SUSTAINABLE DEVELOPMENT GOAL 4

QUALITY EDUCATION

CONTRIBUTIONS OF EMBRAPA

Joanne Régis Costa
Patricia da Costa
Valéria Sucena Hammes
Adriana Maria de Aquino

Technical Editors

Embrapa

Brazilian Agricultural Research Corporation
Ministry of Algriculture, Livestock and Food Supply

Sustainable Development Goal 4

QUALITY EDUCATION

CONTRIBUTIONS OF EMBRAPA

Joanne Régis Costa
Patricia da Costa
Valéria Sucena Hammes
Adriana Maria de Aquino

Technical Editors

Translated by
Paulo de Holanda Morais

Embrapa
Brasília, DF
2020

Embrapa
Parque Estação Biológica (PqEB)
Av. W3 Norte (Final)
70770-901 Brasília, DF
Phone: +55 (61) 3448-4433
www.embrapa.br
www.embrapa.br/fale-conosco/sac

Unit responsible for the content
Embrapa, Intelligence and Strategic Relations Division

Technical Coordination of SDG Collection
Valéria Sucena Hammes
André Carlos Cau dos Santos

Local Publication Committee

President
Renata Bueno Miranda

Executive Secretary
Jeane de Oliveira Dantas

Members
Alba Chiesse da Silva
Assunta Helena Sicoli
Ivan Sergio Freire de Sousa
Eliane Gonçalves Gomes
Cecília do Prado Pagotto
Claudete Teixeira Moreira
Marita Féres Cardillo
Roseane Pereira Villela
Wyviane Carlos Lima Vidal

Unit Responsible for publication
Embrapa, General Division

Editorial Coordination
Alexandre de Oliveira Barcellos
Heloiza Dias da Silva
Nilda Maria da Cunha Sette

Editorial Supervision
Wyviane Carlos Lima Vidal

Translation Revision
Ana Maranhão Nogueira

Bibliographic Standardization
Iara Del Fiaco Rocha (CRB-1/2169)

Translation
Paulo de Holanda Morais
(World Chain Idiomas e Traduções Ltda.)

Graphic project, Electronic Editing and Cover
Carlos Eduardo Felice Barbeiro

Image Processing
Paula Cristina Rodrigues Franco

1st Edition
Digital Publication – PDF (2020)

Cataloging in Publication (CIP) data
Embrapa

Quality education: Contributions of Embrapa / Joanne Régis Costa ... [et al.], technical editors. – Brasília, DF : Embrapa, 2020.
PDF (81 p.) : il. color. (Sustainable Development Goals / [Valéria Sucena Hammes ; André Carlos Cau dos Santos] ; 4).

Translated from: Educação de qualidade: contribuições da Embrapa. 1st edition. 2018.
ISBN 978-65-86056-46-4

1. Learning. 2. Sustainable Agriculture. 3. Development Policy. 4. Qualification. I. Costa, Joanne Régis. II. Costa, Patrícia da. III. Hammes, Valéria Sucena. IV. Aquino, Adriana Maria de. V. Collection.

CDD 370.1

Rejane Maria de Oliveira (CRB-1/2913)

Authors

Adriana Maria de Aquino
Biologist, doctoral degree in Soil Science, researcher at Embrapa Agrobiology, Seropédica, RJ, Brazil

Alcides Galvão dos Santos
Business administrator, master's degree in Economics, analyst at Embrapa Roraima, Boa Vista, RR, Brazil

André Luiz dos Santos Furtado
Biologist, doctoral degree in Ecology, researcher at Embrapa Satelite Monitoring, Campinas, SP, Brazil

Célia Regina Grego
Agricultural engineer, doctoral degree in Energy in Agriculture, researcher at Embrapa Agricultural Informatics, Campinas, SP, Brazil

Cristina Aparecida Gonçalves Rodrigues
Zootechnician, doctoral degree in Plant Biology, researcher at Embrapa Satelite Monitoring, Campinas, SP, Brazil

Cristina Criscuolo
Geographer, master's degree in Environmental Engineering, researcher at Embrapa Satelite Monitoring, Campinas, SP, Brazil

Edson Raimundo da Silva Alves
Agricultural engineer, master's degree in Agribusiness, researcher at the General Division, Embrapa, Brasília, DF, Brazil

Elizângela de França Carneiro
Business administrator, master's degree in Agriculture and Sustainability in the Amazon, analyst at Embrapa Western Amazon, Manaus, AM, Brazil

Fernando Antonio Hello
Agricultural engineer and psychologist, doctoral degree in Education, researcher at Innovation and Business Division, Embrapa, Brasília, DF, Brazil

Inocêncio Júnior de Oliveira
Agricultural engineer, doctoral degree in Genetics and Plant Breeding, researcher at Embrapa Western Amazon, Manaus, AM, Brazil

Joanne Régis Costa
Biologist, master's degree in Ecology, researcher at Embrapa Western Amazon, Manaus, AM, Brazil

José Olenilson Costa Pinheiro
Economist, master's degree in Family Agriculture and Sustainable Development, researcher at Embrapa Western Amazon, Manaus, AM, Brazil

Juliana Lúcia Escobar
Journalist, doctoral degree in Sociology, analyst at the Intelligence and Strategic Relations Division, Embrapa, Brasília, DF, Brazil

Kátia Staretz
Data-processing technologist, specialist in Software Engineering, analyst at the General Division, Embrapa, Brasília, DF, Brazil

Lindomar de Jesus de Sousa Silva
Sociologist, Doctoral Degree in Sustainable Development of the Humid Tropics, researcher at Embrapa Amazônia Occidental, Manaus, AM, Brazil

Maíra Gabriela Santos de Souza
Psychologist, master's degree in Social Psychology, researcher at the General Division, Embrapa, Brasília, DF, Brazil

Maria Aldete Justiniano da Fonseca
Agricultural Engineer, doctoral degree in Genetics and Plant Breeding, researcher at Embrapa Genetic Resourses & Biotechnology, Brasília, DF, Brazil

Maria Conceição Peres Young Pessoa
Mathematics, doctoral degree in Electrical Engineering, researcher at Embrapa Environment, Jaguariúna, SP, Brazil

Maria Fernanda Berlingieri Durigan
Agricultural engineer, doctoral degree in Plant Production, researcher at Embrapa Roraima, Boa Vista, RR, Brazil

Mirza Carla Normando Pereira
Agricultural engineer, master's degree in Plant Production, researcher at Embrapa Western Amazon, Manaus, AM, Brazil

Michell Olívio Xavier da Costa
Technologist in data processing, master's degree in Information Science, analyst at Embrapa Eastern Amazon, Belém, PA, Brazil

Patricia da Costa
Biologist, doctoral degree in Biodiversity and Conservation, researcher at Embrapa Roraima, Boa Vista, RR, Brazil

Patrícia de Andrade Oliveira Sales
Psychologist, master's degree in Social Psychology, analyst at the General Division, Embrapa, Brasília, DF, Brazil

Selma Lúcia Lira Beltrão
Journalist, master's degree in Sustainable Development, analyst at the Innovation and Business Division, Embrapa, Brasília, DF, Brazil

Terezinha Pinto de Arruda

Attorney, master's degree in Territorial Development and Environment, analyst at Embrapa Instrumentation, São Carlos, SP, Brazil

Valéria Sucena Hammes
Agronomist, doctoral degree in Environmental Planning, researcher at Embrapa, Intelligence and Strategic Relations Division, Brasília, DF, Brazil

Vandréa Moraes Ferreira
Social communicator, master's degree in Business Administration and Development, analyst at Embrapa Agrobiology, Seropédica, RJ, Brazil

Vânia Beatriz Vasconcelos Oliveira
Journalist, master's degree in Rural Extension, researcher at Embrapa Rondônia, Porto Velho, RO, Brazil

Walter José Rodrigues Matrangolo
Agricultural engineer, doctoral degree in Ecology and Natural Resources, researcher at Embrapa Maize & Sorghum, Sete Lagoas, MG, Brazil

Wilson Tadeu Lopes da Silva
Chemist, doctoral degree in Chemistry, researcher at Embrapa Instrumentation, São Carlos, SP, Brazil

It is necessary to reduce the distance between what is said and what is done, until, at a certain moment, your speech is your action.

Paulo Freire

Foreword

Launched by the United Nations in 2015, 2030 Agenda for Sustainable Development is powerful and mobilizing. Its 17 goals and 169 targets seek to identify problems and overcome challenges that affect every country in the world. The Sustainable Development Goals (SDG), for their interdependent and indivisible character, clearly reflect the steps towards sustainability.

Reflecting and acting on this agenda is an obligation and an opportunity for the Brazilian Agricultural Research Corporation (Embrapa). The incessant search for sustainable agriculture is at the core of this institution dedicated to agricultural research and innovation. Moreover, sustainable agriculture is one of the most cross-cutting themes for the 17 goals. This collection of books, one for each SDG, helps society realize the importance of agriculture and food in five priority dimensions – people, planet, prosperity, peace, and partnerships –, the so-called 5 Ps of 2030 Agenda.

This collection is part of the effort to disseminate 2030 Agenda at Embrapa while presenting to the global society some contributions of Embrapa and partners with potential to affect the realities expressed in the SDG. Knowledge, practices, technologies, models, processes and services that are already available can be used and replicated in other contexts to support the achievement of goals and the advancement of 2030 Agenda indicators.

The content presented is a sample of the solutions generated by agricultural research at Embrapa, although nothing that has been compiled in these books is the result of the work of a single institution. Many other partners joined in – universities, research institutes, state agricultural research organizations, rural technical and extension agencies, the Legislative Power, the agricultural and industrial productive sector, research promotion agencies , in the federal, state and municipal ranges.

This collection of books is the result of a collaborative work within SDG Embrapa Network, which comprised, for 6 months, around 400 people, among editors, authors, reviewers and support group. The objective of this initial work was to demonstrate, according to Embrapa, how agricultural research could contribute to achieve SDGs.

It is an example of collective production and a manner of acting that should become increasingly present in the life of organizations, in the relationship

between public, private and civil society. As such, this collection brings diverse views on the potential contributions to different objectives and their interfaces. This vision is not homogeneous; sometimes it can be conflicting, just as is society's vision about its problems and respective solutions, a wealth which is captured and reflected in the construction of 2030 Agenda.

These are only the first steps in the resolute trajectory that Embrapa and partner institutions draw towards the future we want.

Maurício Antônio Lopes
President of Embrapa

Preface

The Brazilian Agricultural Research Corporation (Embrapa), in its essence, seeks sustainable technological solutions for the Brazilian agriculture. This contribution has obtained greater social infiltration from actions in the educational field, whether formal or non-formal.

The Sustainable Development Goals Collection, of which this book is part, results from the interest of Embrapa in sharing its many actions in accordance with the 17 Sustainable Development Goals (SDG) established in 2015 in 2030 Agenda of the United Nations (UN).

This book addresses the development of human capacities in the field of agribusiness and family farming, and is especially aligned with SDG 4 (Quality Education), which aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"[1].

Researchers and analysts present, in six chapters, the paths Embrapa has taken towards the sustainability of Brazilian agriculture, targeting not only the current generation, but also future generations.

Chapters 1 and 2 of this e-book *Quality education: contributions of Embrapa* present the context and challenges of education in the Brazilian rural community. Chapter 3 presents materials and methods that aim to instrumentalize meaningful learning in order to contribute to meeting SDG 4 targets 4.1 and 4.7.

Several practices for disseminating knowledge and technologies through events, programs, partnerships, content and demonstration spaces aimed at children, young people and adults are presented in Chapter 4, besides the contributions of Embrapa to meeting target 4.4.

Chapter 5 presents the resources and good educational practices used to promote inclusion and meet target 4.5. The last chapter summarizes the effective role of Embrapa in supporting the achievement of SDG 4 targets and highlights future challenges for sustainable development.

Technical editors

[1] Available at: <https://sustainabledevelopment.un.org/sdg4>.

Table of contents

Chapter 1

For a better world

Joanne Régis Costa
Valéria Sucena Hammes

Introduction

The Sustainable Development Goal 4 (SDG 4) of 2030 Agenda establishes education as a thematic dimension that aims to transform the educational field around the world by 2030. The main focus is "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (United Nations, 2017).

In this chapter makes a contextualisation on the topic, presenting information about the educational process on the planet, in Brazil, and within Embrapa.

Educate to develop

Education is one of the fundamental rights embodied in the Universal Declaration of Human Rights (Nações Unidas, 1948). Nevertheless, in the *Global Education Monitoring Report* (Education..., 2015), the United Nations Educational, Scientific and Cultural Organization (Unesco) has estimated that there are over 770 million illiterate adults in the world , out of which more than 60% are women. There are 58 million children without access to school, and it is estimated that about 100 million will not complete primary education. Adding to this, 126 million young people on the planet lack basic reading and writing skills.

Stagnation in the progress of education has profound consequences for children and adolescents who cannot go to school. Education of women and children has a positive multiplier effect on progress in all areas of development (Education..., 2015).

Unesco's *Global Education Monitoring Report* 2017/2018 (Relatório..., 2017) reinforces that education without adequate learning is a waste of financial resources and human potential, which means a social injustice affecting children, young people and adults all over the planet. Everyone has a role to play in improving education; both ordinary citizens and teachers and non-teaching

professionals, students, non-governmental organizations, the private sector and governments have the power to contribute to SDG 4.

The construction of 2030 Agenda Platform (Plataforma Agenda 2030, 2017) by the United Nations Development Program (UNDP Brazil), which gathers information on the Agenda, its goals and indicators, represents an important means of monitoring government actions to achieve SDG 4. The commitment of the Brazilian Institute of Geography and Statistics (IBGE) and of the Institute of Applied Economic Research (IPEA) to produce annual documents measuring the implementation of the Agenda by Brazil is also important.

Quality education

The *Global Education Monitoring Report* (GEM Report) released by Unesco in 2017 (Relatório..., 2017) highlights the importance of better education for women and girls, which would be the most effective form to change current reality. The report also shows that education is the key to achieving other SDGs: better education leads to greater prosperity, improved agriculture, better health outcomes, less violence, more gender equality, higher social capital and an improved natural environment.

According to the World's Most Literate Nations ranking, in 2016 (Central Connecticut State University, 2016), Brazil won the first place in greater allocation of gross domestic product (GDP) for education and more students in school. However, in terms of quality education, the country ranked 55th out of 61 countries.

The National Household Sample Survey (PNAD) estimates that 2.9 million children and adolescents between 4 and 17 years of age are out of school, and only 55.2% of the population between the ages of 15 and 17 are enrolled in high school (IBGE , 2014). Brazil is among the ten nations responsible for 72.0% of the world's illiterate population, with 13 million people aged 15 or over who cannot read (Education..., 2015), especially in rural areas.

The Municipal Human Development Index (MDI-M) of 2013 revealed that education in Brazil was the main obstacle in the last 20 years for a more vigorous improvement in the index (O índice..., 2013).

The expectation of the continuity of the migration of people from rural areas to cities and the limitations of education in Brazil, as well as processes that together contribute to the shortage of qualified work in the field, increase the need for

expansion of the supply and adoption of technologies in rural areas as decisive factors to increase labor productivity in the field (Contini et al., 2010).

In rural areas, low schooling makes it difficult for workers to deal with complex technologies, and this aggravates the scarcity of skilled labor.

Therefore, quality education, whether formal or non-formal, is the basis of economic, environmental, technological and social changes and advances. Its importance is revealed in the formation of citizens who are prepared to contribute to the country's development. In this way, eradicating extreme poverty, creating opportunities and moving forward in changes become achievable goals.

Policies can induce changes in direction by expanding the supply of public goods, by imposing limits on the use of resources and by promoting changes in the balance of private and social costs and benefits. These scenarios are derived from the strategies for rural development, planned and effectively implemented, whose success depends not only on technological factors, but also on other non-technological factors, such as logistics, education and sanitation (Embrapa, 2015).

Educational actions of Embrapa

Embrapa's work of research and technology transfer is based on the concept of education for sustainable development, which seeks to raise critical awareness of society and know-how.

In 2017, 478 actions of professional training, technological updating and exchange of knowledge, 88 environmental education actions, 75 social development and community organization actions were registered, 61 external information and communication products, 48 advisory actions, representation and technical subsidies and 34 actions to promote or participate in workshops and exhibitions (Embrapa, 2017).

Embrapa's results are offered to the whole society in its different groups: family farmers, small, medium and large-scale producers, riverside peoples, extractivists, indigenous, quilombo remnants, among others, considering the differences in their relations with land and their work and natural resources in the different Brazilian biomes.

Embrapa's social responsibility was reflected in more than a thousand actions in 2016 (covering a variety of topics), of which 29% promoted gender and/or

race equality, 10% food security and productive inclusion, and 43% professional training and the technological update. There are currently 72 Embrapa contracts with rural extension agencies.

There are several multidimensional arrangements of Embrapa solutions, as well as products and processes that aim to develop science and technology, disseminate knowledge and encourage the adoption of good agricultural practices.

These actions aim to contribute to families remaining in rural areas with dignity, which requires a multidimensional and operational approach to sustainability.

Final considerations

Faced with the intensification of the loss of natural ecosystems and social inequalities, it is crucial to seek ways to encourage society to act in accordance with the ethics of citizen action in order to contribute to change.

Through truly transformative quality education, people become able to change their context and build and seize opportunities, which contributes to generating social peace.

As an institution committed to its social duty to generate technical-scientific knowledge, influence the quality of life and promote the development of capacities, Embrapa develops educational practices to collaborate with the dissemination of knowledge that contributes to the development of agricultural sustainability for the benefit of Brazilian society.

References

CENTRAL CONNECTICUT STATE UNIVERSITY. **World's most literate nations**: rank breakdown. Available at: <http://www.ccsu.edu/wmln/rank.html>. Accessed on: Oct. 18, 2017.

CONTINI, E.; GASQUES, J. G.; ALVES, E.; BASTOS, E. T. Dinamismo da agricultura brasileira. **Revista de Política Agrícola**, ano 19, p. 42-64, 2010.

EDUCATION for all 2000-2015: achievements and challenges. Paris: Unesco, 2015. 58 p. (EFA Global Monitoring Report, 2015). Concise report.

EMBRAPA. **Embrapa em números**. Brasília, DF, 2017. 140 p.

EMBRAPA. Secretaria de Gestão e Desenvolvimento Institucional. **VI Plano diretor da Embrapa**: 2014-2034. Brasília, DF, 2015. 24 p.

IBGE. **Pesquisa nacional por amostra de domicílios contínua**: PNAD 2014. [Brasília, DF, 2014].

NAÇÕES UNIDAS. **Declaração Universal dos Direitos Humanos**. 1948. Available at: <https://www.ohchr.org/EN/UDHR/Pages/Language.aspx?LangID=por >. Accessed on: Oct. 14, 2017.

O ÍNDICE de desenvolvimento humano municipal brasileiro. Brasília, DF: PNUD, 2013. 96 p. (Série atlas do desenvolvimento humano no Brasil 2013). Available at: <https://www.ipea.gov.br/portal/index.php?option=com_content&id=19153>. Accessed on: Oct. 17, 2017.

PLATAFORMA AGENDA 2030. Available at: <http://www.agenda2030.org.br>. Accessed on: Oct. 17, 2017.

RELATÓRIO de monitoramento global da educação: resumo 2017/8: responsabilização na educação: cumprir nossos compromissos. Paris: Unesco, 2017. 62 p. Available at: <http://unesdoc.unesco.org/images/0025/002595/259593por.pdf>. Accessed on: Oct. 17, 2017.

UNESCO. **Educação para os objetivos de desenvolvimento sustentável**: objetivos de aprendizagem. [S.l.], 2017. 62 p. Available at: <http://unesdoc.unesco.org/images/0025/002521/252197POR.pdf>. Accessed on: Oct. 18, 2017.

UNITED NATIONS. **Sustainable development goal 4**: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all: targets & indicators. Available at: <https://sustainabledevelopment.un.org/sdg4>. Accessed on: Oct. 10, 2017.

Chapter 2

Education challenges in Brazil

Lindomar de Jesus de Sousa Silva
Elizângela de França Carneiro
José Olenilson Costa Pinheiro
Joanne Régis Costa

Education in the Brazilian context

Brazil is a continental-size country, with a high diversity of natural ecosystems, a large amount of arable areas and a high demand for food, due to the 207.7 million inhabitants (Brasil, 2017a). This demand requires the pursuit of self-sufficiency in production, an increase in agricultural productivity and improvements in food quality, in accordance with practices that ensure sustainability in the economic, social and environmental tripod.

Therefore, there is a long and challenging path that also involves the prioritization of education.

Education is a social right responsible for the preparation for citizenship and training of human resources that will guarantee social development, with a view to building a free, fair and solidary society (Stefano et al., 2014).

Education is an essential instrument for overcoming the limits that deprive Brazilians of a sustainable society. In addition, when it is firmly taken, education can unleash individual and collective transformations, once it enables, along with existing individual knowledge, the acquisition of new skills. These abilities start to operate and trigger changes in all aspects of life. Therefore education that is the main strategy that can foster opportunities for sustainable living.

However, for such, education must be contextualized, being appropriate to the local reality, at the risk of training technicians who will be displaced from the realities where they should act, not being able to use their skills and creativity to identify and act in the real needs of the social groups with whom they will work.

Although education is a right for all (Brasil, 2000), regardless of social class, skin color, place of birth and place of residence (urban or rural area), it is a great challenge to make it in the Brazilian countryside.

The Brazilian countryside scenario reveals several difficulties that prevent not only greater agricultural productivity, but also local development as a whole. These difficulties push young people to cities, since in the countryside there is a lack of employment and leisure, low or no income, few available communication resources and low-quality formal education (available schools are often located at great distances, which requires rural school transport).

Quality education is essential for rural development in a sustainable way, mainly because it enables farmers to use sustainable technologies and innovations in their productive activity. People live in the "knowledge society", and the only path to be followed is the one "[...] of decisions based on knowledge, science, technology and innovation. And we cannot achieve it without education" (Crestana; Mori, 2015, p. 73, our translation).

It should be emphasized that this educational process, in order to be efficient, must be holistic and systemic, based on a collective construction and on the exchange of experiences already developed by the farmers, that is, from local knowledge as a bridge to a new contextualized education.

Education challenge for agribusiness

According to Oliveira (2016), there are, in Brazil, 53% of functional illiterates working in agriculture. In this sector, only 4% of rural workers have higher education. This fragility compromises the development of the agricultural sector, "[...] an open industry, much more complex than other types of industry, because it uses a lot of technology, that is, it demands prepared people" (Celidônio, 2016 quoted by Oliveira, 2016, our translation). Data from the Relação Anual de Informações Sociais do Ministério do Trabalho (Annual Social Information Report of the Ministry of Labor – RAIS/MTE) (Brasil, 2017b) show that the agricultural sector is the one with the lowest level of education. There are 57% of the workers concentrated in the illiterate or educated up to the 5th grade of elementary education categories, while commerce and services sector each have 11%, civil construction 31% and industry 16%.

Low schooling may constitute a barrier to the development of the agricultural sector. Celidonio (2016 quoted by Oliveira, 2016) states that there is an increasingly latent demand in agribusiness for greater qualification of rural workers. For Guedes et al. (2014, p. 143, our translation), basic education and the qualification of labor are some of the "[...] main obstacles to the country's growth". According to the

author, there is still a "[...] demographic gap in this period [...]" (Guedes et al., 2014, p. 143, our translation), and Brazil will only profit from the gains "[...] if it makes heavy investments in education" (Guedes et al., 2014, p. 143, our translation). Guedes et al. (2014, p. 143, our translation) present some suggestions, such as: "[...] structure secondary schools in production units integrated with teaching and research centers; reformulate the curriculum and calendar of rural schools, focusing on regional agricultural themes and the issue of entrepreneurship".

Brazilian agriculture increasingly incorporates technologies and innovations in its production process, which requires professionals with the ability to operate a complex system. Buainain et al. (2013, p. 112, our translation) report that "the process of production and diffusion of innovations in agriculture has changed" and that the industrialization of Brazilian agriculture has been increasingly stimulated.

In this context, education presents itself as an instrument capable of stimulating and enabling people with a set of skills, being a strong competitive advantage, able to contribute to the efficiency and effectiveness of agribusiness and to the development of a sustainable production in the national territory.

Education challenge for family farming

Family farming, defined as that in which property, management and labor are primarily carried out by individuals with blood or marriage bonds (Abramovay, 1997), is increasingly assuming an essential role in the production of healthy food, income generation and the conservation and maintenance of socio-biodiversity.

For family farmers, education is an important tool for rural development. However, for an effective contribution, education needs to incorporate in its universe an openness to collective and organizational and cultural diversity and to have a political-pedagogical project capable of fostering education in its broad sense, beyond the formal space of school. Education needs to be an instrument capable of preventing rural exodus, especially of young people and women, and it must contribute to overcoming the challenge of rural aging, which is growing in many communities. In addition, education must allow the exploitation of the endogenous potential of rural territories and essentially be able to work "[...] a centuries-old knowledge of relatively little economic efficiency and great social efficiency" (Martins, 2014, p. 24, our translation).

Education in family farming needs to provide elements that contribute to emancipatory action by farmers, in which they are able to autonomously take decisions on the adoption of practices and technologies that contribute to the delivery of environmentally healthy products socially appropriate and for a better quality of life.

Contributions of Embrapa

Improving the ability and agility of transforming advances in scientific knowledge into technologies and processes that fuel innovation and promote the production process is essential. It is also important to contribute to "facilitating access to information and technology" and "training and empowering people for new job opportunities and meeting the demand for skilled labor". (Guedes et al., 2014, p. 126, our translation).

Embrapa's instruments, tools, resources and methods of technology transfer are designed and developed so that those interested in using ready technology will be able to capture it. In addition, participatory methodologies are used so that the farmer is also an actor in the technology construction process, considering the family as part of this process. In this case, actions are developed in a consensual way, considering the interests, plans and priorities of the family. The action is for farmers and with farmers.

In addition, Embrapa's strong interaction with several public and private institutions has allowed the exchange of information and the formation of multiplier agents at various levels and productive spaces. In this sense, Embrapa introduces knowledge and technological innovations in the most diverse sectors of society and, in this way, contributes to providing society (mainly farmers and actors linked to the rural environment) with knowledge and skills essential for the promotion of sustainable development.

Final considerations

The low schooling and low qualification situation of Brazilian rural workers refers to a greater work for institutions such as Embrapa that work with the development of agribusiness and family farming. Considering this reality, Embrapa has made a strong investment in the development of capacities and competences in the Brazilian countryside so that the technologies generated can be part of the

universe of farmers, being appropriate to the local situation, in order to improve their quality of life.

The position of Embrapa is that a new country is being built. Therefore, it is fundamental that education be of quality, inclusive and capable of assuring to Brazilians their status as protagonists in the transformation of their realities and in the promotion of a genuine and sustainable development.

References

ABRAMOVAY, R. Paradigmas do capitalismo agrário em questão. In: SEMINÁRIO NACIONAL DE ASSISTÊNCIA TÉCNICA E EXTENSÃO RURAL, 1997, Brasília, DF. **Uma nova extensão para a agricultura familiar**: anais. Brasília, DF: Pnud, 1997. p. 29.

BRASIL. Constituição (1988). **Constituição da República Federativa do Brasil**. Organização de Alexandre de Moraes. 16. ed. São Paulo: Atlas, 2000.

BRASIL. Ministério do Trabalho e Emprego. **RAIS**: relação anual de informações sociais. Available at: <http://acesso.mte.gov.br/portal-pdet/o-pdet/registros-administrativos/rais/apresentacao.htm>. Accessed on: Nov. 1, 2017b.

BRASIL. Resolução nº 4, de 28 de agosto de 2017. **Diário Oficial da União**, 30 ago. 2017. Seção 1, p. 58. Available at: <http://pesquisa.in.gov.br/imprensa/jsp/visualiza/index.jsp?jornal=1&pagina=58&data=30/08/2017>. Accessed on: Nov. 17, 2017.

BUAINAIN, A. M.; ALVES, E.; SILVEIRA, J. M.; NAVARRO, Z. Sete teses sobre o mundo rural brasileiro. **Revista de Política Agrícola**, ano 22, n. 2, p. 105-121, Apr./May/June 2013.

CRESTANA, S.; MORI, C. de. Tecnologia e inovação no agro: algumas tendências, premências e drivers de mudanças. In: BUAINAIN, A. M.; BONACELLI, M. B. M.; MENDES, C. I. C. (Org.). **Propriedade intelectual e inovações na agricultura**. Rio de Janeiro: INCT, 2015. p. 59-85.

GUEDES, A. C.; TORRES, D. A. P.; CAMPOS, S. K. Sustentabilidade e sustentação da produção de alimentos e o papel do Brasil no contexto global. In: BUAINAIN, A. M.; ALVES, E.; SILVEIRA, J. M. da; NAVARRO, Z. (Ed.). **O mundo rural no Brasil do século 21**: a formação de um novo padrão agrário e agrícola. Brasília, DF: Embrapa, 2014. p. 117-146.

MARTINS, J. de S. A modernidade do "passado" no meio rural. In: BUAINAIN, A. M.; ALVES, E.; SILVEIRA, J. M. da; NAVARRO, Z. (Ed.). **O mundo rural no Brasil do século 21**: a formação de um novo padrão agrário e agrícola. Brasília, DF: Embrapa, 2014. p. 22-30.

OLIVEIRA, S. de. Só a educação salva o agronegócio. **Revista Agro DBO**, 14 nov. 2016. Super Manchete. Educação. Entrevista com Otávio Celidônio, do Senar-MT. Available at: <https://issuu.com/portaldbo/docs/agro_ed_84>. Accessed on: Nov. 1, 2017.

STEFANO, I. G. de A.; CANEGUSUCO, M.; KÜMPEL, V. **Direito constitucional**. Rio de Janeiro: Elsevier, 2014.

Chapter 3

Agri-environmental education for valorization of life in the countryside and in the city

Joanne Régis Costa
Valéria Sucena Hammes
Vânia Beatriz Vasconcelos Oliveira
Inocêncio Júnior de Oliveira
Mirza Carla Normando Pereira
Walter José Rodrigues Matrangolo
Maria Aldete Justiniano da Fonseca
Terezinha Pinto de Arruda
Wilson Tadeu Lopes da Silva

Introduction

The targets of Sustainable Development Goal 4 (SDG 4) addressed in this chapter refer to meaningful learning that determines the improvement of social, economic and environmental relations, giving the subjects the ability to act in the protection of the landscape for sustainable development.

These being:

> [Target] 4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.
>
> [...]
>
> [Target] 4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development. [...] (United Nations, 2017).

Contributions of Embrapa to the aforementioned targets refer to formal and non-formal educational actions developed in the regions of the country that contribute to the valorization of life.

Cultural sustainability

The cultural identity of peoples must be recognized and respected by all. Culture is today identified as an instrument that promotes development and is recognized as an essential factor to the balance of society.

The United Nations Educational, Scientific and Cultural Organization (Unesco, 2002) has proposed that education, in addition to propagating teaching and learning about the cultural diversity of the human being, reinforces the recognition that all are equal and interdependent. This union is presupposed for the attainment of world citizenship.

The Brazilian Agricultural Research Corporation (Embrapa) operates in all Brazilian regions and recognizes that cultural development and cooperation must be based on the recognition of differences of identities, understanding that each has its value. Cultural diversity and the participation of the population are crucial for conscious transformation towards sustainable development.

Since the Environmental Education Treaty for Sustainable Societies and Global Responsibility, at the *United Nations Conference on Environment and Development* (*Eco 92*), Embrapa has developed several solutions for agri-environmental awareness with the purpose of inserting environmental issues into the processes of technological solutions developed. Some practices aim to work on conceptual models and, consequently, paradigm changes.

Macroeducation

Macroeducation is a set of techniques, methods and materials developed by Embrapa Environment with the objective of systematizing a process of awareness that results in the change of attitude of family farmers, students of rural schools and agricultural technicians through the training of rural extension multiplier agents and public education networks (Brasil, 2012).

It is a participatory planning method to guide the formation of sustainable community. The moderator conducts the process of developing collective

perception about the territory or organization so that, in an agile way, the community delineates its own methodology of socio-environmental interaction of management and governance aiming at sustainable development. The main strategy is the formation of present and future development agents with the purpose of influencing the transition from the present to the sustainable future, starting from the building of relationships that result in local quality of life.

Macroeducation is applicable to all Brazilian regions and biomes, involving diverse publics and the interrelation between adults, youngsters and children of the education networks, from kindergarten to undergraduate education, also permeating agricultural and non-agricultural vocational education. In this last area, the integrated production of strawberry (PIMo) and the technical-agricultural schools in organic production and integrated production stand out. The results were certifications won by family farmers and schools, as well as the recognition of macroeducation as a good practice in environmental education in family farming by the Ministry of Environment (Brasil, 2012).

Environmental Education collection for sustainable development

The main result regarding macroeducation is the launch of the Environmental Education Collection for Sustainable Development, with seven volumes (today in the third edition). This kind of material serves primary and secondary education and is used for the training of moderators, community leaders and public and private organizations, making them able to jointly develop their own socio-environmental responsibility methodologies. The method was awarded by the Ação pela Água do Consórcio Intermunicipal das Bacias dos Rios Piracicaba, Capivari e Jundiaí (Water Action from the Piracicaba, Capivari and Jundiaí Rivers Basin Intermunicipal Consortium) for the work done with 110 schools in 30 municipalities of São Paulo state.

Education of sustainable development agents

Sustainable development is one that seeks to meet the needs of the present generation without compromising the ability of future generations to meet their own needs (Comissão Mundial sobre Meio Ambiente e Desenvolvimento, 1991). In accordance with this concept and with the aim of promoting the sustainability of Brazilian agriculture, Embrapa develops educational practices appropriate

to public and private organizations and civil society organizations, such as rural communities and publics that directly or indirectly influence the living conditions. Embrapa also carries out actions directed to the education networks (from kindergarten through graduation) aiming to contribute to its improvement through the awareness of students, potential development agents.

Agricultural research by nature requires continuous interaction with the productive sector to develop knowledge and provide technological solutions. Technicians, farmers, cattle breeders and rural communities are distinct publics, which require different forms of communication; these forms are presented below.

Field day

Embrapa organizes events and programs called "field days" and implements spaces, either in the institution itself or in strategic locations, with the purpose of demonstrating its technologies, services and products, through direct contact, in a consolidated manner, with action practices and knowledge exchange between technicians and farmers.

One of the formats of the field days is the program Field Day on TV, which allows greater visibility to Embrapa's research because it is broadcasted in a language appropriate to the target audience by broadcasters of national reach and by satellite dish.

Education experience of multiplying agents

Among many experiences of training of multiplier agents, it is important to highlight the one led by researchers from Embrapa Western Amazon, in Manaus, AM, in 2016.

Researchers trained 18 mid-level technicians and three agronomists to act as multiplier agents on the Production Systems of cassava, cowpea and corn. The training was aimed at increasing the productivity of these crops and increasing the supply of food, food security and quality of life of the population. After the participation of the technicians in the training courses, 90 Demonstration Units were installed and 2,788 farmers were trained in 22 municipalities, distributed in 236 rural communities. It was verified that the average agricultural productivity of the Demonstration Units was superior to the average of the state of Amazonas. This reveals the importance of using technology and technical training, especially

in a state with one of the lowest levels of education in the country (Oliveira; Pereira, 2017).

This experience is an example of how the implementation of Demonstration Units has contributed to the training of professionals and students aligned with the technologies offered by Embrapa and enabling farmers to produce in a sustainable way.

Community communication for strengthening local development

Embrapa Technological Information has built a communication method based on the premises of community communication and popular education. The method arose in the context of a public policy, the Plano Brasil Sem Miséria (Brazil Without Poverty Plan), in which Embrapa worked with farmers and rural extension workers in 14 Territories of Citizenship in the Northeast region. The objective is to encourage the continuous formation of community leaders to exercise the communicative role, in order to contribute to a new perspective of rural development, with an agroecological approach and based on the premises of sustainability.

The tools used in the communication process are:

- Training in community communication for territorial leaderships – farmers, communicators, educators, rural youngsters and rural extension technicians – through workshops on agroecology and systematization of experiences (concepts and practices).
- Communication tools (techniques for producing audios, videos, photographs and bulletins).
- Dialogue groups articulating elements of participatory rapid diagnosis of the Territory and analysis of narratives from the theme "traditional versus alternative media".
- Experiences in agroecological spaces for recording images, interviews and photo production and use of social media in the formation of networks.

Embrapa partners in this work were the Department of Transfer of Technology, Embrapa Coastal Tablelands, Embrapa Tropical Agroindustry, Embrapa Goats & Sheep, Embrapa Semiarid Agriculture, Embrapa Cassava & Fruits, Embrapa Maize & Sorghum, Embrapa Cocais, Embrapa Cotton e Embrapa Mid-North, besides

Articulação Semiárido Brasileiro (Brazilian Semiarid Articulation – ASA) and its state organizations.

In 2017, Banco do Brasil Foundation (FBB) certified the methodology as social technology reapplicable under the 9th edition of Prêmio Fundação Banco do Brasil de Tecnologia Social (Banco do Brasil Social Technology Foundation Award).

Agricultural property management

The method developed by Embrapa Western Amazon, applied in Manaus, AM, is addressed to family farmers (individual, family or community) and aims to develop the capacity and autonomy of the management of agricultural property as a strategy to improve the quality of life and search for the sustainable local development.

The methodology consists in the elaboration of a schedule of courses, workshops, lectures, talk groups, technical visits and field days, according to the interest of the families and the needs observed. At the same time, practical actions are taken to recover degraded areas, rehabilitate Permanent Preservation Areas (APPs) and Legal Reserve areas, in accordance with Brazilian law.

The goal is to emphasize participation, the expansion of environmental knowledge and its interface with health, critical reflection, experiential learning and the democratic ownership of the processes of change. In these meetings, there are exchanges of experiences, observations and discussions on techniques and procedures that can be adapted by farmers.

Building skills are important to promote sustainable management of farms. Environmental education is considered to be an effective tool for raising awareness and training on environmental, social and economic issues.

The method was recognized as a good practice of environmental education in family farming by the ministry of the environment. In addition, the linked project was considered a reference in the Amazon biome (Brasil, 2012).

In 2011, the project's partner association was selected as a finalist of Banco do Brasil Social Technology Foundation Award, which is sponsored by Petrobras and by a partnership of the Ministry of Science and Technology, Unesco and KPMG Auditores Independentes.

Fish for schools

Researchers from Embrapa Fisheries & Aquaculture, in partnership with other institutions, have been undertaking, since 2016, in Tocantins, actions to train fishermen, women who prepare meals, students and teachers to meet the prerequisites of the Programa Nacional de Alimentação Escolar (National School Feeding Program – PNAE).

The actions seek to make the schools accessible to fishermen, enabling the producer with correct forms of creation, slaughter and distribution, so that the product is consumed by the school units. The training and guidance of fishermen in good practice present excellent results. Of the 36 participants, 15 fishermen are included in PNAE, which has resulted in a significant increase in their income.

It also carries out the training of the women preparing the meals, who learn about fish cleaning, preparation of recipes, ways of serving and tests of acceptance.

Students and teachers are also trained in fish farming as part of the partnership between Embrapa and the school. The work that addressed training and guidance to fishermen (Sousa et al., 2016) was awarded by the International Fund for Agricultural Development (IFAD), an agency of the United Nations (UN). The experience report with public schools and fishermen from Brejinho de Nazaré, TO, was one of the five selected for publication on the page of FIDA Mercosul and it received award in cash.

Pedagogical Bank of Família Agrícola School of Sobradinho

The spaces created for teaching and learning in some units of Embrapa are well diversified having as background the rural landscape and the creation of trails to instrumentalize the technological and ecological learning.

There are also spaces in schools, such as the work developed at Escola Família Agrícola (Rural Family School), located in the municipality of Sobradinho, BA.

These schools are community-based institutions run by an association of families, ex-students, people and related entities, with the mission of promoting the integral formation of family farmers' and rural workers' children, aiming at sustainable development through alternative education. The pedagogy of alternation is an educational concept that seeks to promote the dialogue between empirical,

traditional and scientific knowledge from a formation that alternates school time and community time. The school of Sobradinho, although located in this municipality, has as students the children of family farmers from different other municipalities of the region.

The work developed was the creation, in 2016, of the Banco Pedagógico da Agrobiodiversidade (Pedagogical Bank of Agrobiodiversity – BPA), with seeds of creole varieties coming from different municipalities of Bahia. The registration of the information of the creole varieties kept in the seed bank was carried out with the participation of the students. Currently, BPA conserves 65 semiarid creole varieties, of which 38 were brought from their communities by school students during community activity. Twenty-six seed guardians were identified in the 15 communities where the collections were made.

Community seed banks are important because they are a privileged space for learning, development of management capacity, articulation of families for agro-ecological innovation processes and exchanges of knowledge, strengthening of cooperation and solidarity relations, seed recovery and of lost knowledge.

BPA is therefore an interesting and innovative strategy not only for the conservation and use of creole varieties, but also for the awareness of both teachers and students, farmers, technicians and other professionals in related areas on the importance of these varieties for family farming. In this work, Embrapa Semiarid Agriculture is a partner of the Instituto Regional da Pequena Agropecuária Apropriada (Regional Institute of Small Appropriate Agriculture – Irpaa) and the Federal University of Vale de São Francisco (Univasf). This experience will also be established in 11 other agricultural family schools in the state of Bahia that are part of the Rede das Escolas Famílias Agrícolas Integradas do Semi-Árido (Network of Integrated Agricultural Family Schools of the SemiArid Region – Refaisa).

Sisteminha (little system) Embrapa at school

Sisteminha Embrapa is a technological solution for integrated food production developed by Embrapa Mid-North in Teresina, PI, which consists of a rotation involving the integrated production of fruits, vegetables, poultry, small animals (guinea pig) and fish, with recirculation of nutrients from fish farming. The solution has turned into public policy, with projects to install more than 3 thousand systems in different Brazilian locations.

The Cristóvão Colombo de Queiroz State School, located in the municipality of Doutor Severiano, RN, together with Embrapa Tropical Agroindustry, implemented

a unit demonstrating *Sisteminha* Embrapa. *Sisteminha* has become a teaching-learning practice adopted in chemistry and biology, besides providing food that is consumed by teachers, assistants and students. Also benefiting families that survive at social risk. Students of the mentioned school received awards for researches related to the *Sisteminha*, in the *6ª Feira de Ciências do Semiárido Potiguar* (*6th Science Fair of the Potiguar Semiarid Region*).

Environmental Education Space

Embrapa Soybean revitalized in 2010 the old headquarters of its farm, an area of environmental and historical importance buit when the farm used to grow coffee. The Espaço de Educação Ambiental (Environmental Education Space – EEA) includes an APP, water sources, dam and a Legal Reserve area. EEA is used as a learning space and a culture of respect for the environment. The visit to the place includes an ecological trail and the visit to an old coffee barn, which now houses a museum that tells the history of the farm and the north of Paraná. EEA serves the community of Londrina, PR, and region, especially to elementary and middle school students and undergraduates.

Interpretative trail for environmental education

Several Embrapa units use the interpretive trail (Figure 1) as a pedagogical communication tool for environmental education in order to train multiplier agents on the technological solutions developed by Embrapa and to support discussions about environmental problems.

Embrapa Western Agriculture, headquartered in Dourados, MS, stands out with the trails integrated to the thematic and training workshops, campaigns and communication pieces (booklets, laboratory journal, photography, educational video), among others.

Green Room

The Green Room is a dynamic environment in which the citizen has access to information and experiences related to environmental education through workshops on handicrafts, theater and music, research in books, lectures, video presentations and walks on monitored trails. The activities aim to promote

Photo: Clarice Zanoni Fontes

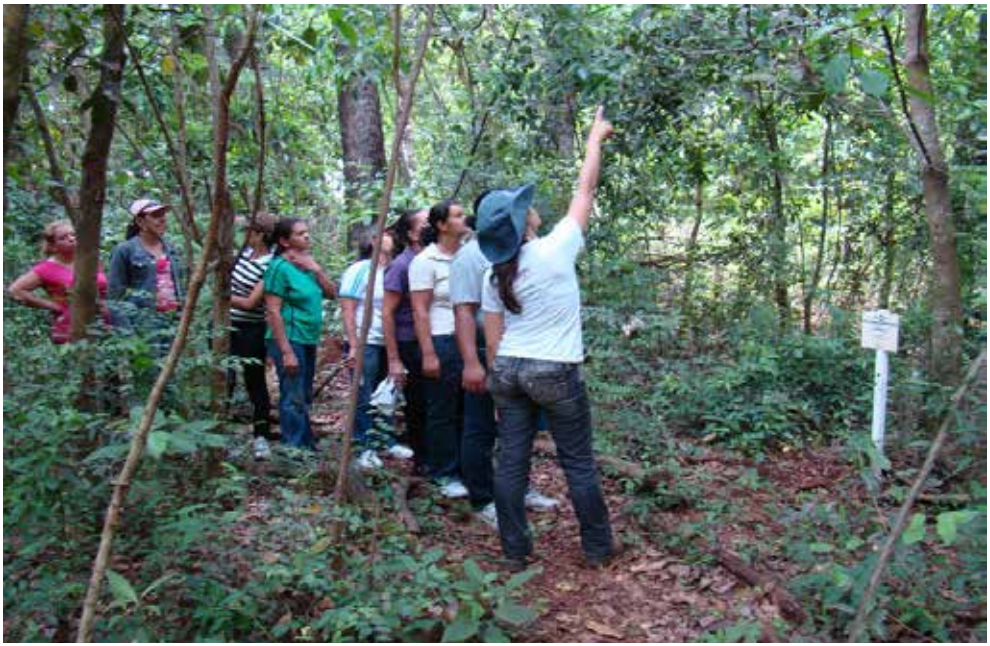

Figure 1. Interpretive trail receives students for learning about environmental issues, in Dourados, MS.

reflection for changes, allowing the recognition of the factors that lead to socio-environmental degradation.

The Green Room is coordinated by Embrapa Environment, located in Jaguariúna, SP, in partnership with the Ministry of Environment, the Municipal Environmental Education Center Dr. Darcy Machado de Souza de Jaguariúna and the Secretariat of Education of the Municipality of Jaguariúna.

Practices of agrienvironmental education-learning

Embrapa develops materials, dynamics and constructivist interaction practices that lead to meaningful learning about natural, rural, or urban landscapes. These tools help to incorporate principles and create harmonious conditions between the parts necessary to develop a particular action. Among them, the following are highlighted: Educommunication Practices; Integrated Environmental Education; Environmental Pictorial Model of Situation-Reflection-Solution Analysis; Ecoliteracy; Campaign Environment and the School; and Systematized Experience of Environmental Education.

Educommunicative practices

The set of initiatives developed by Embrapa Rondônia, under the name of Práticas Educomunicativas Socioambientais (Socio-Environmental Educommunication Practices) (Figure 2), in Porto Velho, RO, Brazil, is a social technology through which dialogue between social actors is promoted and, collectively, produce content (intended for formal education as well as media dissemination) related to the enhancement of renewable natural resources and the protection of natural ecosystems.

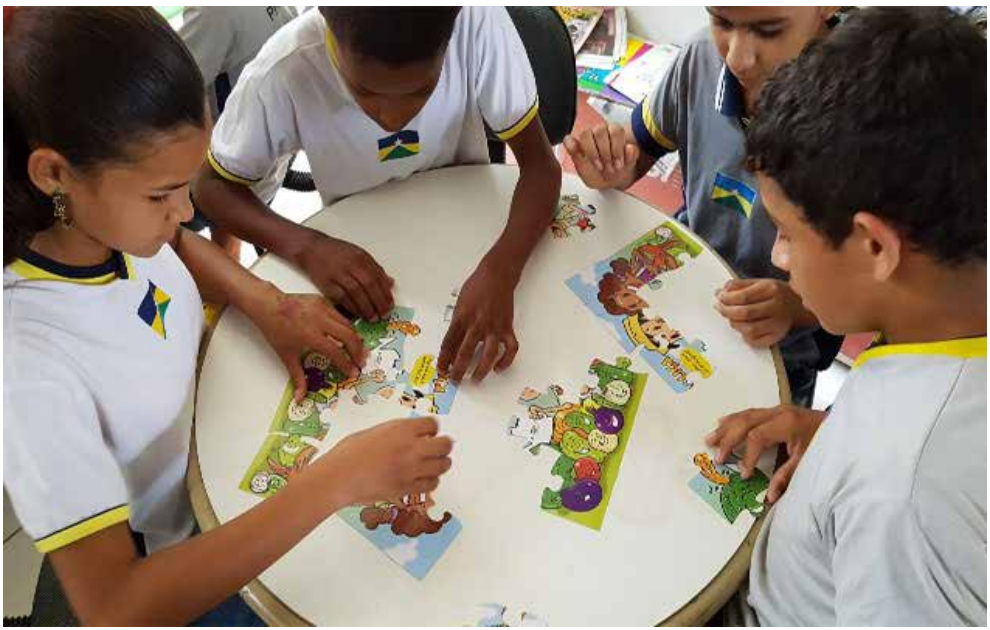

Photo: Vânia Beatriz Vasconcelos Oliveira

Figure 2. Students in the 4th to 6th grade of elementary education in *Educommunication* Workshop, in Porto Velho, RO.

Integrated Environmental Education – The Six Elements

Integrated Environmental Education – The Six Elements (Rachwal; Souza, 2003) is a multiplier training method developed by Embrapa Forestry. The method emphasizes the interdependence between the six natural elements (air, water, soil, flora, fauna, and human being). The human being (the sixth element), although being part of the fauna, is given special prominence because it is the

only one capable of reversing the process of current degradation by recovering and conserving the planet.

Therefore, during the presentation of the contents, awareness activities are inserted with the objective of working the positive side of the human being, showing that they are also part of nature, builders and agents of change. The method uses thematic kits (air, water, soil, flora, fauna) containing natural materials that deal with training, use (correct and incorrect) and ways of recovery and conservation of the elements.

Environmental Pictorial Model of Situation-Reflection-Solution Analysis

The Pictorial Model was developed by Embrapa Southeast Livestock. It allows the visualization, in three figures, of the basic elements for environmental education: current situation, reflection on the situation and proposition of solutions to the current situation.

The model allows dialogue on the key points of environmental degradation. It is used in environmental education actions with the objective of educating and recovering the perception of ecological fundamentals that support good practices in the management of efficient and sustainable production systems (Primavesi; Arzabe, 2006).

Ecoliteracy

The Ecoliteracy Tatu-Bolinha (armadillo) or Ecoliteracy is an instrument developed by Embrapa Maize & Sorghum that aims to strengthen students' link with ecology. The armadillo was the animal chosen as the main character of this tool because it is a common animal in backyards and the knowledge of most people since childhood. A survey was conducted online directly with teachers to characterize the interviewees' perception about the armadillo.

A storytelling on the ecological role of the armadillo was elaborated, which was then adapted to comic book format and published by Embrapa and other institutions (Matrangolo; Lima, 2014). A video (Matrangolo, 2016) was also produced, with resources from the National Council for Scientific and Technological Development (CNPq), demonstrating the steps for the creation of a terrarium for the creation of small animals as a potential ecological literacy tool in schools. The terrarium

supported environmental education actions promoted by the Subcommittee of Ribeirão Jequitibá Basin and by the Embrapa & School Program with the school community. The proposal inspired activities in other schools, which produced publications, plays and dance presentations.

Environment and School Campaign

From the application of Macroeducation, the Environment and School Campaign was developed by Embrapa Environment, in partnership with the company Motorola, with state boards of education and city halls of the region of Campinas, SP. The objective of the campaign was to train multiplier agents among the educators of the state or municipal education networks (from 17 municipalities in the state of São Paulo) to develop projects, programs and policies of transversal and interdisciplinary environmental education.

The campaign highlights the interdependence between urban and rural areas experienced in different environments: classroom, school, school neighborhood, city and planet. The action contributes to promoting citizenship through the exercise of education-learning actions that are agreed with the school community and the neighborhood on the themes: Water and energy; Natural resources; Citizenship and health; Agriculture and food; and Trash. This set is part of the rescue of social function of schools, aimed at transforming the local reality through quality education (Hammes; Rachwal, 2012).

Systematized Experience on Environmental Education

Embrapa Instrumentation carried out social technology transfer actions (septic tank, biodigester, Embrapa chlorinator and filtering garden) in a traditional family farming unit (Sítio São João) located in the municipality of São Carlos, SP. The farm area is about 13 ha, where the family survives from horticulture, fish farming and native seedling production. The family became a transformative agent, in an interactive and participative way, from agroenvironmental practices and the installation of technologies, together with forest restoration.

The accumulated knowledge, the protagonism of the farmer, the mastery of the concepts of rural basic sanitation and its direct and indirect impacts on farming were fundamental. This vision led to effective actions of environmental education,

reconciled to production activities, which annually address about 3,700 students (kindergarten, elementary and high school). In the period, there was the spontaneous creation of a language suitable for children from 4 to 6 years old. In addition, concern was expressed about the transmission of this knowledge to neighboring farmers. It was also observed that the adoption of social technologies can be a means of raising awareness and empowering farmers, who can become protagonists of socio-environmental transformations (Arruda; Silva, 2014).

Distance education

Embrapa has been building its contribution in the area of distance education in order to increase the access of its public to the knowledge generated. Through distance educational projects, people in different parts of the world have access to quality technical content (Gorga; Silva, 2015; Torres et al., 2016).

For Embrapa, distance education, besides an educational action and "[...] a multiple and two-way learning instrument [...]" (Gorga; Silva, 2015, p. 5, our translation), is also a communication strategy to meet the demands of information and knowledge coming from society (Torres et al., 2016). In this sense, when adopting distance education, Embrapa considers the specificities and constraints of the objective reality of the current society, which is known to be moving toward virtuality, interactivity and dialogicity, aiming to broaden spaces, channels and means of participation and critical reflection (Torres et al., 2016).

Institutional Arrangement of Ceffas Network

Through the Arranjo Rede de Centros Familiares de Formação por Alternância (Network Arrangement of Family Centers of Training by Alternation – Ceffas), Embrapa brings together, in a single scope, all research and technology transfer, exchange and knowledge building initiatives of the Embrapa units together with the schools that work with the pedagogy of alternation. Therefore, it was established axes that allow, regardless of the location of Embrapa's Decentralized Unit (UD) or its focus product, to promote this transfer, exchange and collective construction of knowledge based on local demands and products.

Through integration with other arrangements, the following become possible:

- Prospecting regional technological demands with the Ceffas public.

- Creation of science, technology and innovation observatories aimed at young people and children to generate booklets at the end of learning.
- Training and technological updating of farmers, students, teachers and other multipliers.
- Establishment of technology reference centers in schools serving as education-learning units of locally appropriate technologies.
- Validation and technological adaptation, collective construction of knowledge, conservation and dissemination of locally adapted animal and plant genetic resources.
- Opportunity for students to carry out internships as a way of complementing their technical training.
- Establishment of a consistent network of knowledge and innovative technologies multiplier agents.

Activities are also encouraged in the community, such as the establishment of pre-incubators with the incentive to local activities, incentive courses in rural property planning and administration, and marketing practices, among others.

For training, in addition to the traditional research and technology transfer, exchange and knowledge building strategies (field days, courses, lectures, etc.), actions and instruments of distance education and Embrapa Mini Library are aggregated. Another instrument adopted in Ceffas is the professional project, in which each student must develop, in the place where they live, during the 3 years of the course, an activity in which they can put into practice the acquired knowledge. This didactic resource guides young people to work in segments according to the biodiversity of the biome in which they are inserted and allows them to seek, through cooperatives, groups of exchanges and associations to access previously unreachable markets.

Final considerations

One of the most urgent needs of Brazil is to qualify education at all levels. The improvement of the educational standard is essential for the country's development.

All actions developed by Embrapa and presented in this chapter are aimed at the development of capacities aimed at socio-environmental transformation.

Embrapa uses a number of facilitating instruments to promote the participation of local actors, awareness and social and environmental awareness, dissemination of information and technological solutions, and the formation of partnerships with different institutions (including municipal and state education secretariats) seeking to consolidate initiatives to change rural and urban areas. The role of research centers in the implementation of these actions stands out, showing good application effectiveness in different regional contexts.

These opportunities amplify the work of Embrapa and are important strategies to contribute to the search for a more impartial education.

References

ARRUDA, T. P.; SILVA, W. T. L. Educação ambiental a partir da instalação de tecnologias sociais desenvolvidas pela Embrapa. In: CONFERÊNCIA INTERNACIONAL DE EDUCAÇÃO AMBIENTAL E SUSTENTABILIDADE – "O MELHOR DE AMBOS OS MUNDOS", 6., 2014, Bertioga. **Caderno de resumos**... São Paulo: Sesc Bertioga, 2014. p. 120.

BRASIL. Ministério do Meio Ambiente. Secretaria de Articulação Institucional e Cidadania Ambiental. **Boas práticas em educação ambiental na agricultura familiar**: exemplos de ações educativas e práticas sustentáveis no campo brasileiro. Brasília, DF: Departamento de Educação Ambiental, 2012. 244 p. (Série educativa, v. 1).

COMISSÃO MUNDIAL SOBRE MEIO AMBIENTE E DESENVOLVIMENTO. **Nosso futuro comum**. 2. ed. Rio de Janeiro: Fundação Getúlio Vargas, 1991. 430 p.

GORGA, G.; SILVA, S. **Educação a distância na Embrapa**: trajetórias, perspectivas e desafios: manual de gestão e produção em EaD. [Brasília, DF: Embrapa, 2015]. 49 p.

HAMMES, S. V.; RACHWAL, M. F. G. (Ed.). **Meio ambiente e a escola**. Brasília, DF: Embrapa, 2012. 490 p. (Educação ambiental para o sustainable development, 7). Available at: <https://ainfo.cnptia.embrapa.br/digital/bitstream/item/128271/1/educacao-ambiental-vol-7-ed01-2012.pdf>. Accessed on: Nov. 5, 2017.

MATRANGOLO, W. J. R. **Montagem de um terrário**: ferramenta de educação ecológica. Sete Lagoas: Embrapa Milho e Sorgo, 2016. Available at: <https://www.youtube.com/watch?v=DgZfSl4t4Xg>. Accessed on: Dec. 10, 2017.

MATRANGOLO, W. J. R.; LIMA, P. **Que tatu é esse?** Sete Lagoas: Embrapa Milho e Sorgo, 2014. 16 p.

OLIVEIRA, I. J.; PEREIRA, M. C. N. **Transferência de conhecimentos para adoção de inovações tecnológicas nas culturas alimentares pelos pequenos agricultores do Estado do Amazonas**. Manaus: Embrapa Amazônia Ocidental, 2017. 127 p. (Embrapa Amazônia Ocidental. Documentos, 131). Available at: <http://ainfo.cnptia.embrapa.br/digital/bitstream/item/166591/1/Doc-131.pdf>. Accessed on: Dec. 11, 2017.

PRIMAVESI, O.; ARZABE, C. **Gestão ambiental na Embrapa Pecuária Sudeste**: educação ambiental: o modelo pictórico, apresentado em três figuras: situação, reflexão e soluções. São Carlos: Embrapa Pecuária Sudeste, 2006. Available at: <https://www.infoteca.cnptia.embrapa.br/bitstream/doc/47893/1/Folder3.pdf>. Accessed on: Dec. 10, 2017.

RACHWAL, M. F. G.; SOUZA, R. G. Os Seis Elementos: Educação Ambiental Integrada para multiplicadores. In: SEMANA DO ESTUDANTE UNIVERSITÁRIO, 1., 2003, Colombo. **Florestas e meio ambiente**: palestras. Colombo: Embrapa Florestas, 2003. 12 p. Available at: <https://ainfo.cnptia.embrapa.br/digital/bitstream/item/50880/1/Rachwal-Souza.pdf>. Accessed on: Dec. 9, 2017.

SOUSA, D. N. de; KATO, H. C. de A.; MILAGRES, C. S. F.; NIEDERLE, P. A. Transferência de tecnologia e estratégias de comercialização do pescado da agricultura familiar para a alimentação escolar: a experiência da Embrapa no Estado do Tocantins. In: CONGRESSO DA SOCIEDADE BRASILEIRA DE ECONOMIA, ADMINISTRAÇÃO E SOCIOLOGIA RURAL, 54., 2016, Maceió. **Desenvolvimento, território e biodiversidade**. Maceió: Ed. Universidade Federal de Alagoas: Sober, 2016. 15 p.

TORRES, T. Z.; SOUZA, M. I. F.; PEREIRA, N. R.; CUNHA, L. M. S. Remote education: uma estratégia comunicacional para disseminação e transferência de tecnologias na Embrapa. In: CONGRESSO BRASILEIRO DE CIÊNCIAS DA COMUNICAÇÃO, 39., 2016, São Paulo. **Anais**... São Paulo: Intercom, 2016. p. 1-15.

UNESCO. **Declaração universal sobre a diversidade cultural**. Paris, 2002.

UNITED NATIONS. **Sustainable development goal 4**: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all: targets & indicators. Available at: <https://sustainabledevelopment.un.org/sdg4>. Accessed on: Oct. 10, 2017.

Chapter 4

Education and entrepreneurship for sustainable rural development

Patricia da Costa
Joanne Régis Costa
Adriana Maria de Aquino
Alcides Galvão dos Santos
André Luiz dos Santos Furtado
Célia Regina Grego
Cristina Aparecida Gonçalves Rodrigues
Cristina Criscuolo
Edson Raimundo da Silva Alves
Juliana Lúcia Escobar
Kátia Staretz
Maíra Gabriela Santos de Souza
Maria Fernanda Berlingieri Durigan
Michell Olívio Xavier da Costa
Patrícia de Andrade Oliveira Sales
Selma Lúcia Lira Beltrão

Introduction

Target 4.4 "By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship" (United Nations, 2017) of Sustainable Development Goal 4 (SDG 4) deals specifically with the provision of education for the development of people with technical and vocational skills and abilities in order to guarantee their access to decent work and employment, but also to the training of people capable of innovating and enterprising.

In rural areas, low levels of education, coupled with lack of skills and competencies, are one of the main problems that limit and restrict the appropriation of knowledge and the adoption of technologies. Disseminating knowledge and technological solutions and stimulating the investigative learning of science are tools capable of changing this scenario, contributing to the expansion of the well-being of rural communities, as well as to the generation and incorporation of technologies capable of promoting sustainable rural development.

This chaper presents different actions of the Brazilian Agricultural Research Corporation (Embrapa), both formal and non-formal, which contribute to the development of skills and competences in the Brazilian rural environment.

Schools and information technology

Embrapa Decentralized Units are stimulated, through programs, to establish strategic actions to disseminate knowledge and promote science and the development of technological solutions.

Mini Libraries

The popularization of science, the dissemination of Embrapa's research results and its use to improve production, food security, sustainability and income are among the targets of the Programa Institucional Minibiblioteca (Mini Library Institutional Program).

Each Mini Library is composed of 120 printed publications titles, 40 titles from Embrapa Prosa Rural radio programs and 37 video titles from the Field Day on TV and the rural video library edited by Embrapa.

Among the contents covered in the collection, the following stand out: preservation and environmental education, citizenship, cooperativism, gardening, quality food production, soil and water management, among others.

As a counterpart, the benefited school must carry out trainings with the teachers (aimed at guiding them on the use of the Mini Library), as well as interactive classes and mobilization actions with the participation of students and the local community for projects of common interest (Figure 1).

Embrapa Academic Hackathon

Entrepreneurial Education aims at the development of entrepreneurial skills and insertion in the world of work. It means valuing educational processes that promote the development of the human being so that they can contribute to the world of business and to the place where they are inserted.

Created in the late 1990s, *Hackathon* (an acronym for hacker and marathon) is an event that unites people of different profiles in a short space of time to develop a

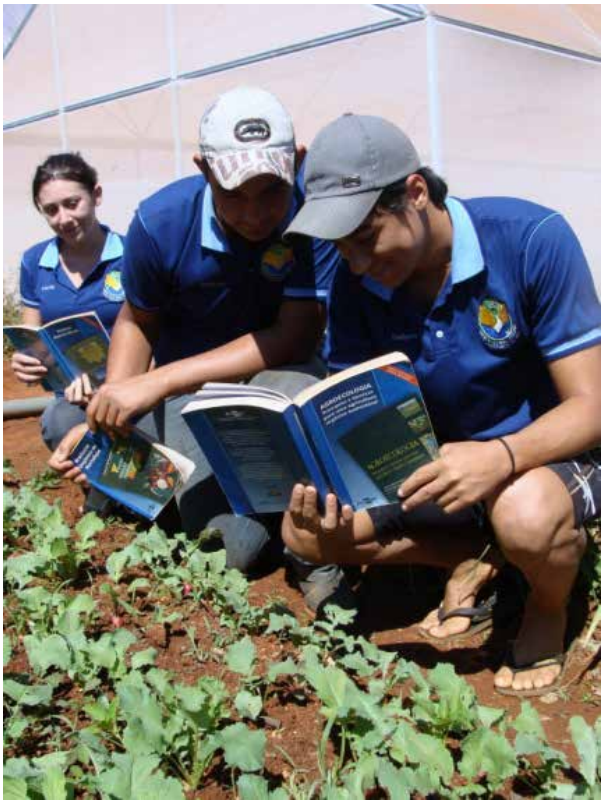

Photo: Katia Simone Marsicano Correa

Figure 1. Students from Escola Família Agrícola de Orizona, GO, using the Mini Library books in a vegetable garden project.

technological solution to some problem or something that replaces or improves an existing solution.

In 2016, Embrapa began this movement of open innovation in search of collaboration and citizen participation. Focusing on university and scholl students, in 2017, *Hackathon Acadêmico Embrapa Nacional* (*Embrapa National Academic Hackathon*) was held, mixing academic knowledge with professional market practices.

With the participation of six Embrapa Decentralized Units, the event took place in the cities of Belém, PA, Boa Vista, RR, Brasília, DF, Recife, PE, Seropédica, RJ, and Teresina, PI. The 288 enrollees were high school, technical and undergraduate students, who formed teams and participated in the marathon in the city in which they registered, with the objective of developing solutions for specific topics as a way of generating technological innovations geared to the needs of the various regions of the country. The teams presented digital solutions using mobile applications, hardware solutions, internet of things (IoT) solutions, and educational parts/games focused

on technologies of agricultural interest. Canvas (design plan) and storyboard (prototype) were delivery requirements at the first meeting of teams. Students have learned that organization, deadlines, and commitment to deliveries are also a reality outside the academic world. For support in the development of solutions, Embrapa experts accompanied and supported the participants with information from the agricultural research (Figure 2).

Photo: Márcio Marco Ashford

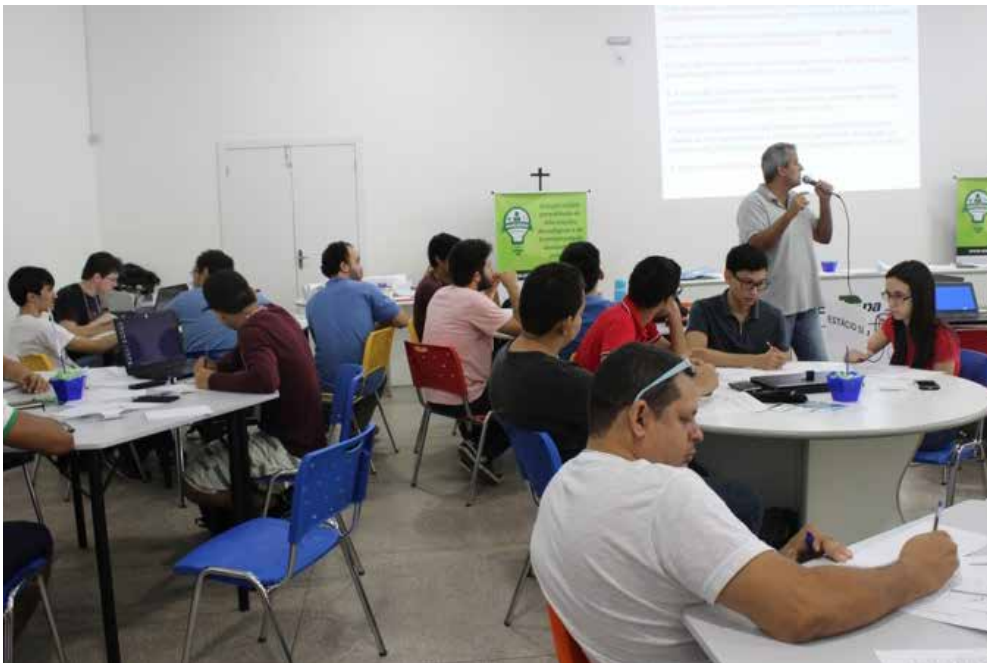

Figure 2. Orientation of the teams participating in the *Embrapa National Academic Hackathon* 2017, organized by Embrapa Roraima in Boa Vista, RR.

Interactive mobile games on Integrated Pest Management; a character who becomes ill and needs to consume more vegetables to raise his well-being and his level of happiness; biofuel truck produced from corn, soybeans and sugarcane; and tips on how to grow vegetable crops through the hydroponics method are some examples of the results achieved in the edition of *Hackathon* in Brasília (Guaraldo, 2017).

Anyone who thinks that technology has nothing to do with the plain areas of the Amazon estuary is wrong. A group of young information technology students presented an application that optimizes the production of the native acai plantations of the region and took the first place in the marathon in Belém,

PA, which was named *Hackathon Acadêmico – Desafios para o Açaí* (*Academic Hackathon – Challenges for Acai*) (Lima; Braga, 2017).

In Seropédica, RJ, the theme of the stage was *Mobile solutions for sustainable production focusing on functional attributes of Atlantic Forest plants and conservative biological control*. The Döbereiner team – a name created to honor the scientist Johanna Döbereiner, one of the precursors of Embrapa Agrobiology –, formed by three information system students and one agronomy student, all of the Federal Rural University of Rio de Janeiro (UFRRJ) – was the winner. The team developed an application capable of guiding farmers and extensionists to choose suitable species for environmental restoration considering factors such as soil, terrain and drainage capacity (Bello, 2017).

In Boa Vista, RR, the Overflow team, made up of three electrical engineering students from the Federal University of Roraima (UFRR), won the top prize with the presentation of the Agronews application, which met the challenge of creating a mobile solution for broadcasting technological information and survey of research demands, the theme of *Hackathon* in the state. The intuitive and functional tool conquered the judging committee by presenting, besides the connectivity to the information of the Embrapa Portal, different access according to user profile (producer, merchant, technician, etc.). Another important feature was the possibility of forming networks of relationship and discussion around common themes to the various profiles (Rocha, 2017).

The TecAgro team of the Piauí Higher Education Association – Piauí University (Aespi-Fapi), from Teresina, was the great champion of the Piauí marathon with the automated Irrigation mobile application. The objective of the marathon was to assist technicians and producers in making decisions for the sustainability of agriculture and livestock using results of Embrapa research, benefiting society (Sinimbu, 2017).

As it can be seen, in addition to discovering what *Hackathon* is, now it is possible to know the benefits of this event: a step in the construction of a new organizational culture focused on innovation, a stimulus for collaborative work (open initiatives) and the vision of interconnecting teams, which invigorates and inspires professionals.

Training of employes and associates

Since its creation, Embrapa has invested in the development and education of its employees and associates in order to acquire and improve knowledge.

From January to November 2017, through 872 agreements with education and promotion institutions spread all over the country, the Company provided training and preparation for the professional performance of 8,211 students in different levels of education (elementary, undergraduate and graduate), which were supervised by employees and directly experienced Embrapa's production process by participating in research projects and support activities. This investment provides the institutional approach and the collective construction of knowledge with the academic environment, as well as contributing directly to the training of future scientists in the country (since it is common to identify, among the current employees, a significant number of former interns or scholarship holders). In addition, at the time of the creation of Embrapa, the intense demand for the training of highly qualified professionals to compose its framework and overcome the scientific and technological challenges in the country culminated in the elaboration of a program to encourage long-term training (master's and doctoral degree). Since then, more than 3,700 employees have been trained in national and international centers of academic excellence.

In the last 2 decades, with the broadest offer in Brazil of stricto sensu courses and with Embrapa's policy of attracting researchers with a completed PhD course (88.5% of its researchers already have the degree), postdoctoral studies became an important action to maintain the excellence of the technical training of its employees. In accordance with Embrapa's internationalization actions, employees with a PhD have had the opportunity to improve themselves in the best international centers through partnership and technical-scientific cooperation actions, directing their academic training to the real research needs through the Programa de Capacitação Cientista Visitante (Visiting Scientist Training Program) in areas such as: animal nutrition, plant and soil science, plant biodiversity and biotechnology. These guidelines are reflected in the increase in the number of completion of this type of training, which reaches 461, and in the visibility of Embrapa in the international scenario. In addition, in 2017, there were 289 Embrapa employees participating in technical-scientific events abroad to update knowledge in the United States, Canada, France, the Netherlands, the United Kingdom, Germany and Colombia. Over 3,000 employees are also trained annually in short courses in the country focused on the development of specific skills needed for professional performance. All these initiatives affect the improvement of institutional processes and increase its capacity to generate innovative technological solutions that meet the related demands of the Brazilian society.

Agriculture research and undergraduation and postgraduation

Embrapa encourages the accomplishment of internships and/or orientation for students of high school, undergraduate and postgraduate (specialization, master's degree and doctoral degree).

The Company actively participates in the Programa Institucional de Bolsas de Iniciação Científica (Institutional Program for Scientific Initiation Scholarships – Pibic) and the Programa Institucional de Bolsas de Iniciação em Desenvolvimento Tecnológico e Inovação (Institutional Program for Initiatives in Technological Development and Innovation – Pibiti), both of the National Council for Scientific and Technological Development (CNPq), programs to promote new talents in all areas of knowledge and aimed at undergraduate students from higher education institutions (Figure 3).

Embrapa also has agreements with different higher education institutions to promote cooperation between institutions. Part of the employees work in teaching activities and advising theses, dissertations and work of course conclusion. Cooperation also takes place through the use of structures, such as laboratories, libraries, experimental fields and data processing centers for the elaboration of such works.

Photo: Maria Jose Ferreira Tupinambá

Figure 3. Students of scientific initiation programs of Western Amazon, in Manaus, AM, in 2015.

Events and spaces dedicated to the sharing of knowledge and technology transfer

Learning spaces, institutional programs dedicated to knowledge sharing, technologies transfer, and stimulation to the development of science are tools used to transfer technologies to the directly interested sectors, subsidizing the decision making by the farmers.

Events as learning spaces

The offer of courses contributes to the transfer of technologies to directly interested sectors, while events in the format of workshops are appropriate to establish a communication with the society on the development of science in the agricultural sector, providing space for interaction with the public.

Embrapa Caravan

Caravana Embrapa (*Embrapa Caravan*) was created as a strategy for technology transfer on the *Helicoverpa armigera* caterpillar throughout Brazil. Between 2013 and 2015, it covered 17 states in addition to the Federal District. *Helicoverpa armigera* is a caterpillar that surprised farmers and researchers for their destructive power, causing damage mainly to corn, soybean and cotton crops in several places in Brazil. Until the beginning of 2013, there were no records of the plague in Brazil; therefore, when the first reports appeared, the researchers thought to be a species of the same genus, *Helicoverpa zea*, known as corn-caterpillar.

After its correct identification, the Embrapa research team traced, in an emergency, strategies for the control and management of the caterpillar. Strategies were also drawn for the transfer of technology (training and qualification) on the subject. Thus, the hotsite on *Helicoverpa* and on *Helicoverpa* and soybean. Finally, *Embrapa Caravan* was created, during which Embrapa employees and partners from other institutions visited states where there was a record of caterpillar occurrence or potential introduction. The proposal was to provide guidance to producers and extensionists on the control of *Helicoverpa armigera* and other pests of economic interest (Figure 4).

Photo: Joseani Mesquita Antunes

Figure 4. *Embrapa Caravan*: training in Integrated Pest Management in Passo Fundo, RS, in 2013.

International training

The training of foreigners through technical cooperation is one of the instruments that Embrapa has used to support the development of agriculture in other countries. In this sense, several courses have been offered by different Embrapa Units.

In 2012, the *Agricultural Experimental Techniques Course* was the first Embrapa training outside Brazil, in Nampula, Mozambique. The objective of the course was to present Embrapa technologies developed in the Brazilian *Cerrado*. The event was supported by the Federal University of Goiás (UFG).

The *Curso Internacional de Produção Sustentável de Hortaliças* (*International Course on Sustainable Vegetable Production*) was carried out annually by Embrapa Vegetables from 1995 to 2017 for technicians from Portuguese-speaking African countries (Angola, Cape Verde, Mozambique and São Tomé and Príncipe).

Embrapa Cassava & Fruits offered, from 2001 to 2011, the *Production and Processing of Cassava* and *Tropical Fruit Production* courses for technicians from Angola, Cape Verde, São Tomé and Príncipe, Guinea Bissau and Mozambique. The partner agencies of Embrapa in the execution of the three courses mentioned were the Brazilian Cooperation Agency (ABC), the Ministry of Foreign Affairs and the Japan International Cooperation Agency (JICA).

Embrapa Maize & Sorghum and Embrapa Soybean offered in 2011 courses for technicians from 31 African countries on the corn and soybean crops included in the Brazil-Africa Platform for Technological Innovation for Food Security.

In 2017, young people from 14 African countries participated in the *Training in Propagation, Production and Processing of Cassava for Young Africans*, taught by Embrapa Maize & Sorghum. The initiative is part of the Youth Technical Training Program (YTTP), conducted by Instituto Brasil África (Ibraf), a non-profit organization focused on South-South cooperation projects with emphasis on Brazil-Africa. The countries represented were: Benin, Burundi, Cameroon, Côte d'Ivoire, Ghana, Malawi, Mozambique, Nigeria, Republic of Congo, Senegal, Sierra Leone, Tanzania, Uganda and Zambia.

The *International Training Course on Agroforestry Technology Systems* offered by Embrapa Western Amazon in 2015, in its fifth version, trained technicians from Colombia, Brazil, Ecuador, Peru and Venezuela to disseminate sustainable production technologies.

In 2017, a series of training programs carried out by Embrapa in several Brazilian states sought to meet the international technical cooperation project entitled Formação de Técnicos Especializados em Agricultura, Pecuária e Silvicultura Tropical para o Desenvolvimento das Zonas Tropicais do México: Tecnologia de Produção e Certificação de Plantas para Viveiros Tropicais (Training of Specialized Technicians in Agriculture, Livestock and Tropical Forestry for the Development of Tropical Zones in Mexico: Production Technology and Plant Certification for Tropical Nurseries). The courses aimed at transferring technologies to increase the competitiveness of cocoa, coffee, citrus, coconuts, rubber trees, palm oil and forests in the humid tropical region. Around 90 mexican technicians and researchers from the agrarian sciences participated in the training.

Technologies Showcase

Vitrine de Tecnologias (*Technologies Showcase*) was created in 1997 to open Embrapa doors to public visitation and to provide Brazilian society with a participative follow-up on the results and commercialization of its researches. Using an annual exposure methodology that maintains the main characteristic of crops in ornamental forms, the research results generated by Embrapa and partners with the dissemination of technologies that include machines, plants and animals are presented. The showcase allows the sharing of knowledge and

technologies not only with those who dedicate themselves to the business in rural areas, but also with all segments of the urbanized society.

Since 2000, the *Showcase* has been installed in both the Embrapa Units and in partner areas of the Sistema Nacional de Pesquisa Agropecuária (National Agricultural Research System – SNPA). A total of 41 events were held between 1997 and 2013, involving more than 1 million people, among producers, technicians, students (Figure 5), authorities and urban public, who were able to get to know and ask questions about the hundreds of technologies exposed and the work of Embrapa in its social mission to improve the people's quality of life. There were also active visits to some Embrapa Units.

Photo: Fabio Junho Felipe Sousa

Figure 5. Reception of high school students at *Amazontech 2008*, in São Luiz, MA.

Students perceive space as an environment that awakens their scientific spirit and participates in writing contests, the results of which are subsequently disclosed, awarded and published in Embrapa media. For university students, *Showcase* became an open-air laboratory, serving as a scenario for supervised internships, motivating interns to develop monographs and thesis.

National Science and Technology Week

The *Semana Nacional de Ciência e Tecnologia* (*National Science and Technology Week* – SNCT), under the coordination of the Ministry of Science, Technology, Innovations and Communications (MCTIC), is held every year since 2004. Its aim is to bring science and technology closer to the population by promoting events that congregate institutions in the whole country. Activities are carried out that stimulate and motivate the population to discuss science and to deepen their knowledge about the suggested topics (Figure 6).

The theme Science Feeding Brazil was chosen for the 13th edition of SNCT, focusing on the development of research and new technologies on food quality, human evolution and its relation with food, daily food and inclusion of vulnerable populations. Embrapa participated actively in the event and obtained important results, of which the following stands out:

- Restructuring, expansion and modernization of Embrapa & School Program within the Open Doors of SNCT (where research institutions

Photo: Fabiane Fenalti da Rosa

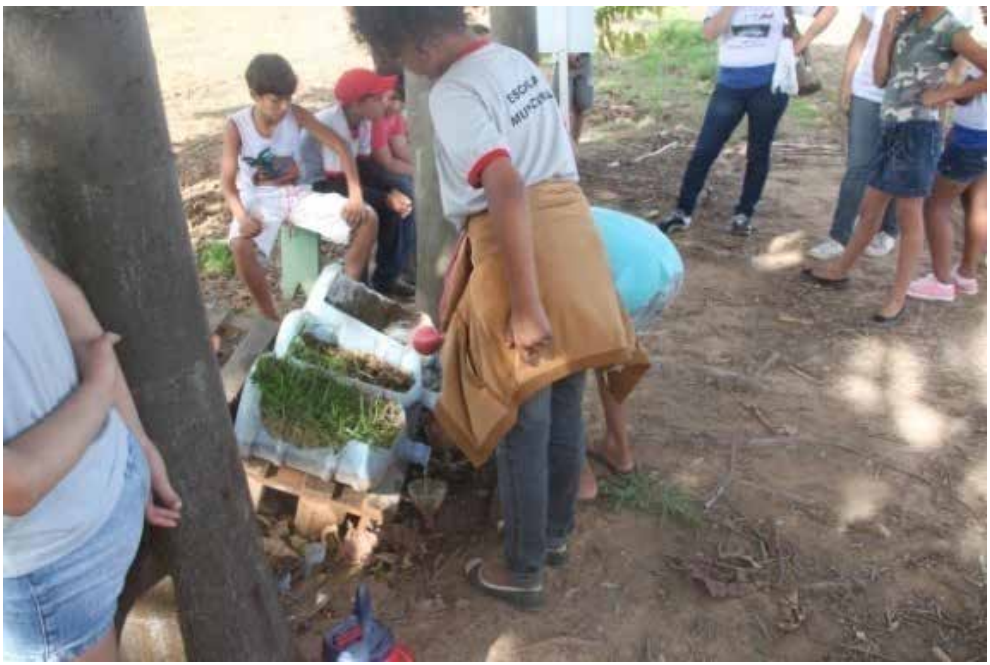

Figure 6. Students from the Municipal School of Basic Education Uilibaldo Vieira Gobbo, from Sinop, MT, participating in an experiment on the importance of soil cover during the *National Science and Technology Week* held by Embrapa Agrosilvopastoral in 2013.

allow guided visits to their structures), focused mainly on local schools. There are lectures and workshops that bring together, train and integrate students, farmers, technicians and professionals.

- Formation of new partnerships and projects that were born from the event.
- Participation in state fairs aimed at students of basic education, technical high school, elementary education and primary education, public and private schools. Promoting the dissemination and integration of Embrapa with students who, for the most part, are just awakening to the subject, but already knowing Embrapa as partner and prominent in the Brazilian agricultural development, related or not to the theme of the fair.
- Participation of booths, fairs, mini-courses, workshops, lectures and classes aimed at the target audience of SNCT, promoting a strong integration of Embrapa with the Brazilian population.

Observation and Demonstrative Units

The dissemination of knowledge and technological solutions to the productive sector requires facilities in the Decentralized Units or in production areas to support the demonstration of the results and to support the decision-making of the farmers.

Agroecological Little Farm

The Sistema Integrado de Produção Agroecológica (Integrated Agroecological Production System – Sipa), known as Fazendinha Agroecológica (Agroecological Little Farm), was established in 1993 in Seropédica, RJ. It represents a joint initiative of Embrapa Agrobiology, Empresa de Pesquisa Agropecuária do Estado do Rio de Janeiro (Agricultural Research Corporation of the State of Rio de Janeiro – Pesagro-Rio) and the Federal Rural University of Rio de Janeiro (UFRRJ), in order to exercise agroecological practices.

Little Farm currently has 79 ha, where the agroecological principles are applied, and the redesign of the landscape and the use of organic waste are recommended (Figure 7). From the integration of animal and vegetable production activities, the recycling of nutrients is guaranteed, especially through the use of manure from dairy cattle. No-till plantation and green manures are also used in soil

management, with emphasis on the use of legumes, which contribute to the nitrogen supply through the biological fixation process. The management of phytoparasites is mainly by prevention, through the integration of cultural practices in order to maintain the occurrence of diseases and pests at a tolerable level. Little Farm receives annually more than 1 thousand visitors, among farmers, technicians, extensionists and university students from Brazil and abroad.

Photo: Ana Lúcia Borges

Figure 7. Live cover of the soil with plant "cocktail" in banana trees in an organic system within the area of the Agrobiological Little Farm at at Embrapa Agrobiology, located in Seropédica, RJ.

In 2009, the Centro de Formação em Agroecologia e Agricultura Orgânica (Training Center in Agroecology and Organic Agriculture – CFAAO) was set up on Little Farm, where, in addition to the training, a professional master's course in organic agriculture from UFRRJ was given in partnership with Embrapa Agrobiology. The master's degree program began in 2010, having already trained 88 students from various Brazilian regions and institutions.

Organic Yards

The Quintais Orgânicos de Frutas (Organic Fruit Yards) project is coordinated and executed by Embrapa Temperate Agriculture and since 2004 has implemented more than 2,018 yards in the Southern Region of Brazil and Uruguay, reaching 60,701 direct beneficiaries. Financed by the Companhia de Geração Térmica de Energia Elétrica do Sistema Eletrobras (Eletrobras System Electric Power Termic Generation Company) and supported by Fundação de Apoio à Pesquisa e Desenvolvimento Agropecuário Edmundo Gastal (Edmundo Gastal Agricultural Research and Development Support Foundation – Fapeg).

Organic Yards contribute to the food and environmental security of poor communities in rural and urban areas, as it is aimed at family farmers, *quilombolas*, indigenous people and rural and urban schools. It focuses on various aspects of sustainability in addressing cultural, ethnic, environmental, food, educational, economic and medicinal issues.

The technologies developed in the project (such as the development of new cultivars, knowledge of the functional properties of the food that make up the yard and the process of verticalization or transformation and aggregation of value to food) contribute to the social inclusion of the beneficiaries and to enable the generation of employment and income. Each Organic Fruit Yard constitutes a Demonstration Unit or transfer of technology of the products, processes and services generated by Embrapa.

In 2008, the project was the winner of the 16° Prêmio Expressão de Ecologia (16th Ecological Expression Prize) in the Socioenvironmental Technologies category, which is the largest environmental award in the South Region. The project had already been recognized in 2007, when it received the Social Technology Certification from Fundação Banco do Brasil, in partnership with Petrobras and support from the United Nations Educational, Scientific and Cultural Organization (Unesco). Through the Organic Yards project, Embrapa Temperate Agriculture won the Finep Innovation Award 2009 in the Social Technology category. The project was also selected in 2016 to make up the Good Practices for Sustainable Development Platform, which is part of the cooperation program with the Food and Agriculture Organization of the United Nations (FAO) entitled Brazil-FAO International Cooperation.

Contents in multiple formats

The presentation of content in multiple formats contributes to the promotion and sharing of knowledge, transfer of technologies and stimulation to the development of science.

Contents developed for formal and non-formal education

Interactive books and web pages are among the various formats used by Embrapa for the promotion and dissemination of science content in the agricultural sector for society, especially at elementary and high school levels.

School atlas of the Metropolitan Region of Campinas

In 2008, Embrapa Satellite Monitoring and the Education Department of the municipality of Campinas, SP, initiated a partnership with the purpose of elaborating the *Atlas Escolar da Região Metropolitana de Campinas* (*School Atlas of the Metropolitan Region of Campinas*) (Figure 8) (Criscuolo, 2016) and developing methodologies for the construction of didactic material customized from geotechnologies.

The atlas was built in an innovative way by inserting contents and concepts that should form part of the curriculum of the final series of elementary education guided by a main thematic axis: agricultural activities, both those that occurred in

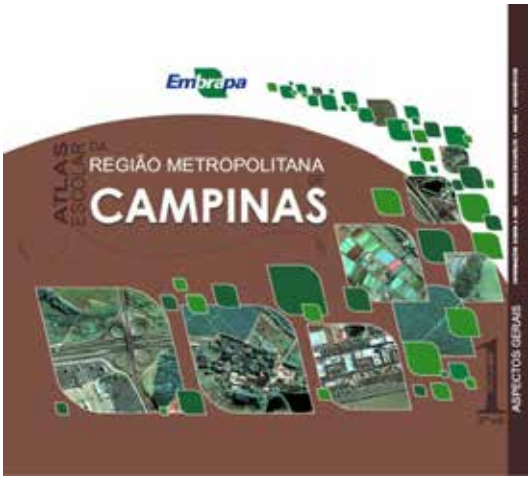

Figure 8. Cover of the School Atlas of the *Metropolitan Region of Campinas* book: inductor of the technology transfer actions celebrated by the partners.

Source: Criscuolo (2016).

the past and contributed to the formation of landscapes as well as most current practices in the region. Such information, in general, is not part of the textbooks used in the classroom.

In the atlas, the public can find texts, data, maps, graphs and images of satellites with contents related to the municipality and the region where students live. Starting in 2014, the municipality of Campinas created a local program to encourage the use of the atlas in the classroom and to develop scientific research projects with elementary education students. This program, called Pesquisa e Conhecimento na Escola (Research and Knowledge at School – Pesco), has a platform for distance learning in which teachers interact with the management team. Throughout the year, students and teachers carry out group research, collect, systematize and process data and provide results and evaluate the items learned, identified as the main theme and object of study. Between 2015 and 2017, about 8 thousand students of the municipal education network were involved in the program and studied, from the atlas, various topics of local interest both in the surrounding regions of the school and in the neighborhood, municipality or region.

Sharing Science on the Web

Contando Ciência na Web (Sharing Science on the Web – CCWeb) is an on-line initiative of scientific divulgation directed to the children and youth audience that aims to inform in a playful way (Figure 9). To support this audience in their school learning process, CCWeb uses multimedia resources, seeking to be in tune with

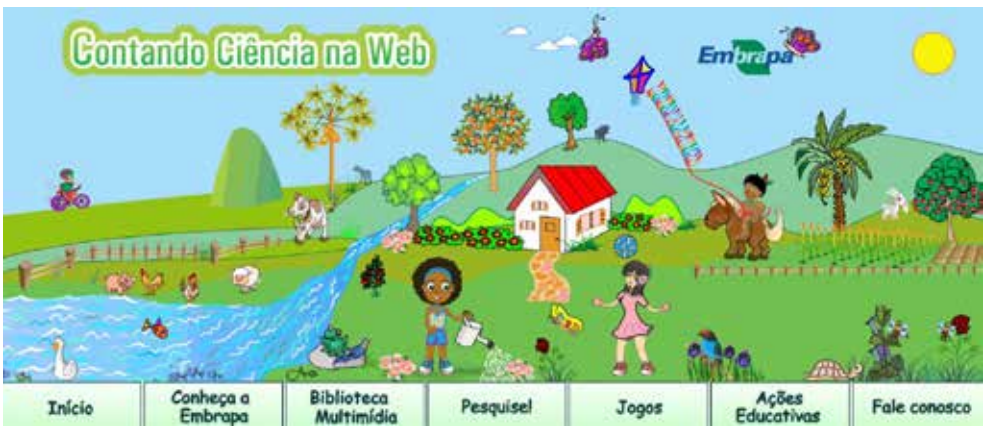

Figure 9. Reproduction of the home page of the Sharing Science on the Web.

Source: Embrapa Informação Tecnológica (2017).

the technological reality where the new generations are immersed, especially the children and adolescents of the 21st century.

Through its games, texts, books, booklets, audios and videos, the site offers content that seeks to promote a culture of valorization of sustainable development and cultural diversity of Brazil. It is represented, for example, in the characterization of the characters, created exclusively for CCWeb: the little scientist, the future biologist, the Indian and the girl who want to be veterinarians, as well as the adolescent who wants to be an agricultural technician. The characters interact with researchers and a farmer in scenes that bring the context of research laboratories closer to the natural environment of a farm, helping the little web surfers to project themselves professionally. At the same time, CCWeb highlights the importance of combining scientific knowledge with sustainability and the preservation of nature.

Frequently consulted to support school research, the website is a source of pedagogical aid for the learning of the natural sciences, which, due to the language and resources used, it is particularly suited to the context of elementary education.

Training and contents for farmers, extensionists, technicians and university students

Training and content development are relevant initiatives to promote change. In addition to those already mentioned throughout this e-book, we must mention other actions developed by the Decentralized Units that contribute to sustainable rural development, such as:

- Zootechnical Residency, idealized by Embrapa Dairy Cattle.
- Training for cooperative technicians of the Organização das Cooperativas Brasileiras/Serviço Nacional de Aprendizagem do Cooperativismo (Organization of Brazilian Cooperatives/National Cooperative Learning Service – OCB/Sescoop), idealized through the partnership and executed by Embrapa Wheat.
- Partnership between Embrapa, Ministry of Education and National Council of Institutions of the Federal Network of Vocational, Scientific and Technological Education (MEC/Conif).

- Training for medium rural producers, promoted by the Projeto de Agricultura de Baixa Emissão de Carbono (Low Carbon Agriculture Project – ABC Cerrado Project) (partnership between Embrapa, World Bank, National Rural Apprenticeship Service and Ministry of Agriculture, Livestock and Food Supply).
- Building of tools such as information systems, which are important means for capacity building, for the dissemination of research results and technologies, for use in teaching and research projects or as a tool for rural planning.
- Sistema de Informação de Solos Brasileiros (Brazilian Soil Information System – SiSolos), which was developed through a partnership between Embrapa Agricultural Informatics and Embrapa Soils. The system aims to store, manage, recover and make available information on Brazilian soils. The database gathers information on physical, chemical and mineralogical analyzes of soils from all regions of Brazil accessed on the internet. Based on this database, applications can be developed to aid decision making in agribusiness, in areas such as: agricultural zoning, crop productivity estimation, mapping of soil properties, and subsidization for teaching and research projects, in addition to other uses. Currently, the database contains 220 registered research projects and about 8,800 soil profiles. The database is constantly updated, being continuously fed by researchers from Embrapa and representatives of partner institutions.

Final considerations

Embrapa initiatives presented in this chapter aim to promote education, entrepreneurship and knowledge sharing for different audiences and in different ways, always with a focus on sustainable rural development.

The knowledge generated in agricultural research must be available quickly for the whole of society and, in particular, must be available for teachers to use in the teaching-learning process and in the training of Brazilian citizens from elementary, secondary, technical and undergraduate education, including in agrotechnical and family agricultural schools (based on the pedagogy of alternation) throughout Brazil. Embrapa develops several strategies to raise awareness and train multiplier agents, such as offering physical spaces for interaction with science and educational practices based on contents and materials related to the agroenvironment.

Several instruments have been developed and used, some of which privilege the direct and practical contact with the technology developed, the learning by doing. Other instruments are readily available for use in teaching and research projects, or for use as a rural planning tool. All these instruments present themselves as contributions to change the Brazilian rural scene, focusing on the expansion of the well-being of rural communities and the generation and incorporation of technologies capable of promoting sustainable rural development.

References

BELLO, L. **Equipe da UFRRJ vence Hackathon em Seropédica**. Brasília, DF: Embrapa, 2017. Notícias. Available at: <https://www.embrapa.br/busca-de-noticias/-/noticia/29185771/equipe-da-ufrrj-vence-hackathon-em-seropedica>. Accessed on: Jan. 19, 2018.

CRISCUOLO, C. (Ed.). **Atlas escolar da Região Metropolitana de Campinas**. 2. ed. Brasília, DF: Embrapa, 2016. v. 1, 97 p.

EMBRAPA INFORMAÇÃO TECNOLÓGICA. **Contando ciência na web**. 2017. Available at: <https://www.embrapa.br/en/contando-ciencia>. Accessed on: Dec. 13, 2017.

GUARALDO, M. C. **Jogo eletrônico sobre biocombustíveis é vencedor do Hackathon Acadêmico 2017 – Brasília**. Brasília, DF: Embrapa, 2017. Notícias. Available at: <https://www.embrapa.br/busca-de-noticias/-/noticia/29223630/jogo-eletronico-sobre-biocombustiveis-e-vencedor-do-hackathon-academico-2017---brasilia>. Accessed on: Jan. 19, 2018.

LIMA, A. L.; BRAGA, V. **Alunos do IFPA vencem maratona de programação da Embrapa**. Brasília, DF: Embrapa, 2017. Notícias. Available at: <https://www.embrapa.br/busca-de-noticias/-/noticia/29197623/alunos-do-ifpa-vencem-maratona-de-programacao-da-embrapa>. Accessed on: Jan. 19, 2018.

ROCHA, C. **Equipe da UFRR vence o Hackathon Embrapa Roraima 2017**. Brasília, DF: Embrapa, 2017. Notícias. Available at: <https://www.embrapa.br/busca-de-noticias/-/noticia/29186018/equipe-da-ufrr-vence-o-hackathon-embrapa-roraima-2017>. Accessed on: Jan. 19, 2018.

SINIMBU, F. **Aplicativo para irrigação automatizada ganha o Hackathon Embrapa no Piauí**. Brasília, DF: Embrapa, 2017. Notícias. Available at: <https://www.embrapa.br/busca-de-noticias/-/noticia/29156303/aplicativo-para-irrigacao-automatizada-ganha-o-hackathon-embrapa-no-piaui>. Accessed on: Jan. 19, 2018.

UNITED NATIONS. **Sustainable development goal 4**: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all: targets & indicators. Available at: <https://sustainabledevelopment.un.org/sdg4>. Accessed on: Oct. 10, 2017.

Chapter 5

Inclusive education in the countryside

Adriana Maria de Aquino
Patricia da Costa
Maria Conceição Peres Young Pessoa
Fernando Antonio Hello
Vandréa Moraes Ferreira
Joanne Régis Costa

Introduction

This chapter refers to target 4.5 of Sustainable Development Goal 4 (SDG 4), that is:

> By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the most vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations. (United Nations, 2017).

Although inclusive education is still a controversial issue in Brazil, Embrapa has an effective commitment to provide information, instruments and technological solutions accessible to all. The following are some opportunities built by Embrapa to contribute to the educational process of different publics and of inclusion situations.

Agroecology for children

In its activities, Embrapa Agrobiology was one of the pioneers working for children. In 1996, this Embrapa Unit produced a publication called *A história de Seu João das Alfaces* (The story of Seu João Lettuce) (Aquino; Neves, 1996) (Figure 1), the result of the partnership of two researchers involved with children, who presented the principles of organic agriculture in a playful way.

Due to this editorial success, in 2006, the Unit developed a project called Agroecologia para Gente que Cresce (Agroecology for People who Grow).

As part of the project, several materials were produced, such as:

- Website.

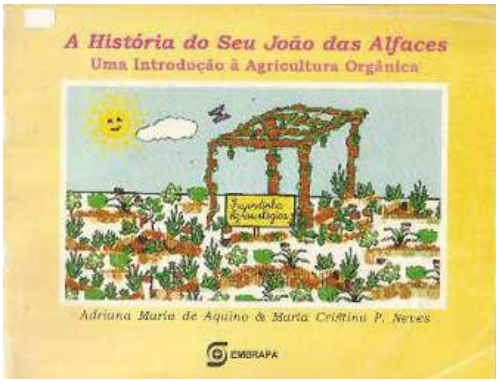

Figure 1. Cover of the book *A história de Seu João das Alfaces*.

Source: Aquino e Neves (1996).

- Series of booklets explaining to children the microorganism benefic to agriculture: *O Mulungu* (Neves, 2008b), *O Mulungu e seus amigos rizóbios* (*Mulungu and his friends rhizobia*)] (Neves, 2008a), *O Mulungu e suas amigas joaninhas* (*Mulungu and his ladybug friends*) (Aguiar-Menezes; Neves, 2014), *O Mulungu e seus amigos gongolos* (*Mulungu and his friends millipedes*) (Correia et al., 2014), *O Mulungu e suas amigas minhocas* (*Mulungu and his friends earthworms*) (Aquino et al., 2014), *Conhecendo o Brasil com o Mulungu* (*Getting to know Brazil with Mulungu*) (Resende; Ferreira, 2015).
- Two animations; one of them (using the stop motion technique) showing the importance of organic agriculture, doing no harm to the environment (*A História de João das Alfaces*) (A História ..., 2008), and another one (in 3D format) shows a tree of the leguminosae family (*O Mulungu e seus amigos*) (O Mulungu..., 2015).
- Miniportfolio of projects for teachers, with small experiments using materials such as wooden crate, cake packaging, etc.
- Memory game insert.
- Ludo type insert with the theme of agroecology for children to learn from educational games.
- Educational kit (Figure 2).

The project has always been concerned including children with visual impairment. Therefore, one of the booklets (*O Mulungu*) (Neves, 2008b) has been converted to braille, and all other booklets have been converted to the audiobook format, which allows the content of the publications to be learned through hearing. In

Photo: Vandréa Moraes Ferreira

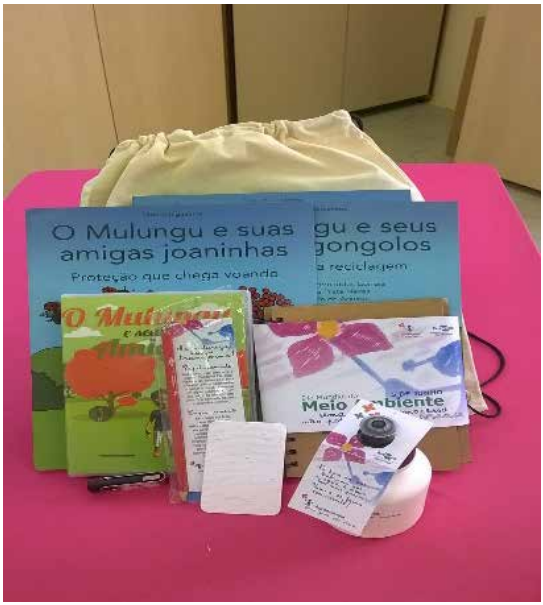

Figure 2. Embrapa educational kit for donation to schools, libraries, non-governmental organizations (NGOs) and other institutions for use as a playful educational tool on agroecological concepts.

addition, a tactile map in printed/braille format was drawn up and positioned in the Unit hall.

Due to the positive repercussion of these actions, a second phase of the project was supported by Embrapa in 2012 and entitled Agroecologia para Gente que Cresce: uma Viagem pelo Mundo Sustentável (Agroecology for People who Grow: A Sustainable World Trip), with a broad range of activities, including sustainable practices.

The local experience of Embrapa Agrobiology over the past 10 years has been to add efforts of the Embrapa & School Program and the Agroecology for People who Grow project to increase the transmission of knowledge of agroecological practices and to also add the focus of sustainability, so that children and young people may be aware of the world that awaits them, in case they do not change behavior and attitude.

The various materials are disclosed and disseminated to schools and teachers, serving as an educational, didactic and popularization tool for the scientific knowledge generated by the Unit. This synergy has been very positive, since both the students and the members of Embrapa & School program, the Agroecology for People who Grow project and Embrapa Agrobiology itself benefit from the results achieved.

Collection of environmental education Ema Environmental Games Booklets

The Cartilhas dos Jogos Ambientais da Ema (Ema Environmental Games Booklets) (Figure 3) is a collection of environmental education developed within the scope of the Environmental Education Project of Embrapa Environment with the support of the Programa Alimento Seguro do Campo à Mesa (Safe Food Program from the Field to the Table – PAS-Campo) – and the Secretariat of Policies for Sustainable Development of the Ministry of the Environment. The collection includes seven thematic booklets (water, soil, air, fauna, trees/forests, garbage/recycling and quality of life – a focusing on hygiene, nutrition and food security), a CD of songs about the environment (Cartilhas..., 2003) and an external game called Ambiente (Environment).

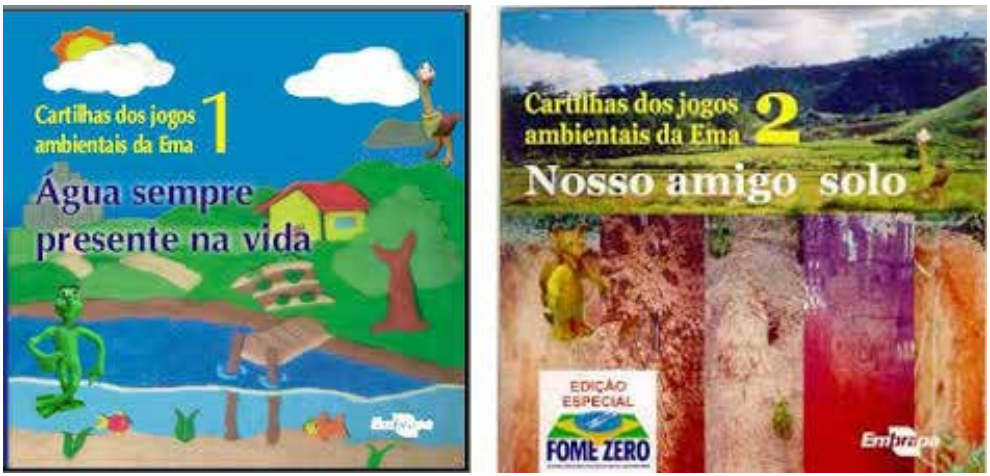

Figure 3. Cover of booklet 1 and booklet 2 of Ema Environmental Games Booklets.

Source: Queiroz and Pessoa (2003) and Gomes et al. (2003).

The strategic differential of methodological modification of the process of stimulating the internalization of environmental concepts present in this material was to focus its elaboration on demands of the Política Nacional de Educação Ambiental (National Environmental Education Policy – PNEA, Federal Law 9,795/1999).

It was also focused on the Parâmetros Curriculares Nacionais (National Curricular Parameters –PCN) and on the Lei de Diretrizes e Bases da Educação Nacional (Law

on Guidelines and Bases of National Education – Law9,394/1996), focusing on the cross-sectional theme Environment from the 1st to 4th grades of elementary school (range in which the education of the majority of the Brazilian population was concentrated at the time of preparation, according to 2000 Census (IBGE, 2003).

The elaboration counted on the voluntary adhesion of people (employees, interns, friends and relatives of employees of the Unit and of the municipality of Lagoa dos Três Cantos, Rio Grande do Sul state), which provided the material with differentials: languages/images/melodies forms presented in styles integrated to environmental themes promoting interaction between concepts and promoting socialization (specific games) in a unique way, differently from those available in Embrapa publications at the time. Values and practices were thus made available to be more easily incorporated into the habits of the population, as well as, into the actions carried out in the classroom. Being more representative of the Brazilian environmental culture, the material encourages the understanding of the relations between man and the environment, in a systemic way, considering different forms of expression of this knowledge, also acting in the emotional dimension of the reader, observer or listener (essential component of the learning process), which also encourages the awareness raising and internalization of environmental concepts in a pleasant format to the general audience.

The booklets on water and on soil (Queiroz; Pessoa, 2003; Gomes et al., 2003) and the music CD (Cartilhas..., 2003) were launched in November 2003 at the United Nations' *1st National Children and Youth Conference on Environment* of the, in Brasilia, Federal District; the other publications were published in 2004. They were transcribed into braille language, although printed in limited edition with the support of the Centro Cultural Louis Braille (Louis Braille Cultural Center) of Campinas, São Paulo state, and presented for the visually impaired through Dosvox software (Universidade Federal do Rio de Janeiro, 1993), which allows reaching a larger audience. It contributes both to social inclusion and to the formation of better-informed citizens, aware of their social participation and active in the area where they live.

The publications were used in programs/projects/events of Embrapa (such as Embrapa School and Itinerant Mini Libraries), in the *Semana Nacional de Ciência e Tecnologia* (*National Science and Technology Week*), among others. The collection was a finalist of the Banco do Brasil Foundation (FBB) of Social Technology Award (2005), granted by FBB/Unesco/Petrobras, in the Education category, having been recognized as Social Technology.

The seeds journey

The book *A viagem das sementes* (*The seeds journey*) (Carvalho; Duarte, 2000) (Figure 4), which was launched in 2013 by Embrapa Forestry and is aimed at children and adolescents, reports the various paths through which seeds pass to become new plants. The book has simple language; it was also printed in braille and comes with a CD-ROM, which makes it very accessible.

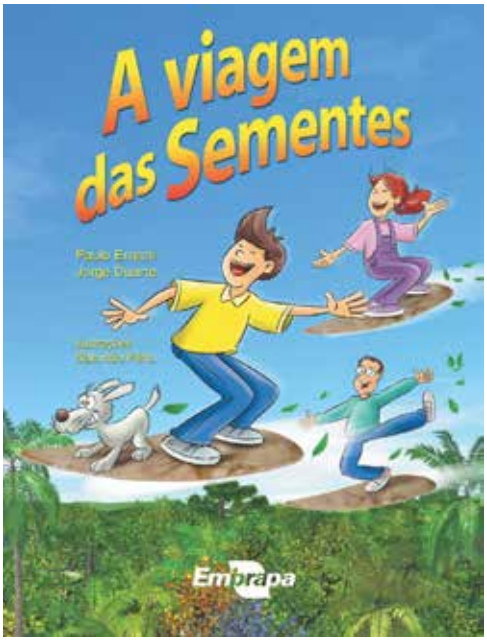

Figure 4. Cover of the book *The seeds journey*.

Source: Duarte and Carvalho (2006).

Digital inclusion of tilapia producers

The Sistema Informatizado de Apoio às Boas Práticas de Manejo e Gestão Ambiental da Aquicultura (Computerized System of Support to Best Management Practices and to Environmental Management in Aquaculture) (Aquisys v.1.3, 2015) was developed by Embrapa Environment, Embrapa Coastal Tablelands, Embrapa Western Agriculture, Embrapa Western Amazon, Embrapa Fisheries & Aquaculture by Agência Paulista de Tecnologia dos Agronegócios (Apta) – Polo Regional do Leste Paulista de Monte Alegre do Sul (São Paulo Agribusiness and Technological Agency – Regional Hub of the East of São Paulo at Monte Alegre do Sul) to enable public internet access to a minimum set of practices in support of good practices in aquaculture management and environmental management, with immediate applicability to the sustainability of aquaculture production systems.

Aquisys is also an innovative way to promote digital inclusion. The method is based on the profile of the target audience of the validated Aquisys (focused on the tilapia producer in the excavated tank), identified in field observations, in technical-scientific events that had the participation of different actors in the aquaculture area and in questionnaire analyzes applied during the system validation process. Thus, a set of synergetic actions, focused and organized in a feasible and strategic way was proposed to make Aquisys feasible as a technology to be immediately incorporated into the practices of digital inclusion programs.

In general, the method proposes different approaches to be applied considering the opportunities of internet access identified by states and/or municipalities, the age groups of the individuals to be trained and the potential digital inclusion projects in progress. The proposed actions are signaled to be carried out in a manner compatible with the different educational levels of tilapia producers, incorporating the use of methods identified in the technical-scientific literature as already validated for the digital inclusion of young people (children of producers) and adults (producers between 21 and 60 years of age and senior producers).

In areas where inclusion projects are not available, actions are advised to make up the classes by the degree of computer literacy of the individual for the basic course and for the prior training of teachers and monitors, among others. This way, human, logistical/physical and financial resources are optimized in the operational strategies that concretize the proposed method more quickly and with greater expectation of success. It is hoped, therefore, that the Aquisys v.1.3 validated technology will offer Brazilian producers more access to information and knowledge about sustainable practices applicable to the productive system and be an additional motivator to increase the insertion and permanence of these users in digital inclusion activities.

Food security of indigenous peoples

Embrapa recently approved, under the Embrapa Project System, Arrangement Nº 41, dated September 18, 2017, called Construção e Intercâmbio de Conhecimentos para o Desenvolvimento Sustentável de Povos e Comunidades Tradicionais (Construction and Knowledge Exchange for the Sustainable Development of Traditional Peoples and Communities – ConPCTs), which intends to promote actions that contribute to identify, characterize and value traditional systems that contribute to their food and nutritional security.

Certainly, with the approval of the ConPCTs Arrangement, it will be possible to guarantee the implementation and maintenance of actions with impacts on several axes, among which the food security and sovereignty of traditional peoples and communities stand out, considering their practices and life ways; the strengthening of their cultural identity and autonomy; the formation of social capital through the sharing of information and decisions; and the empowerment of local actors.

The Brazilian indigenous population is made up of 220 peoples that today occupy 13% of the national territory. Many of these peoples face serious food insecurity problems.

In partnership with the Fundação Nacional do Índio (National Indian Foundation – Funai), the network of indigenous rural technical assistance and extension (indigenous Ater) and several non-governmental organizations (NGOs), Embrapa develops several actions with indigenous peoples in a dialogical and participatory manner to encourage communities to participate in the diagnosis, reflecting on the food and environmental issues and planning actions to overcome them together with the researchers. This research involves access to genetic resources and associated traditional knowledge and it is preceded by the construction of the prior informed consent process and authorization of the Conselho de Gestão do Patrimônio Genético (Genetic Heritage Management Council – CGEN/MMA).

In order to reduce the food insecurity of indigenous peoples, Embrapa has carried out the following actions :

- Conservation of genetic resources, food security and cultural strengthening through initiatives such as: promotion of eight traditional seed fairs, attended by more than 2,500 indigenous people of different Brazilian ethnicities.
- Enrichment of Krahô yards in the state of Tocantins, with the planting of 20,000 seedlings and training related to planting and cultivation, and research on valuation of non-timber forest products in the Krahô Indigenous Land, such as jatobá (*Hymenaea* sp.) and tiririca (*Scleria* sp.), among others.
- Food security and cultural strengthening of communities in the Xingu Indigenous Park. The actions developed are: the delivery of cipó kupa (*Cissus* sp.) to the Kayapó people and; the preservation and sustainable management of the tracajá (*Podocnemis unifilis*), relative of the

Amazonian turtle (strategic food of the indigenous peoples of the Xingu Indigenous Park, tracajá has been suffering a reduction in its population due to population growth, deforestation and predatory hunting). Still on the management of tracajá, Embrapa develops a work of recovery of populations of this species, which includes: protection of nine beaches from human and natural predation, release of about 30 thousand tracajás in the lagoons of the region and environmental education courses.

Embrapa also works in partnership with other indigenous communities in Brazil with actions of:

- Recovery, multiplication and availability of traditional corn varieties for indigenous communities (Xavante People, MT; Bororo, MT; Maxakali, MG; Guarani, MS; Kaingang, RS; Pataxó, BA; Krahô, TO, and Kayabi, MT).
- Training of indigenous farmers of Canela, MA (Porquinhos and Descalvados villages), Apinayé, TO, and Kaiapó, PA, in strategies for the conservation of ex situ and on farm genetic resources, management and use of agrobiodiversity; planting of fruit trees in Krahô village.
- Study of cultural aspects and their relationship with crops, agricultural practices and therapeutic use of medicinal plants in ten indigenous communities of the Kulina group in Acre.
- Support for the production of watermelon (*Citrullus lanatus*) in Roraima, especially for Makuxi and Wapixana indigenous people (currently the largest producers in the state).
- Availability of technologies related to cassava cultivation (*Manihot esculenta*) and its consortium with cowpea (*Vigna unguiculata*) for the Makuxi and Wapixana indigenous communities in the Roraima area.

Collective training of Embrapa Ethics Committee

Since 2007, Embrapa has established the Ethics Committee of Embrapa (CEE), under with Decree nº 1,171/1994 and Decree nº 6,029/2007, consolidating the management of ethics in the Company. In 2004, Embrapa's Code of Ethics was created (revised in 2014) and, in 2012, Embrapa's Code of Conduct was established. As one of the institutional values that integrate *VI Plano Diretor da Embrapa: 2014-2034* (*Embrapa's VI Master Plan*: *2014-2034*) (Embrapa, 2015), ethics means "we work for the common good, with respect for our neighbor and integrity"

(Embrapa, 2015, p. 9, our translation). The training of employees is one of the actions provided for in the Work Plan of CEE 2015-2018 and it has been developed in partnership with the Programa Pró-Equidade de Gênero, Raça e Diversidade (Gender, Race and Diversity Equality Program).

The general objective of the training program is to guide employees, interns and others about ethics in the organizational environment (including duties and prohibitions on the conduct of the public agent) and to disseminate values of equality in order to promote equality between women and men in the work for development in their personal and professional lives, as well as of their citizenship, respecting the mission, vision, and values of ethics and equality of Embrapa.

Thus, it is proposed a program that enables to work in an educational and preventive manner, creating spaces for exchange, discussion, and construction of knowledge, based on participatory methodologies. In this context, instructors mainly play the role of facilitators and/or moderators in plenary discussions or group discussions.

Ethics is approached transversally, as a guideline for the problematization of issues related to the conduct of the public agent and equality in the organizational environment.

At the end of the day, duties and prohibitions are reinforced in Embrapa's Codes of Ethics and Conduct, focusing on relevant topics such as: the use of social networks (care related to access content, time of use, etc.); the conduct in the service to the public (by telephone or in-person); the ethical attitude related to information security; the use of appropriate clothing (mainly for interns); communication and integration between employees and associates; and the behaviors in general related to the ethical and professional position in the workplace. Clarifications are also provided on the Gender, Race and Diversity Equality Program and the available communication channels (CEE, Ombudsman, etc.).

Gender, Race and Diversity Equality Program

The initiatives at Embrapa began in 2005, with the formation of a working group whose objective was to propose the creation of a nucleus of studies and evaluation of actions of social responsibility, gender and diversity, including the dimensions of race and ethnicity. In 2007, Embrapa makes voluntary adherence to the Programa Pró-Equidade de Gênero e Raça (Gender and Race equality Program) of the Secretaria Especial de Políticas para as Mulheres (Special

Secretariat for Policies for Women), currently linked to the Ministry of Justice and Citizenship. Embrapa concluded its participation in the 2nd, 3rd, 4th and 5th editions of the program by obtaining the Gender and Race Equality Seal, an instrument that proves the commitment to the development of new conceptions of people management and organizational culture in the promotion of equality of race and gender and equal opportunities in the workplace.

In accordance with the corporate values Commitment, Cooperation, Equality, Ethics, Excellence, Flexibility and Social and Environmental Responsibility, Embrapa's Gender, Race and Diversity Equality Program emphasizes respect, recognition and appreciation of diversity as essential steps for the promotion of equal rights for people with different identities, interacting in the same social system. Thus, a more equal working relationship is sought, respecting the diversity existing in the work environment.

Final considerations

In this chapter, target 4.5 of SDG 4 was presented, which deals with inclusive education, and it aims to guarantee the right of everyone to information from people in situations of social vulnerability, with disabilities, of global development disorders and also those with high skills, including the dimensions of gender, race, and ethnicity.

The need for the interface between inclusive education and rural education has made Embrapa seek to make available materials related to various issues in the field to promote equal opportunities. Examples of books related to field issues produced for children and adolescents were presented here, which were transcribed into braille and published in audiobook format, allowing the access of children with visual impairment. Certainly, a lot still needs to be done so that Embrapa's collection of publications is widely available in these formats, greatly increasing the access to information produced.

Other initiatives should be highlighted, such as the Sharing Science on the Web website (CCWeb) (Embrapa Informação Tecnológica, 2017), presented in Chapter 4. This website, accessible to children and adolescents with visual impairment and low vision, besides serving people with other disabilities, represents a communication channel designed not only for the technical-scientific divulgation of the institution, but above all presents itself as a contribution to the Brazilian society in school education in science and technology.

Embrapa has also developed several actions aimed at supporting and guaranteeing productive inclusion through the promotion of sustainable technologies locally built and/or adapted for traditional peoples and communities. Some of the actions developed to guarantee the food security of indigenous peoples were presented, resulting from a broad work of knowledge construction starting from the articulation between scientific knowledge and traditional knowledge. Examples of diversity are the actions of research, exchange and knowledge building established with traditional peoples and communities; it is noteworthy that, besides indigenous peoples, there are or have been actions with traditional Afro-descendant peoples, andiroba, chestnut, mangaba, cipó extractivists, *Pantanal* residents, artisanal fishermen, coco-babassu breakers, riverside people, rubber tree extractivists, among others.

Some institutional initiatives that began more than a decade ago to promote ethics and equal rights for people with different identities in the work environment were also highlighted, valuing interpersonal ethics and promoting gender and race equality and equal opportunities on work environment.

Much still needs to be done to provide access, promote participation and learning for Brazilians. We believe that the present initiatives of Embrapa can be a stimulus for the production of many other materials in favor of a better quality of life for all.

References

A HISTÓRIA de João das Alfaces: um filme de Cacinho. [Brasília, DF: Embrapa; Seropédica: Embrapa Agrobiologia], 2008. 1 DVD.

AGUIAR-MENEZES, E. de L.; NEVES, M. C. P. **O Mulungu e suas amigas joaninhas**: proteção que chega voando. Seropédica: Embrapa Agrobiologia, 2014. 27 p. (Embrapa Agrobiologia. Série amiguinhos, 3).

AQUINO, A. M. de; NEVES, M. C. P. **A história do seu João das Alfaces**: uma introdução à agricultura orgânica. Brasília, DF: EMBRAPA-SPI, 1996. 33 p.

AQUINO, A. M. de; NEVES, M. C. P.; FERREIRA, V. M. **O Mulungu e suas amigas minhocas**: as construtoras de túneis. Seropédica: Embrapa Agrobiologia, 2014. 21 p. (Embrapa Agrobiologia. Série amiguinhos, 5).

AQUISYS V.1.3: Sistema informatizado de apoio às boas práticas de manejo e gestão ambiental da aquicultura. Versão 1.3. [S.l.]: Embrapa: Apta, 2015. Software.

CARTILHAS dos jogos ambientais da Ema músicas de temas ambientais. Letras: Maria Conceição P. Y. Pessoa, Vera Lúcia Ferracini, Heloisa Filizola e Clóvis Pereira Salgado. Músicas: Leandro Ruppenthal e Pablo Roberto Oliveira. Interpretação e arranjo: Leandro Ruppenthal e Banda Kaos. Jaguariúna: Embrapa Meio Ambiente, 2003. 1 CD.

CARVALHO, P. E. R.; DUARTE, J. A. M. **The travel of seeds**. Brasília, DF: Embrapa Comunicação para Transferência de Tecnologia, 2000. 59 p.

CORREIA, M. E. F.; NEVES, M. C. P.; AQUINO, A. M. de; FERREIRA, V. M. **O Mulungu e seus amigos gongolos**: a mágica da reciclagem. Seropédica: Embrapa Agrobiologia, 2014. 20 p. (Embrapa Agrobiologia. Série amiguinhos, 4).

DUARTE, J. A. M.; CARVALHO, P. E. R. **The travel of seeds**: versão em Braille. Brasília: Embrapa, 2006. 60 p.

EMBRAPA INFORMAÇÃO TECNOLÓGICA. **Contando ciência na web**. Available at: <https://www.embrapa.br/en/contando-ciencia>. Accessed on: Dec. 5, 2017.

EMBRAPA. Secretaria de Gestão e Desenvolvimento Institucional. **VI Plano Diretor da Embrapa**: 2014-2034. Brasília, DF: Embrapa, 2015. 24 p.

GOMES, M. A. F.; FILIZOLA, H. F.; SOUZA, M. D. de. **Nosso amigo solo**. Jaguariúna: Embrapa Meio Ambiente, 2003. 24 p. (Cartilhas dos jogos ambientais da Ema, 2).

IBGE. **Censo demográfico 2000**: características gerais da população: resultados da amostra. Rio de Janeiro, 2003. Available at: <https://www.ibge.gov.br/estatisticas-novoportal/sociais/populacao/9663-censo-demografico-2000.html?=&t=o-que-e>. Accessed on: Nov.14, 2017.

NEVES, M. C. P. **O mulungu e seus amigos rizóbios**: tamanho não faz diferença. Seropédica: Embrapa Agrobiologia, 2008a. 24 p. (Embrapa Agrobiologia. Série amiguinhos, 2).

NEVES, M. C. P. **O mulungu**. Seropédica: Embrapa Agrobiologia, 2008b. 24 p. (Embrapa Agrobiologia. Série amiguinhos, 1).

O MULUNGU e seus amigos: gongolo, joaninha, rizóbio. Seropédica: Embrapa Agrobiologia, 2015. 1 DVD.

QUEIROZ, J. F.; PESSOA, M. C. P. Y. **Água sempre presente na vida**. Jaguariúna: Embrapa Meio Ambiente, 2003. 39 p. (Cartilhas dos jogos ambientais da Ema, 1).

RESENDE, A. S. de; FERREIRA, V. M. **Conhecendo o Brasil com o mulungu**. Seropédica: Embrapa Agrobiologia, 2015. 13 p. (Embrapa Agrobiologia. Série amiguinhos, 6).

UNITED NATIONS. **Sustainable development goal 4**: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all: targets & indicators. Available at: <https://sustainabledevelopment.un.org/sdg4>. Accessed on: Oct. 10, 2017.

UNIVERSIDADE FEDERAL DO RIO DE JANEIRO. **Dosvox**. Versão 5.0 beta. Rio de Janeiro, 1993. Software

Recommended literature

AUSUBEL, D. P. **Educational psychology**: a cognitive view. New York: Holt, Rinehart and Winston, 1968.

BRASIL. Comissão de Ética Pública. **Código de conduta da alta administração federal, normas complementares e legislação correlata**. Brasília, DF: Presidência da República, 2013.

CHAIM, A.; FERRACINI, V. L.; LIMA, M. A. de. **O ar que respiramos**: o que estamos fazendo com o nosso ambiente? Brasília, DF: Embrapa Informação Tecnológica; Jaguariúna: Embrapa Meio Ambiente, 2004. (Cartilhas dos jogos ambientais da Ema, 6).

COBB, P.; CONFREY, J.; DISESSA, A.; LEHRER, R.; SCHAUBLE, L. Design experiments in educational research. **Educational Researcher**, v. 32, n. 1, p. 9-13, 2003. Available at: <http://edr.sagepub.com/content/32/1/9.full.pdf>. Accessed on: Dec. 10, 2014.

DELORS, J. C. **Educação**: um tesouro a descobrir: relatório para a UNESCO da Comissão Internacional sobre Educação para o Século XXI. São Paulo: Cortez, 1998. Available at: <http://ftp.infoeuropa.eurocid.pt/database/000046001-000047000/000046258.pdf>. Accessed on: Apr. 4, 2012.

EMBRAPA. **Código de conduta da Embrapa**. Brasília, DF: Embrapa, 2012.

EMBRAPA. Código de conduta, ética e integridade da Embrapa. **Boletim de Comunicações Administrativas**, ano 46, n. 42, ago. 2020. Available at: <https://www.embrapa.br/documents/10180/56556577/C%C3%B3digo_Conduta_Etica_Integridade_daEmbrapa.pdfRC207.pdf/caa4d33e-7a5a-d048-0da7-12583d0eaf64>. Accessed on: Dec. 17, 2020.

FERRACINI, V. L.; CAPALBO, D. M. F.; PESSOA, M. C. P. Y. **Qualidade de vida**: nutrição, higiene e segurança dos alimentos. Brasília, DF: Embrapa Informação Tecnológica; Jaguariúna: Embrapa Meio Ambiente, 2004. (Cartilhas dos jogos ambientais da Ema, 5).

FERRAZ, J. M. G.; SALGADO, C. P.; PESSOA, M. C. P. Y. **Lixo**: qual será a herança que vamos deixar? Brasília, DF: Embrapa Informação Tecnológica; Jaguariúna: Embrapa Meio Ambiente, 2004. (Cartilhas dos jogos ambientais da Ema, 4).

FREIRE, P. **Educação como prática da liberdade**. 31. ed. São Paulo: Paz e Terra, 2008.

FREIRE, P. **Pedagogia da autonomia**: saberes necessários à prática educativa. São Paulo: Paz e Terra, 1997.

FREIRE, P. **Pedagogia da esperança**: um reencontro com a pedagogia do oprimido. 12. ed. São Paulo: Paz e Terra, 1992.

FREIRE, P. **Pedagogia do oprimido**. 38. ed. Rio de Janeiro: Paz e Terra, 2004.

KELLY, A. E.; LESH, R. A. **Handbook of research design in mathematics and science education**. Mahwah: Erlbaum, 2000.

KNOWLES, M. S.; HOLTON III, E. F.; SWANSON, R. A. **Aprendizagem de resultados**: uma abordagem prática para aumentar a efetividade da educação corporativa. Rio de Janeiro: Elsevier, 2011.

LIMA, V. V. **Learning issues raised by students during PBL tutorials compared to curriculum objectives**. 2001. Dissertation (Master) -- Department of Health Education, University of Illinois, Chicago.

LUCKESI, C. C. Independência e inovação em Tecnologia Educacional: ação-reflexão. **Tecnologia Educacional**, v. 15, n. 71/72, p. 55-64, 1986.

MATUS, C. **Política, planejamento e governo**. Brasília, DF: IPEA, 1993.

MOREIRA, M. A. **Aprendizagem significativa**. Brasília, DF: Ed. Universidade de Brasília, 1999.

MORIN, E. **Os sete saberes necessários à educação do futuro**. São Paulo: Cortez, 2000.

PERRENOUD, P. **10 competências para ensinar**: convite à viagem. Porto Alegre: Artmed, 2000.

PERRENOUD, P. **Construir as competências desde a escola**. Porto Alegre: Artes Médicas, 1999.

PESSOA, M. C. P. Y.; FRASCA-SCORVO, C. M. D.; LOSEKANN, M. E.; SILVA, M. S. G. M. e; SILVA, C. A. da; HISANO, H.; SCORVO FILHO, J. D.; INOUE, L. A. K. A. **Método para promover a inclusão digital**

de produtores de tilápia pelo uso do Aquisys v. 1.3. Jaguariúna: Embrapa Meio Ambiente, 2016. 52 p. (Embrapa Meio Ambiente. Documentos, 104).

PIAGET, J. **A construção do real na criança**. Rio de Janeiro: Zahar, 1971.

PIAGET, J. **A formação do símbolo na criança**. Rio de Janeiro: Zahar, 1971.

PIAGET, J. **O nascimento da inteligência na criança**. Rio de Janeiro: Zahar, 1971.

PRAHALAD, C. K. Reexame de competências. **HSM Management**, ano 3, n. 17, p. 40-46, 1999.

RODRIGUES, G. S.; SÁ, L. A. N. de; RODRIGUES, I.; CHAIM, A. **Vida de bicho**: a fauna e o meio ambiente no Brasil. Brasília, DF: Embrapa Informação Tecnológica; Jaguariúna: Embrapa Meio Ambiente, 2004. (Cartilhas dos jogos ambientais da Ema, 7).

SKORUPA, L. A. **Nós, as árvores e as florestas**. Brasília, DF: Embrapa Informação Tecnológica; Jaguariúna: Embrapa Meio Ambiente, 2004. (Cartilhas dos jogos ambientais da Ema, 3).

VIGOTSKY, L. **A formação social da mente**. São Paulo: Martins Fontes, 1999.

Chapter 6

Future advances and challenges

Joanne Régis Costa
Patricia da Costa

Introduction

This book addresses the Sustainable Development Goal 4 (SDG 4) – Quality Education – whose goals refer to relevant and effective learning outcomes, knowledge and skills necessary to promote the quality of life in an inclusive and fair way.

SDG 4 is of crucial importance to all other SDGs. Its general objective is to develop transversal competences and, in informing and empowering people, contributing to promote the transformations aimed at reaching the goals, whether social, economic, political and/or behavioral changes.

Embrapa's advances

Education in Brazil is still fragile and requires more solid efforts to advance and achieve the quality desired.

Quality education is an instrument capable of building the necessary basis for obtaining multiplier effects as it empowers people to build consistent advancements.

The research and technology transfer work of Embrapa is based on the concept of education for sustainability, production of knowledge and innovative technologies for the different sectors of society. Embrapa's initiatives related to SDG 4 have been built in order to develop capacities and contribute to social-environmental awareness and the dissemination of information and technological solutions.

Several resources have been used by Embrapa to carry out adequate training of multiplier agents at different levels and regions of the country. This strong investment in the development of skills and competencies has transformed the Brazilian countryside. This reflects in important results, such as the adoption of technologies, changes in agricultural practices that result in improved income and favorable opinion surveys, such as the survey on the Brazilian Agriculture

Producer Profile conducted by the Agribusiness Department of the Federação das Indústrias do Estado de São Paulo (Federation of Industries of the State of São Paulo – Fiesp) and by the Organização das Cooperativas Brasileiras (Organization of Brazilian Cooperatives – OCB). It was verified that the rural producer values the scientific and technological research carried out by the public research centers (Icagro, 2017); almost 60% (58.8%) of the interviewed producers believe that such research centers, such as Embrapa, help their rural activities with adequate technologies.

Presenting information, knowledge, opportunities and technological solutions, as well as encouraging entrepreneurship and inclusive educational processes for different audiences are crucial factors to contribute to Brazilian sustainable development.

Future challenges

For Embrapa, it is imperative that the information and technologies generated by it reach its different publics, which leads Embrapa to use a series of instruments to reach the largest possible number of people.

In recent decades, Brazilian rural development has moved towards industrialization, incorporating, every day, more technologies and innovations in its production process. The different sectors of agribusiness are demanding more and more professionals capable of operating complex systems. In turn, family farming increasingly assumes an essential role in the production of healthy food, income generation, conservation and maintenance of socio-biodiversity.

Associated with these scenarios, several other trends have been mapped out over the next 10 years, including:

- Development of integrated training actions to improve agricultural risk management through technology transfer.
- Protagonism and empowerment of farmers.
- Technical support for the modernization and rationalization of family-based production systems.
- Entrepreneurial education, which aims to promote the offer of entrepreneurship content to consolidate the entrepreneurial culture.

- Technical support for the conservation of natural resources and local territorial management.
- Adoption of open standards in research: valorization and incorporation of external knowledge (the so-called "*crowd science*") both in the analysis phase of the phenomena and in the validation of the results and products obtained; or establishment of collaborative and experimental technological laboratories that allow and promote a context of training, implementation and use in rural areas.

Education is a basic human right and lays the foundation for building peace, well-being and sustainable development. It is an essential strategy in the search for the realization of all SDGs (Unesco, 2017).

References

ICAGRO. **Perfil do produtor agropecuário brasileiro**. 2017. Available at: <http://icagro.fiesp.com.br/perfilprodutor.asp>. Accessed on: Dec. 11, 2017.

UNESCO. **Educação para os objetivos de desenvolvimento sustentável**: objetivos de aprendizagem. [S.l.], 2017. 62 p. Available at: <http://unesdoc.unesco.org/images/0025/002521/252197POR.pdf>. Accessed on: Dec. 14, 2017.

MINISTRY OF
AGRICULTURE, LIVESTOCK
AND FOOD SUPPLY

ISBN: 978-65-86056-46-4

CGPE 016268