efforts do exist in Latin America and that there are efforts from the public and private sectors.

3. IT activities in favor of gender equity in Costa Rica

In the last five years, a series of activities have been organized by public and private institutions in Costa Rica, including workshops, hackathons, among others. The activities are aimed at promoting gender equity, giving an opportunity to disseminate these activities in order to integrate young women to participate in these events. In this section a compilation of activities is made in order to visualize all the efforts that have been made in Costa Rica in recent years.

Since 2012, the Sulá Batsú cooperative in conjunction with the Technological Institute of Costa Rica, from the San Carlos Local Technological Campus, has developed projects that seek to create employment conditions and work for women in rural areas, among these projects are clubs for girls and clubs for mothers, where they have developed communication and leadership skills, as well as technology camps and hackathons, among other activities aimed at women in the San Carlos area.

In addition, the case of National Instruments, which has held since 2014 the annual Girl's Day: Let's Engineer! activity, an event dedicated to girls from 6 to 12 years old, in which all its employees -both men and women- conduct workshops focused on science and engineering [24].

Since 2016, SYKES has been organizing the SWIT event, the aim of the activity is to get more SYKES employees interested in technological areas, this space is dedicated to female employees of the company [25].

The office of the First Lady of Costa Rica in conjunction with the U.S. government and the Ministry of Public Education promoted in 2018 the Teach Her initiative which aimed to reduce the gender gap in education through public-private partnerships, so that women could have access to scientific, engineering, mathematics and design careers, this project was developed in a pilot plan in which the following institutions participated: Naranjo Experimental Bilingual High School, San José de la Montaña High School, Poas High School, Hojancha Professional Technical High School, Changuena Rural High School, El Roble Environmental High School and Turrialba Experimental Bilingual High School [26].

For its part, Intel in conjunction with Inspiring Girls in 2018 held the Wikithon, an activity in which 60 girls learned about the history of outstanding women in STEM areas and uploaded their profiles to Wikipedia. The activity was aimed at girls from public schools [27].

The STEAM Workshops for Young Women project, promoted by the Embassy of the United States of America in 2019, carries out a series of workshops in which a constructionist methodology is applied, which allows participants to learn by doing in a fun, creative and collaborative way. The

project is carried out with the support of the Ministry of Public Education (MEP) and the Omar Dengo Foundation (FOD) and is aimed at women between the ages of 9 and 20 [28].

The Virtual Innovation, Science and Technology Meeting for women in the Northern Zone was held in 2019, this event aimed to promote the development of activities that would inspire men and women to study technological careers, create their own ventures and use technology as a strategic tool for their businesses, and thus contribute to the development of a more equitable region with greater opportunities. This initiative was made possible thanks to the National Learning Institute (INA), the Agro-industrial Technical School (ETAI), INAMU, the Technological Institute of Costa Rica (TEC), the National Technical University (UTN), the Ministry of Economy, Industry and Commerce (MEIC), the Ministry of Planning (Mideplan) and the Sulá Batsú Cooperative [29].

On October 22, 2020, the Gender Parity Commission of the Federated College of Engineers and Architects held the First Meeting of Women in Science and Technology, an activity in which they held talks on gender gaps, vocational development, and the participants also enjoyed virtual games. This initiative was aimed at students from technical and academic high schools in 9th, 10th and 11th grade from all over the country. The activity was supported by MICITT, MEP, INA, ICE, TEC, UCR, INAMU and the Organization of Iberoamerican [30].

The MenTe in Action (Women in Science and Technology) program in 2020 carried out its 12th Edition, the objective of this project was to promote the development of young women in the area of Science and Technology, so that there are more and more women involved in STEAM areas in the country. The event was aimed at young women between the ages of 15 and 19. This activity was carried out in conjunction with the U.S. Embassy in Costa Rica, and the companies Accenture and P&G [31].

CINDE developed in 2020 the Women Engineering Projects in Community Service initiative which promotes the teaching of STEAM areas to women from schools outside the Greater Metropolitan Area, the project is supported by Arizona State University, the Ministry of Public Education and the U.S. Embassy in Costa Rica [32].

The MICITT in celebration of the International Day of Women and girls in science in the year 2022 held participatory talks allowing an approach that would motivate girls and young women to study science and technology-oriented careers [33]. One week was dedicated to the development of lectures and initiatives.

On the other hand, Microsoft and the Ministry of Science, Technology and Telecommunications (MICITT) carried out the sixth edition of the DigiGirlz program in 2022, which seeks to break stereotypes and empower girls and women who want to dedicate their lives to creating technological solutions. The activity also sought to develop skills in the areas of science, technology and mathematics to combat the gender gap that exists in the area and was aimed at Costa Rican women and girls [34].

4. Building Programming Capabilities Project

4.1 Project description

The project "Building Programming Skills in Youth and Teachers in both Secondary and Higher Education" was formulated in 2019 and started in 2020, it is an extension project of the School of Informatics of the National University. It aims to build programming skills in young people and teachers, both high school and higher education. The participants are from the Greater Metropolitan Area and the regional branches of the National University [35]. In the project, workshops are given using visual programming with the following tools: Scratch, Scratch Jr., Arduino, micro: bit and Tinkercard. The tools are selected because they allow visual programming, Rodriguez defines this concept as: "The use of visual expressions (such as graphics, animations or icons) in the programming

process. It is often used to form new programming languages that lead to new paradigms, such as programming by demonstration. Visual programming can also be used in graphical presentations of the behavior or structure of a program. The goal of visual programming is to improve the understanding of programs and to simplify the programming itself." [36][37].

The workshops incorporate the application of computational thinking, which was coined by Wing he "involves problem solving, system design and understanding of human behavior using fundamental computer science concepts" [38]. To implement its resolution, computer science resorts to the area of programming, which is the set of necessary instructions given to a machine in order to perform a specific task.

4.2 Description of the workshops

The workshops are conducted synchronously using the Zoom videoconferencing tool and are held in a maximum time of two hours where participants are explained about the tool to be used (Scratch, Scratch Jr, Arduino or micro: bit in Tinkercad) and work with them in the development of the construction of a problem. This selection of a problem allows the student to have a greater participation in the development of these problems.

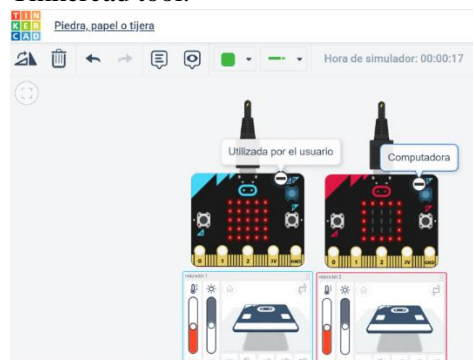Below is an image of the construction of a project in micro: bit where we worked with the Tinkercad tool.

Figure 1: Game made with micro: bit

The image shows the game: rock, paper, scissors where the workshop participants can program using the blocks both the board where they will select the figure (rock, paper or scissors), as well as the board that will be controlled by the computer (where the figures appear randomly) and the board that will be controlled by the computer (where the figures appear randomly.)

In order to support students who, wish to learn more about other resources that are already available, access to the virtual classroom created with materials on the above-mentioned programs is provided. In this way, students can asynchronously watch the videos developed, download manuals, posters and infographics on these topics. Figure 2 below shows the sections according to each of the tools used in the project. This way of having in one place a resource in which students can be supported and even review the material to later create innovative projects in science fairs.

Each of the sections includes video tutorials, manuals, posters explaining the tool and projects in which students can solve problems using computational thinking.

Figure 2: Project Virtual Classroom.

4.3 Methodology

Vargas and Jiménez indicate that constructivism "leads to conceive and develop the teaching and learning processes from the individual's previous knowledge, life experiences and the possible applicability of the contents learned in the real context of the people" [39]. Cambridge Assessment International Education indicates that "Active Learning is based on a theory of learning called Constructivism, which emphasizes the fact that learners construct their own knowledge [40], For this reason, tools such as Tinkercad, micro: bit, Scratch and Scratch Jr. are very useful, because they allow workshop participants to build knowledge that allows them not only to learn the tool for block programming but also to solve problems that may arise in their daily lives.

4.4 Results obtained

Below is a table with the data obtained in the workshops held during the years 2020 and 2021.
Table 2

Data obtained in the workshops

Date	Workshop	Population	Men	Women
October 5, 2020	Programming with blocks	Location Interuniversitaria	11	4
October 7, 2020	Programming with blocks	Location Sarapiquí	16	2
October 28, 2021	Programming with blocks	General public	12	17
October 30, 2020	Programming with blocks	High School Humanístico de Heredia	14	14
October 21, 2020	Programming with blocks	High School Humanístico Nicoya	12	19
December 4, 2020	Programming with blocks	General public	1	4
December 2, 2020	Programming with blocks	General public	5	12
October 29, 2020	Programming with circuits	High School Humanístico Nicoya	7	17
December 4, 2020	Programming with circuits	General public	2	4
December 2, 2020	Programming with circuits	High School Humanístico Coto	4	11
October 7, 2020	Programming with circuits	General public	6	6
September 30, 2020	Programming with blocks	High School Científico Pérez Zeledón	16	15
September 24, 2020	Programming with circuits	General public	3	0
October 15, 2020	Programming with circuits	High School Humanístico Nicoya	7	11
March 23, 2021	Programming with circuits	Location University	9	9
April 14, 2021	Programming with circuits	Location Liberia	23	3
January 25, 2021	Programming with blocks	Location Liberia	1	1

March 2, 2021	Programming with circuits	School of Economics, Universidad Nacional	0	3
March 1, 2021	Programming with blocks	School of Economics, Universidad Nacional	4	2
July 6, 2021	Programming with blocks	MEP Educators	0	7
April 12, 2021	Programming with blocks	Instituto de Estudios de la Mujer, Universidad Nacional	0	3
March 23, 2021	Programming with blocks	Location Nicoya	12	19
February 8, 15 and 22, 2021	Programming with blocks	Costa Rica learn with the public U, General public	7	8
March 3, 2021	Programming with blocks	First entry induction, School of Informatics, Universidad Nacional	30	6
March 3, 2021	Programming with circuits	First entry induction, School of Informatics Universidad Nacional	17	2
March 5, 2021	Programming with circuits	First entry induction School of Informatics, Universidad Nacional	13	2
May 21, 2021	Programming with blocks	Scratch Day (Morning) General public	15	25
May 21, 2021	Programming with blocks	Scratch Day (Afternoon), General public	2	12
August 17, 2021	Programming with blocks	Congress Concities	3	5
October 4, 2021	Programming with blocks	General public	0	4
October 5, 2021	Programming with circuits	Location Chorotega Universidad Nacional	9	2
August 19, 2021	Programming with circuits	General public	14	4
July 28, 2021	Programming with circuits	Congress Compdes4	9	5
July 13, 2021	Programming with circuits	General public	2	3
January 26, 2021	Programming with circuits	Location Liberia	3	1
		Total	289	262

As can be seen in Table 2, there is an almost equal number of 289 male students versus 262 female students for the years 2020 and 2021, for which it is expected to have a higher participation of students in several regions.

These students were asked to respond to a questionnaire about the reasons why they consider this type of workshop to be important:

Table 3
Reasons why you are motivated by these workshops

Reasons why these workshops motivate you
They motivate me to keep learning and reach my goal.
To learn more and improve programming logic
To learn more about the subject
To be able to improve
To get engaged in the subject
To find interest in the career
To reinforce knowledge
To give us an approach to what we are going to receive in the course and career.
They help to guide us
To properly use the programs.
They make the time spent at the National University an interactive environment.
For the variety of knowledge learned
These types of activities help to learn about the various areas in computer science and help to plan in the future in which area to specialize.
In them you can learn about and review interesting topics

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[4] http://www.compdes.org/

They are a good introduction for us freshmen to know what we will find in the career.

They help to understand and visualize some subjects and topics of the career to be studied, in addition to reinforcing the student.

To learn new things

It helps us to get a better extra base, to put it in other words.

Because they give us the initiative to experiment with this kind of programs that teach us

Because they use the elemental, which is the creativity and make us get out of our comfort zone.

Because it is easier to learn by doing than by just listening to someone else explain

Acquire new knowledge

To awaken the interest of students in this type of subjects

They teach in a more dynamic way

To increase our knowledge

Because it motivates us to keep learning and for the enjoyment it gives us.

Help to develop knowledge of topics that are not frequently seen

Because this type of knowledge is important for everyday life, especially now that we live in such a technological time.

To receive a base of short topics that we will be exploring in the future.

Because they help us a lot in learning

Development of new knowledge that can be applied to personal projects

Because it is always useful to learn a little bit of everything, you never know when it might be necessary.

To make students feel more comfortable and prepared for the beginning of classes.

To facilitate the development of programming skills and to generate more interest.

The practices

Because they provide an introduction and create an interest in the subjects being taught.

The National University has 8 university campuses. The regional campuses in which work has been done are: Omar Dengo Campus, Benjamín Núñez Campus, Interuniversitaria Campus, Sarapiquí Campus, Liberia Campus and Nicoya Campus.

Workshops have been held for high school students in the following schools: High School Humanístico de Heredia, High School Humanístico Nicoya, High School Humanístico Coto, High School Científico Pérez Zeledón, and High School Científico Pérez Zeledón.
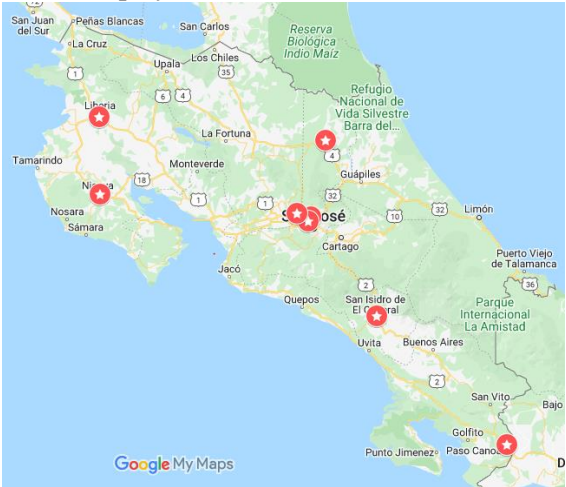
In the image 1 these zones are displayed:

Figure 2: Areas of Costa Rica where workshops have taken place.

A workshop was held for teachers of the Ministry of Public Education and others for the general public, and the company participated in national and international congresses.

There was a positive impact on the methodology that was planned (before COVID-19), since it was thought to be face-to-face. Therefore, it was necessary to carry out online activities. This affected

participation in a positive way because there was support from the teachers of the institutions to participate.

The specific advertising to attract more girls was to make teachers more aware of the importance of promoting gender equity.

6. Recommendations and Conclusions

Table 1 shows that in Costa Rica, the same as in other countries in the Latin American, there are several initiatives in favor of gender equity in the area of technology, which have helped to motivate more young people to study IT.

Since 2020, the project "Creating Programming Skills in Young People and Teachers in Secondary and Higher Education" has overseen conducting various workshops for participants to acquire knowledge in the area of block and circuit programming, in which it has been concerned not only to have this knowledge in the Greater Metropolitan Area (GAM), but also in the different regions of Costa Rica.

The workshops have been carried out using the active learning methodology in different regions of Costa Rica where a wide variety of people have attended, from high school teachers, high school and university students and the general public, both Costa Ricans and foreigners. Having the possibility of having workshops via different video conferencing tools allows us to bring this knowledge to many people in different parts of the country.

Having a framework of other project initiatives at the international level allows us to learn from successful initiatives and cases in other countries and to apply them locally. In Costa Rica, there has been great support from the business sector to encourage activities in the area of gender, which allows us to support Costa Rican youth.

Finally, this project is expected to be able to continue holding workshops in the area of programming by blocks during the year 2022 and to be able to hold a much larger event due to the opening after COVID-19 according to the country's regulations.

7. Bibliography

[1] Ruiz, K. "Technological change and emerging occupations in Costa Rica", Documents of Projects (LC/TS.2020/80), 2020, Santiago, Economic Commission for Latin America and the Caribbean, (CEPAL)

[2] Manpower. Solving the talent shortage. Talent shortage survey 2018. 2018 UR: https://www.manpowergroup.com.mx/estudios-e-investigaciones/escasez-de-talento-2018

[3] Micitt, Science and gender, 2022. URL https://www.micitt.go.cr/ciudadania/ciencia-y-genero

[4] R. Giordano-Lerena, M. M. Larrondo-Petrie, A. Paez-Pino, L. Rathmann and L. E. Romero-Robles, "MATILDA Latin American Open Chair: An international cooperation initiative to increase women in engineering," 2021 World Engineering Education Forum/Global Engineering Deans Council (WEEF/GEDC), 2021, pp. 349-355, doi: 10.1109/WEEF/GEDC53299.2021.9657236.

[5] Energea Bolivia, Club Stem, 2022. URL http://energea.com.bo/club/

[6] GSMA Latin America, GSMA Tech4Girls came to Brazil to bring girls closer to STEM careers, 2019. URL https://www.gsma.com/latinamerica/es/gsma-tech4girls-llego-a-brasil-para-acercar-a-las-ninas-a-carreras-en-stem/

[7] - Meninas Digitais. (2018, abril 10). https://meninas.sbc.org.br/

[9] Diario Sustentable, New PROVOCA Mentoring Network seeks to consolidate scientific vocations in women, 2021. URL https://www.diariosustentable.com/2021/05/nueva-red-de-mentoras-provoca-busca-consolidar-vocaciones-cientificas-en-mujeres/

[10]   R. Giordano-Lerena, M. M. Larrondo-Petrie, A. Paez-Pino, L. Rathmann and L. E. Romero-Robles, "MATILDA Latin American Open Chair: An international cooperation initiative to increase women in engineering," 2021 World Engineering Education Forum/Global Engineering Deans Council (WEEF/GEDC), 2021, pp. 349-355, doi: 10.1109/WEEF/GEDC53299.2021.9657236.

[11] Delfino.cr, 3M recognizes the work of Costa Rican women scientists in the second edition of 25 Women in Science, 2022. URL https://delfino.cr/2022/02/3m-reconoce-labor-de-cientificas-costarricenses-con-la-segunda-edicion-de-25-mujeres-en-la-ciencia

[12] Microsoft, Microsoft celebrated 10 years of female empowerment and STEM skills development through its DigiGirlz program, 2021. URL https://news.microsoft.com/es-xl/microsoft-celebro-10-anos-de-empoderamiento-femenino-y-desarrollo-de-habilidades-stem-mediante-su-programa-digigirlz/

[13] Higher education, STEM Ecuador encourages the study of science in children, 2018. URL https://www.educacionsuperior.gob.ec/stem-ecuador-incentiva-el-estudio-de-las-ciencias-en-la-ninez/

[14] Microsoft, Microsoft celebrated 10 years of women's empowerment and STEM skills development through its program DigiGirlz, 2021. URL https://news.microsoft.com/es-xl/microsoft-celebro-10-anos-de-empoderamiento-femenino-y-desarrollo-de-habilidades-stem-mediante-su-programa-digigirlz/

[15] A. Layne, P. DeFreitas, J. Marks and R. Lackhan, "Cultivating Positive ICT Perceptions: an application of the MST-tree model to the 'Guyanese Girls Code' Initiative," 2020 International Conference on Computational Science and Computational Intelligence (CSCI), 2020, pp. 934-940, doi: 10.1109/CSCI51800.2020.00174.

[16] Microsoft, Microsoft celebrated 10 years of women's empowerment and STEM skills development through its program DigiGirlz, 2021. URL https://news.microsoft.com/es-xl/microsoft-celebro-10-anos-de-empoderamiento-femenino-y-desarrollo-de-habilidades-stem-mediante-su-programa-digigirlz/

[17] La Republica, Girls4Tech return with marathon to inspire women to enter STEM careers, 2021. URL https://www.larepublica.net/noticia/girls4tech-regresa-con-maraton-para-inspirar-a-mujeres-a-adentrarse-en-carreras-stem

[18] OCDE, Mentoring OECD Network to promote STEM among girls and young women in Latin America, 2022. URL https://www.oecd.org/centrodemexico/iniciativa-niastem-pueden.htm

[19] Microsoft, Microsoft celebrated 10 years of women's empowerment and STEM skills development through its program DigiGirlz, 2021. URL https://news.microsoft.com/es-xl/microsoft-celebro-10-anos-de-empoderamiento-femenino-y-desarrollo-de-habilidades-stem-mediante-su-programa-digigirlz/

[20] Delfino.cr, 3M recognizes the work of Costa Rican scientists in the second edition of 25 Women in Science, 2022. URL https://delfino.cr/2022/02/3m-reconoce-labor-de-cientificas-costarricenses-con-la-segunda-edicion-de-25-mujeres-en-la-ciencia

[21] E. Vidal, E. Castro, S. Montoya and K. Payihuanca, "Closing the Gender Gap in Engineering: Students Role Model Program," 2020 43rd International Convention on Information, Communication and Electronic Technology (MIPRO), 2020, pp. 1493-1496, doi: 10.23919/MIPRO48935.2020.9245186.

[22] Delgado, Andrea, Aiala Rosa, Claudina Rattaro, Andrea Viscarret, Lorena Etcheverry, Raquel Sosa, Mercedes Marzoa, and Ewelina Bakala. "Promoviendo carreras de TICs en adolescentes de secundaria en Uruguay," 2017. http://sedici.unlp.edu.ar/handle/10915/65260.

[23] Delgado, A., Rosá, A., Etcheverry, L., Sosa, R., Marzoa, M., Bakala, E., Rattaro, C., & Briozzo, I. (2019). Encouraging girls involvement in Information and Communication Technologies careers in Uruguay. CLEI Electronic Journal, 22(2), 4:1-4:18. https://doi.org/10.19153/cleiej.22.2.4

[24] Ministry of Education, MINERD promotes technology and sciences through e-Girls and Supermatics clubs, 2020. URL https://www.ministeriodeeducacion.gob.do/comunicaciones/noticias/minerd-fomenta-la-tecnologia-y-las-ciencias-mediante-los-clubes-e-chicas-y-supermaticas

[25] La República, Companies awaken women's interest in STEM at school age, 2020. URL https://www.larepublica.net/noticia/empresas-despiertan-interes-de-mujeres-en-stem-desde-edad-escolar

[26] La República, SYKES receives international recognition for incorporating women in technology, 2019. URL https://www.larepublica.net/noticia/sykes-recibe-reconocimiento-internacional-por-incorporacion-de-mujeres-en-tecnologia

[27] Presidency, Teach her initiative: students participate in camp to encourage girls and teenagers to become engineers, mathematicians and scientists, 2018. URL https://www.presidencia.go.cr/comunicados/2018/04/ iniciativa-teach-her-estudiantes-participan-de-campamento-para-impulsar-a-ninas-y-adolescentes-a-ser-ingenieras-matematicas-y-cientificas/

[28] La Republica, Intel has trained 6 thousand students in STEM, 2019. URL https://www.larepublica.net/noticia/intel-ha-capacitado-a-6-mil-estudiantes-en-stem

[29] MEP, MEP, FOD nd U.S. Embassy to provide workshops for girls and young women in science, technology and mathematics, 2019. URL https://www.mep.go.cr/noticias/mep-fod-embajada-estados-unidos-impartiran-talleres-ninas-jovenes-mujeres-ciencias-tecnolog

[30] Virtual Meeting on Innovation, Science and Technology for women in the Northern Zone, Magazines TEC, 2022,URL:https://revistas.tec.ac.cr/index.php/investiga_tec/article/view/6118/5831

[31] CITEC, CFIA Gender Joint Commission, 2021 https://www.citec.or.cr/2021/02/10/comision-paritaria-de-genero-del-cfia/

[32] First in the news, MenTE in action seeks to provide scholarships to 50 women from Guanacaste, 2020. URL URL: https://primeroennoticias.com/2020/06/15/mente-en-accio-becar-50-mujeres-guanacaste/

[33] CINDE, 5 ways Costa Rica has integrated more women into the knowledge economy, 2021. URL https://www.cinde.org/es/noticias/5-formas-c%C3%B3mo-costa-rica-ha-integrado-a-m%C3%A1s-mujeres-en-la-econom%C3%ADa-del-conocimiento

[34] MICITT, MICITT joins International Day of Women and Girls in Science 2022 celebrations. URL https://www.micitt.go.cr/noticias/micitt-se-une-celebraciones-del-dia-internacional-la-mujer-y-la-nina-la-ciencia

[35] Delfino, DigiGirlz: MICITT and Microsoft team up to provide free virtual workshops for girls and women, 2021. URL https://delfino.cr/2021/02/digigirlz-micitt-y-microsoft-se-unen-para-dar-talleres-virtuales-gratuitos-a-ninas-y-mujeres

[36] Hernández-Ruiz, I., and Gómez-Fernández, C. Project Building Programming Skills in Young People and Teachers in Secondary and Higher Education and its Challenge (2021)

[37] Rodríguez, A, Educational robotics through visual programming, 2018. URL https://riull.ull.es/xmlui/bitstream/handle/915/10306/Robotica%20educativa%20

[38] Wing, J. "Computational thinking. Communications of the ACM", 49(3) (2006): 33-35. http://dx.doi.org/10.1145/1118178.1118215

[39] Vargas López, C., and Jiménez Sánchez, S. "Constructivism in online education processes". Ensayos Pedagógicos Magazine, 8(2) (2013): 157-167. https://doi.org/10.15359/rep.8-2.8

[40] Cambridge Assessment International Education, Active learning, 2019. URL https://www.cambridgeinternational.org/Images/579618-active-learning-spanish-.pdf January 31, 2022