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Article

Importance of STEM and STEAM Education for Improvement of the Land in the Rural Environment: Examples in Latin America

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Abstract: Interdisciplinary STEM and STEAM education give us an opportunity for creativity and educational innovation in a world scenario that needs training in which students can achieve all educational objectives and are prepared to achieve sustainable development. The rural environment with its land is a scenario that provides us with a range of educational resources for the development of STEM and STEAM projects in which students who are better trained and prepared for the needs of today's world are developed, as well as students who are more linked and sensitized to the environment, with the rural environment and its land, so important in our time. In this article, we will collect examples from Latin America; STEM projects are being developed in which young people establish links with their environment, territory, and the local environment surrounding them. We must look carefully at projects and works in which students' ties with their land and environment are valued through the STEM and STEAM education necessary today. In this scenario, a comparison has been made between Latin American countries and Spain.

Keywords: 1; STEM and STEAM Education2; Interdisciplinary Education3; Sustainable Development4; Environment 5; Rural Environment6; Land 7; Latin American 8; Spain

1. Introduction

The education we receive throughout our lives and from an early age will constitute the result of each one as a human being. According to Luengo [1], the first maternal care, the social relationships that occur within the family or with groups of friends, attendance at school, etc., are educational experiences that shape our way of being.

We must remember that the concept of education is complex. What precisely does education mean? School, high school, and university are linked closely for most people. But we must all agree that education is a broad concept closely related to the experiences of human beings throughout their lives.

We must ask ourselves what the objective of education is, why we educate ourselves, and what we are looking for when we educate ourselves. As Touriñán exposes [2], the fundamental objective of education, as a result, is the acquisition in the educational process of a set of behaviors that enable the student to choose, commit, decide, and carry out their personal life project. These behaviors will constitute a means to create valuable people and a form of insertion and prosperity of human beings

We know that there are different types of education; we could talk about formal, informal, and non-formal education, although according to Pastor [3], the concepts of formal and non-formal education have an evident historical and political relativity since an educational activity can be formal in a country and non-formal in another. At this point, we can reflect again since, in each country or

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territory, a specific type of education will be binding to the formation of their citizens, and this will be so for different reasons, mainly social reasons.

As Delors affirms [4], one of the four learnings around education throughout life will be "learning to do" to influence one's environment. Training people to impact the environment positively is a current objective in education.

Education must generate a path of improvement, and in our current world in the 21st century, we must train our societies to be committed to improving the planet, which means that they must be involved in caring for their environment and habitat.

With environmental problems such as those derived from global climate change and what this implies, such as droughts, fires, reduction of ice at the poles, and other catastrophes, we must look to education to find a possible solution that involves human beings in respect for the environment. In short, we must use education to train human beings committed to the Earth and its care. According to Hall and Bridgewater [5], the time has come for approaches to mitigate environmental deterioration to be given priority in the context of communication, education, and public awareness. If we do not do it, there is a risk of going towards a spiral of environmental destruction with dire consequences for humanity.

With the emergence of the concept of environmental education in the 70s of the last century, at the International Environmental Conference in Stockholm, education has contributed to generating changes in people, their attitudes, and environmental values. Environmental education and the development of projects from school linked to respect for the Earth train children, who will be our future society, to be more sensitized from an early age to their urban or rural environment. Environmental education constitutes the educational process that deals with the relationship of the human being with his environment (natural and artificial) and with himself, as well as the consequences of this relationship [6] in the human being himself, in his land, his environment and obviously in his life.

If we overview the origins of when environmental education became important. We must go back to the preface in the book edited by UNESCO in 1980 [7], which includes the main guidelines of the UNESCO Tbilisi Conference. The Tbilisi Conference [8] constituted the starting point of an international environmental education program, according to the unanimous desire of the Member States. Environmental education began to gain strength precisely at that moment, a decade in which the Planet was already experiencing immense noticeable environmental changes due, among other causes, to significant industrial and technological advances. In that same book, it is stated that environmental education, properly understood, should constitute a general continuing education that will react to the changes that occur in a rapidly evolving world [7]. That leads us to think about the importance of a permanent education that can and should be developed to achieve the union of the human being with his environment, with the environment that surrounds him, with the land that surrounds him, always taking care of Nature and In short, taking care of the Planet. The same document says that by adopting a global approach rooted in a broad interdisciplinary base, environmental education creates a general perspective within which a profound interdependence between natural and artificial environments is recognized. That leads us to think about the importance of interdisciplinary education today since our current world is interdisciplinary, and interdependence between the natural and artificial environment exists today. As humans, we must take advantage of resources that can provide interdisciplinary education, improve human beings, and make people more sensitive to caring for the environment, land, and planet.

As Labrador and Del Valle [9] mention about the Moscow Congress of 1987 [10], they reiterate that environmental education and the perspective that it should be addressed to the general public of all ages and educational levels, also in non-formal education and education of adults, for specific, very diverse, professional and/or social groups. Within this diversity, including people who live in rural areas is necessary and very valuable. Environmental education also harbors the nuance of transdisciplinarity. As Schrodinger [11] suggests, transdisciplinarity is one of the highest ideals of environmental education in that environmental objectives can only be achieved by addressing the issues across all areas and forming new associations. Martínez [12] explains that there has been

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awareness of the interdependence between the environment, development, and education based on a transversal and transdisciplinary response providing an educational paradigm. Working on environmental education is the basis for generating a series of changes in the behavior of human beings that will lead to creating more just, more developed societies and more careful with their habitat, which is the land on which they live, their environment, and the Planet.

Considering everything mentioned, education for sustainable development has been proposed for some years. Currently, the 17 Sustainable Development Goals (SDGs) of Agenda 2030 [13] will lead us to a better and fairer world. Goal 4, which proposes quality education, is essential to educate our children.

A permanent, interdisciplinary, and transdisciplinary education will train citizens to be better prepared for the world they have had to live in, a world of problems and advances. If we talk about the problems, we must recognize the social, economic, and environmental issues, territories with hunger and wars, which humans must be capable of improving in many aspects to affront those. An education that trains citizens with interdisciplinary and transdisciplinary approaches will help people emerge better developed to adapt to these times. Permanent education should also be designed to sensitize these people from an early age to their land, environment, and planet. In that case, we will create better people to live on this planet with knowledge and be more sustainable, resilient, decisive, and committed to their environment.

In this sense, the 2030 Agenda for Development Sustainable highlights the importance of the STEM approach to education development. It refers to the relevance of the participation of women in STI through STEM. Furthermore, this entity displays the "education in science, technology, engineering, and mathematics (STEM); and education for sustainable development (SDG) as part of a quality education" [13].

Interdisciplinary STEM and STEAM education presents an opportunity for creativity and educational innovation in a world scenario that needs training in which students can achieve all educational objectives and are prepared to achieve sustainable development.

The STEM educational model emerged in the 90s of the 20th century in the United States and has as its pedagogical model the promotion of academic autonomy of students through the development of critical thinking in environments oriented towards the formation of learning communities inside and outside the classroom. In 2006, the STEM model was redefined, incorporating art into its structure and called STEAM [14]. This educational model allows artistic skills such as empathy or creativity to address Science, Technology, Engineering, and Mathematics from different perspectives. A collaborative learning approach transforms theories into models applied to real life and the world around them. It is a strategy to know and understand reality throughout life, from inquiry and interaction.

2. Objectives and Methodology

This study aims to demonstrate that STEM/STEAM education applied in the rural world can be an integrative tool that serves as an impulse for the creation of new citizenships committed to social and environmental justice and, at the same time, to achieve changes that lead to creating links with the territory in which they live and increasing opportunities in this environment. To this end, and to narrow our research, we analyzed some experiences with STEM/STEAM education to improve skills in rural areas in Latin American countries. We mainly focus on Colombia, Chile, and Peru, countries where STEM and STEAM education is more developed in rural areas.

The specific actions developed in this study analyzed the situation in Latin American countries, especially Colombia, Chile, and Peru, regarding education in rural areas and STEM and STEAM education. Also, we proceed with the review of educational programs and laws developed in Colombia. In addition, it analyzed successful cases of implementation of STEM and STEAM education in rural Colombia.

This has sought to collect what has been done of educational interest in STEM and STEAM education in these countries, reflecting its results and its possible implementation in other countries.

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In addition, a comparison is made of various actions by Spain in this area to highlight the advances in STEM and STEAM education for improving education in the rural world in different countries.

This article reflects comparative educational research using a qualitative methodology. The qualitative study is based on a bibliographic review of documentary sources on the evolution of STEM and STEAM focused on the rural world. Considering the research, a selection of primary and secondary sources was made, considering the following keywords: STEM and STEAM; Latin America; rural education; Colombia; Chile; Peru and Spain, since 2000.

The results were systematized and organized to facilitate their study. The primary sources are those based on reports, legislation, and other institutional publications of governments and international organizations such as the United Nations. Regarding secondary sources, a search has been carried out for scientific research articles related to the topic of study in bibliographic databases and storage systems for academic publications. All this information has been categorized into three levels of information, considering the theoretical-conceptual approaches provided by various researchers, institutional approaches and documents, and some contributions from non-scientific publications associated with the object of study.

3. Education for the Improvement of the Land in the Rural Environment

Currently, the rural population represents 70% of the world's population, and inequalities between the countryside and the city constitute a significant obstacle to sustainable development. This is why rural education is traditionally addressed with subsidiary policies, especially in developed countries [15].

Amid the pandemic, we have seen the importance of villages, places where many people from cities went to live and work during COVID-19. Before the pandemic, in many countries, villages were seen by some urbanites as something very backward concerning the urban, places to only go on vacation to enjoy and nothing more. As Hernández [16] points out, we must highlight the recovery of cultural heritage for the population and the projection of local culture for society as a whole. The territory must be presented as an opportunity to live. However, these roots are maintained, and with this, there is an improvement in the rural environment and its land and people, which will be a direct consequence of four pillars that must be assembled functioning in the rural environment: education, technology, work, and gender. It must be noted that the rural environment shows many problems and underrecognized values. As Amiguinho [17] explains, we must emphasize participatory insertion in the closest community to be a citizen of an increasingly globalized world: a citizen of the world is true from somewhere, with roots in the "local." These roots are maintained, and with this, there is an improvement in the rural environment and its land and people, which will be a direct consequence of four pillars that must be assembled functioning in the rural environment: education, technology, work, and gender.

The rural environment offers us agricultural and forestry resources that we must take advantage of, and to do so, we must think about the fundamental physical, biological, historical-cultural, and economic values that are usually little recognized in the rural environment, as food production, rural environment reserves like as a mineral, plant, and animal, the rural environment presents an oxygen factory at the service of humanity thanks to its forests, it is a source of culture in the form of traditions, customs, cuisine, and others, it is a source of architectural resources and archaeological and landscapes that are spaces of incalculable value [18].

In this sense, we can highlight the education service for improving rural areas. How? Forming human beings better linked with their environment, land, and habitat. Education can develop human beings connected to the land on which they live. But let's not only think about the little ones and our future society, but we must also think about our elders in the rural population.

Undoubtedly, citizens' education achieves economic, social, and environmental development. Economical because the best-educated citizens will be able to face the financial problems that arise in their lives and their work; social because education will make human beings grow in all their social; and environmental responses because it will develop better-trained citizens in this area.

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To the permanence of the rural environment, it is crucial that people can live in towns because there are means, work, and economic resources for their population. It is also vital that rural inhabitants have their full social expectations. For this, we must address the problems of depopulation, aging, and gender in many rural areas. In the villages, we must value our elders and women since if there are no women, the population becomes masculinized, and the town ends up dying. The environmental ties from the rural world to its inhabitants are also crucial for the rural environment. If its inhabitants are sensitive to their environment and land, they will want to stay in it and live there, lasting it. In this way, they will try to stay in rural areas, on their land.

With all this, we must highlight the importance of education, specifically STEM and STEAM education, to develop a current, interdisciplinary, transdisciplinary, and permanent economy, society, and environmental vision using the educational resources rural areas offer. The development of STEM and STEAM education projects in this area will train people who are better prepared in rural areas and more linked to their land, with all that this implies. The rural environment with its land is a scenario that offers us a range of educational resources, which must be used in schools and institutes, linked to the agricultural and forestry world and also social, to, among other aspects, propose the development of STEM and STEAM projects in which students who are better trained and prepared for the needs developed of today's world, as well as students who are more linked and sensitized to the environment, to the rural environment and its land, so important in this time. With these resources, rural students can and should achieve interdisciplinary knowledge in Science, Technology, Engineering, Arts, and Mathematics and be more prepared for today's world since one of the objectives of this methodology is to contribute to developing student competencies. 21st century so that more children can become leaders, innovators, and researchers and develop the necessary tools to face today's challenges and their communities' future [19].

The rural environment has social resources that we should pay attention to. The rural environment that suffers from depopulation, with a large part of the population aged in many areas of the planet, must take advantage of the knowledge and wisdom of its elders as educational resources. With their experience, culture, and wisdom, older people can become another educational resource, transmitting their knowledge to new rural generations. Also, STEM and STEAM education can generate knowledge in reverse, generating new knowledge in older adults, such as the European Commission's "BRAIN" project, which aims to transmit a substantial and sustainable impact: older adults involved in the Local Program after having acquired new knowledge and skills will act as replicators of learning results that will raise their self-esteem and promote their social inclusion [20]. This project, called "BRinging STEM into Active AgINg," has been financed with the support of the European Commission, and its information is included in the framework of the European program "Erasmus Plus KA2 Strategic Partnerships for Innovation and the Exchange of Good Practices".

4. Rural Situation in Latin America

Although it is true that already at the beginning of the 21st century, as Hendel affirms [22], several Latin American countries, mainly Bolivia, have begun to experience profound political transitions that propose the redefinition of the organizational parameters of their economy, their politics and their state, outlining a questioning of the notion of development that characterized the rural development policies of the *world's great powers* during the 20th century.

Talking about the rural situation in Latin America is complex due to the number of countries we are talking about; all of them have differences, but they also have common points, such as the spoken language. The definition of urban and rural space in most countries is complex because the meaning of one does not default with the other. However, similar quantitative and/or qualitative criteria are generally adopted [23].

Poverty is one of the most persistent features of Latin American society and has been resistant to conventional policies designed to reduce or eliminate it [24]. According to Clausen [25], rural territories are, therefore, still far from meeting the objective of not being "left behind" in eradicating all forms of poverty.

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Bolivia, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Mexico, Paraguay, Peru, and the Dominican Republic are countries that have unquestionable natural and cultural wealth. Approximately 20% of the world's oil reserves, 25% of strategic metals, and more than 30% of primary forests are in the Latin American and Caribbean region [26]. The recognition of the use of the natural landscape to achieve a better quality of life is an element that has gained validity from rediscovering the concepts of rural development and new rurality [27]. Exploiting natural resources sparks disputes about the use of water, biodiversity, land, and critical ecosystems, among others, and about the repercussions that exploitation has on them [26].

It is important to know the situation of each rural territory, as well as the problems of the people who live there, especially the most vulnerable people, people of different ages (children and older people), and women in rural areas. The Latin American Center for Rural Development (RIMISP), a network formed in 1986 by different partners and allies, helps to understand rural transformations and formulate better strategies to achieve equitable territorial development in Latin America [28]. In the rural environment, understanding the rural situation, the environment, the people who make it up, and their problems, as well as moving towards development on the land, is vital. RIMISP highlights the importance of proposing respectful, relevant, and innovative research strategies that involve the voices and knowledge of territorial actors, considering ethnic, generational, and gender diversity [28].

4.1. Rural Situation in Colombia, Peru and Chile

Colombia is the second most populous country in South America and the fifth largest in territory in both Latin America and the OECD [29]. In Colombia, the economy has recovered significantly from the COVID-19 crisis, and a strong response from monetary and fiscal policies has managed to avoid a further contraction in income. Economic growth has been observed, but to mobilize rural potential, the government must prioritize structural challenges historically limiting rural development, such as gaps in access to quality health and education services [29]. Actually, Colombian rural communities are experiencing profound transformations and public policy. However, the institutional framework still maintains a rural development bias focused on primary activities, social assistance, and security as a legacy of a historical vision of development focused on urban [29]. Deforestation has increased in Colombia, and to achieve current greenhouse gas emissions reduction targets, further reductions in deforestation will be necessary, with the country committing to reducing net deforestation to zero by 2030 [29]. According to the National Administrative Department of Statistics of Colombia (DANE) [30], in Colombia, the unemployment rate throughout 2021 and half of 2022 has been higher for rural women than for men, with a rate gap between 6.8 and 9.7%. The population in rural regions in 2021 was higher than the average of other Latin American OECD countries (Mexico and Chile) [29]. In 2022, 23.7% of the population, 12.2 million people, were located in rural areas, and among the rural population, 48.2% are women and 51.8% are men. On the national average, women are 51.2% [30]. Contrary to the global aging trend, Colombian rural regions benefit from a high young population (26% in 2021), well above the OECD average (17%), and other Latin American OECD countries, such as Chile (19%) [29]. This fact is perfect for the rural world and its development since rural areas will remain associated with technology, innovation, and the economy. Colombian rural regions are a potential source of wealth and well-being and contain one of the most diverse ethnic presences in South America and a more significant number of young population than the OECD average [29].

Peru is the seventh American country in terms of population. In 2022, its population was 3,396,700, 50.4% women and 49.6% men, settled in 1,874 districts [31]. In recent years, inequality of opportunities between rural and urban areas in Peru has been pronounced. Following the recession caused by the COVID-19 pandemic, the economy rebounded quickly but has since slowed sharply to just 1,1%. It is expected to increase gradually by up to 2.7% in 2024 [32]. Looking back and seeing how its population has gone from 2016 to the present, we can observe small changes. In 2016, 20.8% of the population in Peru lived in rural areas, and only 28.2% accessed all drinking water, electricity, and sanitation services vs. 82.6% of urban residents [33]. According to the latest national survey on

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perceptions of inequalities (ENADES 2022), 61% of the people surveyed perceive a severe disparity between Peruvians living in cities and rural areas [31].

Chile is the ninth Latin American country in terms of population. According to data from the National Institute of Statistics of Chile (INE) from the end of 2021, the population figure is 19,458,000 people [34]. The Chilean economy recovered quickly from the pandemic, and inflation has risen to a 30-year high, with peaks close to 14% annually in 2022, driven by expansionary fiscal policy and exacerbated by global supply constraints and the war in Ukraine [35]. Since the population and housing census carried out in 2017 [36], we observe that its population has increased until now, since it was a total of 17,574,003 people, of which 8,601,989 (48.9%) are men and 8,972,014 (51.1%), women [34]. Currently, 25% of the Chilean population lives in territories (82% of the total territory) with high rurality. Environmental challenges and risks are important, but they also offer significant opportunities for the future [35]. Rural-urban migrations, the productive reconversion of farms that have reduced their workforce, and earthquakes have produced unemployment in the countryside, which goes hand in hand with the de-agrarianization of local activities [37].

5. State of the Art of Rural Education in Latin America

At this point, we must point out the characteristics of the education received in rural schools. According to Caliva [38], the contents are conceived in most cases from situations outside the rural area and without sufficient consultation, thus resulting in universalizing, academic, monotonous, excessively extensive curricula with very little range for adaptation to the local situations. It is something that we must reflect on since, in an environment so rich in resources and landscapes on earth, using curricula not adapted to the environment of the rural situation from an educational point of view has its consequences. Education must be capable of responding to each territory's needs. Emphasis should be placed on the need to promote innovative educational processes based on the needs and potential of the different rural populations of Latin America [38]. As cited by Arias [39], today's rural schools must teach school content and recognize local knowledge related to agricultural work, roots in the land, environmental sustainability, and community history.

The educational policy of most of the Latin American and Caribbean region began to experience a reactivation at the end of the 20th century and, especially, at the beginning of the 21st century [40]. In 2023, the Regional Educational Policy Forum was framed in the political implications and implementation strategies of SDG 4 of the 2030 Agenda [41]. Working on this SDG is necessary in all areas of the world. Still, in this Forum, the idea was to think about how digital technologies can contribute to transforming the educational systems of Latin America and the Caribbean [41].

Illiteracy among adults and youth continues to be a mainly rural problem, and the preschool level practically does not exist in these areas [42]. The preschool level practically does not exist in these areas [42]. However, we must highlight that rural education in Latin America is a viable possibility [43]. According to Santa María et al. [44], researchers agree that to confront the problem of educational inequality, a drive for change is required that addresses the factors that mark said inequality.

Latin American countries that achieved coverage of the school system present serious quality problems in the learning results of boys and girls who participate in learning achievement measurements [42]. At international events on education, proposed agreements to improve the population's learning levels and prepare students for life [44]. The latter is essential because educating the population about rural life prepares rural inhabitants to live harmoniously in their local environment, consequently improving their quality of life.

The International Congress Epistemologies of the South and Latin American Ruralities held in 2019 focused on rural education, the Pedagogy of Mother Earth and Ecology of Knowledge and Territory, women and Latin American spiritualities, ancestral practices, and knowledge [45]. We must highlight the importance of the Ibero-American Rural Education Colloquiums that the Rural Education Research Thematic Network (RIER) [46], for those interested in rural education, has been developing for some years now in rural schools. The V Ibero-American Colloquium on Rural

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Education was the last one, held in July 2023 and developed by the Rural Education Division of the National University of Costa Rica in collaboration with the RIER.

5.1. Rural Education in Colombia, Peru and Chile

In Colombia, school dropouts have increased considerably due to the pandemic, especially among students from disadvantaged socioeconomic backgrounds [47]. According to data collected in DANE [30], in Colombia in 2021, 75.4% of rural women and 75.2% of rural men between 6 and 21 years old were studying, while in urban areas, these percentages are 79.3% and 79.2%, respectively. Women suffer from dropping out of school due to home and family issues. 11.2% of rural women between 6 and 21 years old who do not study do so because they must take care of household chores, and 4.4% do so because of pregnancy [30]. Dropout rates in secondary education, which tend to focus on students from disadvantaged socioeconomic backgrounds, increased in 2020, and only 50% of children aged 3 to 5 years have access to preschool education [47]. In the General Education Law of 1994 [48], article 10 describes formal education, article 36 refers to non-formal education, and Article 64 refers to peasant education and rural [49], mentioning that the National Government and the territorial entities will promote a peasant and rural education service, which will mainly include technical training in agricultural, livestock, fishing, forestry, and agro-industrial activities that improve human conditions, work, and farmers quality of life and increasing food production in the country. (Law 115 of 1994, art. 64) [48]. In this country, the PER Rural Education Program is currently being developed. It has Phases I and II, implemented since 2009, to mitigate the problems affecting educational coverage and quality in rural areas, helping to overcome the existing gap, and The Special Rural Education Plan [50,51] In Colombia, there is a clear intention to rescue the living memory of past adversities, recognize forgotten population sectors such as farmers, Afro-descendants, and displaced people, and defend the territory [45]. According to the data provided by the ICFES and the OECD, it is evident the challenge rural education represents for the country in its commitment to improving educational quality [52]. It is also worth remembering the V International Congress of Local Development held in 2019, whose motto was Socioeconomic Systems with Territorial Anchors, where it reflected how local areas should be promoted as places to satisfy economic, social, cultural, and environmental needs [53].

In Peru, public spending on education is low (2.7% of GDP in 2018). At least 96% of adults completed primary education in 2020, thus surpassing other Latin American countries [32]. In 2018, 24% of secondary school students were behind in school versus 7.4% in urban areas, and 8.7% of women over 15 years of age and older versus 3% of men are illiterate, according to data from BELIEVE (Growing with multigrade rural schools in Peru) [54]. This information about women's education is significant. The school dropout rate in rural areas is a fact, and in rural areas, women represent the population with the highest dropout rate (8.6%) compared to men (6%). In rural areas, only 32% of the population completes secondary education, and 8% ends higher education [32]. In secondary school, the gender gap remains relatively high, with 34% of women over 15 years old, compared to 42% of men, completing secondary education [55]. A higher proportion of 15-year-old girls achieve below-average results in mathematics and science compared to their male peers, while girls achieve better results than boys in reading [32]. The work obligations of adolescent girls outside of school and teenage pregnancies are the main factors that explain female school dropouts, especially in rural areas [32]. There is a profound difference between urban and rural education, evidenced even more since 2020 due to social isolation due to the COVID-19 health emergency [31]. Among the actions implemented in the country, we can highlight the Non-School Initial Education Program (PRONOEI). This public early childhood education program comprehensively provides care and education to children in rural and remote areas with limited access to formal education [56]. And also the UNESCO Horizons Program, a rural secondary education program that works in 6 regions of Peru (Amazonas, Ayacucho, Cusco, Piura, Arequipa, and Puno) to ensure that adolescents in public schools located in rural territories finish their secondary school studies [57,58].

In the case of Chile, the school system is structured in two mandatory cycles: 8-year primary education (1st to 8th grade) and 4-year secondary education cycle (1st to 4th grade) [15]. The CASEN

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2022 survey showed 62% more rural poverty than urban poverty in Chile, a figure also supported by the 57% corresponding to extreme poverty rates [59]. Several laws and programs must be highlighted in Chile concerning rural education: The Rural Basic Execution Program of 1980, the Quality Improvement and Equity Program (MECE/Basic/Rural) that took place from the 90s to 2002, Decree No. 4 that Regulates the Rural Basic Education Program of 2001, and Decree No. 968 of 2012 [15]. In 2020, 52 proposals were proposed to improve Rural Education in Chile: Institutionality and public policies for quality rural education, Curriculum and teaching roles with a territorial perspective, Educational offer for a lifelong trajectory, and Infrastructure. And schools that favor learning objectives [60]. In Chile (2019), there are 3,401 rural schools, and around 1,800 correspond to multigrade establishments; that is, they work with students from different grades in the same classroom [61]. Currently, female participation in the labor market is low, and expanding access to quality early childhood education would close critical gaps in cognitive and social progress and enable more women to work [35].

6. STEM and STEAM Education in Latin America for the Improvement of the Rural Environment

According to Bonilla et al. [62], STEM education (Science, Technology, Engineering, and Mathematics) is an emerging trend that seeks modular, adaptable, and easy-to-use tools to help students in practical teaching. STEM/STEAM education offers economic, social, and environmental benefits to the rural population, among other things, by working interdisciplinary with Science, Technology, Engineering, Arts, and Mathematics.

Working on STEM and STEAM education in rural areas of Latin America implies an improvement in the rural environment since participants in this type of education will be better prepared to face the rural world in which they live in their daily lives. Working on gender in rural areas, thanks to STEM/STEAM education, improves the environment in which such education is developed, in this case, the rural environment, since this implies better-trained and prepared women. Better-trained people will live in rural areas and take care of their homes, land, environment, and survival over time in that environment.

For the towns, it is vitally important that women remain in them. Of note in STEAM education is the inclusion of discussion and analysis of gender inequality in the teaching and application of science and technology to encourage the participation of more women in these fields [63]. There are countries where being a woman continues to represent a severe disadvantage in science, both when choosing a career and when looking for a job related to disciplinary skills in STEM. According to UNESCO, in terms of enrollment in STEM careers at the higher education level, women represent only 34% in Argentina, 25% in Chile, 30% in Brazil, and 38% in Mexico. In the case of Colombia, the global gender gap is 73 percent [64]. With the conviction that it is possible to break down gender prejudices and stereotypes, inspire girls in STEM, and increase female participation in this type of career, Ingeniosas: Science and Technology for All was born in Chile in 2016. Its initiatives have expanded to Argentina and Colombia [65]. Considering the networks that promote the STEM/STEAM approach in Latin America, we can highlight the STEAM Laboratory in the rural classroom or the Educa STEAM Network [66,67]. We must highlight the so-called Red STEM Latinoamérica (STEM Network Latin America), comprised of over 180 allied institutions from 14 countries promoted by Siemens Stiftung International Foundation. This network aims to form active citizenship that forges sustainable communities and territories [68].

6.1. *STEM and STEAM Experiences in Rural Environments in Colombia, Peru, and Chile*

In the case of Colombia, Cifuentes and Caplan [19] explain how, after the development of a successful experience of formal STEM/STEAM education in a rural school in Cundinamarca, STEAM education offers possibilities of raising the quality of education in rural contexts when focused on towards a globalizing model in which diversity and inclusion are valued and respected. In Medellín, according to Cano et al. [69], implementing an integrated approach of STEM plus Humanities translates into best results and constitutes a fundamental factor in developing the local context. STEAM allows the generation of ideas to solve local problems and can contribute to developing

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interdisciplinary experiences, motivating students to participate in projects linked to the subjects that comprise it, and promoting cultural diversity [69]. According to Ochoa et al. [63], the STEAM community broadcasting solidarity extension project in Magdalena Medio was developed so that the peasantry can remain in the territory and live in harmony with animal and plant species through the defense of peasant culture and food sovereignty through agroecological practices, as well as peacefully resisting war [63]. The STEAM project Campesino Laboratory for the Transition to Agroecology (LabCampesino) [70], developed between 2018 and 2019, was a solidarity extension project led by groups of students from the faculties of Engineering, Sciences, and Arts of the National University of Colombia and the rural organization Tierra Libre to generate a space for rural youth and children for exploration, experimentation and prototyping around agroecology, co-creation and community organization, promoting adaptive habitat, production and consumption systems. Projects of this nature make rural inhabitants more linked to their environment and more respectful of the surrounding environment. Furthermore, according to Ochoa et al. [63], solidarity economy strategies are necessary to generate stable economic income to allow decent futures in the territory.

In Peru, it is already expected that intervention projects will be increasingly based on systematic studies on schooling in rural areas and that public education will be developed with opportunity and relevance [45]. In 2017, a study carried out in the Peruvian Amazon explored the community practices and knowledge that Shipibo children, as intercultural actors, manage links with extracurricular spaces where their life and activity take place: the house, the river, the forest, and the farm, giving meaning to the school space and taking ownership of the school [71]. The "VI National Educational Research Seminar" that took place in November 2018 in the city of Cusco was held simultaneously with the II Ibero-American Colloquium on Rural Education, addressing the topic "Perspectives and challenges of rural education: dialogues between research and educational policy" [72]. To strengthen the STEM competencies of Peruvian teachers, the Pontifical Catholic University of Peru (PUCP) developed a free course to, among other things, analyze the role of education in forming citizens with local and global socio-environmental rights and duties [68].

In Chile, the Center for Didactic Research in Sciences and STEM Education (CIDSTEM) of the Pontifical Catholic University of Valparaíso developed a STEM education program in a "blended learning" format, creating 83 STEM educational resources with an inclusion and gender perspective [68]. Bascopé and Reiss [73] analyze STEM education in Chile through the socioecological component, concluding that this approach, when applied to local challenges, opens up new sources of knowledge that are difficult to achieve with forms of learning based on the transmission of knowledge. Faced with the global problem of climate change, the Research Center for Advanced Studies in Education, CIAE, the Climate and Resilience Center CR2 and Inquiry-Based Science Education, ECBI, of the University of Chile worked for the development and adaptation of educational resources in various formats on climate change to design a certifiable course for teachers on the subject by surveying 125 teacher members of institutions linked to the STEM Latam Network were survey about their priorities [68].

7. Situation in Spain: Education for the Improvement of the Land in the Rural Environment

As indicated in Gavari, Espinosa, and Lucini [74], the problem of rural depopulation continues in Spain, affecting education and other sectors. This is because the small population in rural areas is aged; there are only a few young people trained in rural areas; the majority must migrate to urban areas to complete their training. This displacement is due, in part, to the gradual reduction of Spanish rural schools, which inevitably forces students to have to move to centers with a larger population.

Although we are facing a population reduction that corresponds to "emptied Spain" [75], we must highlight the recent concept of "new rurality" discussed by Trigueros et al. [76], where new functions are provided to the rural environment, such as recreational, residential, conservation and protector of cultural and landscape heritage. In this search for the potential of rural areas and to improve them, the GEOVACUI project [77], developed by the Complutense University of Madrid, provides promising conclusions to change the view of the rural environment and promote it as a "living and active territory" [78]. It is possible that, if we combine the proposals obtained in said

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project, together with the possibility of accessing funds from the Recovery, Transformation, and Resilience Plan, we could speak of an excellent opportunity to promote the rural environment as an attractive environment in the 21st century [79]. In general, most of the actions undertaken related to the rural aspect, to date, are focused on women in rural areas, and it would be interesting to expand the focus to reach the entire educational community.

However, despite the key role that rural education plays in improving depopulated rural Spain, it is only sometimes feasible to promote its improvement. The rural education sector involves several agents, and it needs open schools with teachers and students in person and available and updated resources. It can be an engine of change towards the living and active rural territory. Compared to the urban school, the rural school presents some economic, geographical, and social peculiarities, such as multigrade classrooms, instability of the teaching staff, or geographical disaggregation. One of the most notable differences between rural and urban schools is the greater involvement of the student in the environment and sustainability; therefore, promoting rural education under the scenario of the 2030 Agenda is a fact that will be more affordable in rural areas.

Regarding the quality of education, we must remember the analysis of the PISA 2015 report by Domínguez and Sánchez [80], where the lack of public resources is already evident, which has implied the closure of rural schools. In the recent PISA 2022 Report [81], the worst data has been shown in the education of Spanish adolescent students. However, we can find that the best results have occurred in communities with depopulation problems in rural areas, such as Asturias, Cantabria, and Castilla y León. This fact leads us to consider whether, despite the gradual reduction of the rural population, in those centers where rural schools are maintained, rural education is presented as a potential alongside urban education to promote the future of young people, stimulating their learning capacity and interest in their education. It would be interesting to analyze the dropout rates in these same communities, even in rural areas, to be able to verify if, in these communities, captivating strategies and methodologies are developed from the point of view of educational success to extrapolate their models to other Spanish regions, where worse of education data is recorded in PISA Report.

In 2022, the Ministry of Education, Vocational Training and Sports awarded 30 projects developed to promote educational inclusion and innovation to which it has granted aid worth one million euros, including the project "The rural school as an inclusive model and element stimulator of culture and the development of the environment" developed at Grouped Rural School (CRA) Río Tajo (Alcolea de Tajo, Toledo), CRA La Coroña (Ceceda, Asturias), CRA De Lozoya (Lozoya, Madrid), the project "Sustainability, health and sport in the rural environment" developed at CRA Bajo Gállego (Leciñena, Zaragoza) and Early childhood and primary education center (CEIP) O Salvador (Pastoriza, Lugo) [82]. Seeing the rural environment as an educational opportunity to form people more linked to their land and environment is noteworthy.

8. STEM and STEAM Education in Spain: Experiences in Rural Environments

In Spain, the competency learning model on the current Organic Law of Education (LOMLOE) is based on the acquisition of eight competencies. One of them is Mathematics and Science and Technology (STEM) competence. In this way, the STEM educational approach is integrated into the competency-based curriculum by integrating mathematical and science, technology and engineering competence that entails understanding the world using scientific methods, mathematical thinking and representation, technology, and methods of engineering to transform the environment in a committed, responsible and sustainable way [83].

Currently, the Rural Campus Program [84] is committed to the potential of the territory, the promotion of young employment and the promotion of local talent, promoting the connection of the population of different areas with rural spaces, generating new forms of roots and ties, which promotes activity and creates employment opportunities in the territory.

In Spain, some STEM/STEAM projects of great interest are being carried out in rural areas, such as the "Rural, Remote and Real, R3 Project" of the University of Deusto [85] to promote STEM vocations in rural schools through remote experimentation. The "STEAM Laboratory in the Rural

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Classroom" Project [86] aims to, among other things, promote the reduction of the gap in science and technology that affects this environment. The STEAM Alliance for female talent, Girls on the Foot of Science, is an initiative of the Ministry of Education and Vocational Training to promote STEAM vocations in girls and young people and reduce the gender gap [87]. It is developed in the rural and urban environment. Still, it is obvious that in the rural environment, it takes on great significance due to the importance generated by the fact that there are women in the depopulated towns of this country, contributing in this way to the significant fact that constitutes the brake of the rural depopulation so existing. in Spain. Let us not forget that if towns become masculinized due to the lack of female population due to unemployment, towns end up dying.

As Alba comments [88], It is important to facilitate access for boys and girls to STEAM training adapted to their sociodemographic reality and address the three factors that continue to hold back girls from becoming interested in technology: the messages they receive from society, gender stereotypes, and the lack of female role models in the technology sector. This responsibility, this sustainability, and this commitment are also the same in the rural environment when this competence is worked on in the formal education of rural schools in Spain.

5. Conclusions

The rural situations of Latin American countries are different, and the rural situations between Latin America and Spain are also different. Although a precise comparison cannot be made because other countries have different educational models, it is possible to emphasize the advances in the countries studied to improve rural areas, their environment, and their land. And, of course, the people who live there.

STEM education was born in the United States in the 1990s, and later, Yakman [89] restructured the term into STEAM, making citizens better prepared for the world we live in, which is an interdisciplinary world. With STEM/STEAM education, our children can be educated to prepare them in current knowledge of Science, Technology, Arts, Mathematics, and Engineering in a united way and without barriers between disciplines; it is a holistic education for a holistic world.

This paper shows that STEM/STEAM education projects are carried out in all the countries studied to improve the rural situation. Each country has different educational situations, so improvement is sought through different STEM and STEAM education strategies.

Women in rural areas in Latin American countries suffer from a gender gap in the countries studied in this article. This leads to a gap and delays in the knowledge of the rural environment's inhabitants at different levels. For rural advancement to be as it deserves, it must be able to uplift women just as it does men, in full equality. Although we have collected information about the educational situation of girls and women in rural areas in Latin America and Spain, a series of STEM and STEAM projects of interest are being developed to fight against the gender gap.

Generating links with the environment and its land is allowed with STEM/STEAM education if the rural and forest resources of each rural area in each part of the world are used, training people who are more prepared to know the land surrounding them. The rural environment and its people should be included in the world, as it is a source of wisdom, culture, and resources of priceless value. Valuing the rural environment is vital in our time to observe the territorial models of countries from other perspectives. The resources of rural areas are undeniable: landscapes, food, land, clothes, dances, wisdom of the elders, environment, etc. The rural environment offers a place to reside and must be cared for and maintained for future generations. Using the resources that rural areas provide makes citizens more linked and aware of the rural environment and land. In this way, children sensitized to rural areas will want to return to their land, live there, and work there, taking care of said land and keeping it alive without depopulation.

We observe that STEM and STEAM education in rural areas is necessary and possible, and even more enriching if the resources that rural areas offer are used as educational resources in their land and their environment, thus forming better-prepared citizens who are more linked to the land and its surroundings. Working on gender through STEM and STEAM education in different countries is

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necessary and even more so in rural areas, where it is observed that if villages become masculinized, they end up dying.

Latin America offers invaluable educational resources in rural areas to train citizens who are better prepared and more aware of their environment from an early age, forming citizens who are more respectful of their land. Colombia, Peru, and Chile are countries where very interesting STEM/STEAM education is being carried out, highlighting rural areas. At this point, we highlight Colombia as a country of great importance in Latin America in developing STEAM education. It is clearly committed to STEM/STEAM education in rural areas.

We can observe that formal education advocates STEM education in Spain since the LOMLOE Education Law contemplates it. This fact is of utmost importance. The main problem in Spain in rural areas is depopulation, although the tendency to move to cities also affects other countries. Here, we must consider other factors, not only educational but also the territorial model desired in each country. In Spain, there are no gender differences in education in rural areas, unlike in the Latin American countries studied. In countries like Spain, the rural population is elderly, and this aging population in the villages can carry out engaging, informal education as they are a constant source of wisdom. It is also essential for older people to be informed and trained to stay up to date in today's world.

We conclude that Education must be used to improve the rural environment and is vital for rural development. Students are trained in rural areas by valuing and knowing their resources and their environment will be citizens who are more linked to it, thus awakening sensitivities from an early age, which will translate into a person-rural environment bond in different areas such as cultural and social, environmental, emotional, professional, etc. STEM and STEAM education is necessary in our world, rural and urban, for students who develop better prepared for the needs of today's world that presents interdisciplinary needs, in addition to training students more linked to the environment, the rural environment, and their land.

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