

## Agroecological Knowledge and the Need of Having an Investigative Dialogue with Elementary School Students

Dieison Prestes da Silveira; Vania Abreu de Oliveira; Jana Koefender; Juliane Nicolodi

Camera; Diego Pascoal Golle

### Abstract

Schools are places where the insertion of individuals with different knowledge, experiences and life stories takes place. It is essential promoting the debate on environmental issues, with particular emphasis on agroecology for knowledge improvement, as well as for human, critical and reflective education. Moreover, it is necessary exchanging knowledge through dialogic practices. Thus, the aim of the current study is to analyze the importance of having students exchanging knowledge about environmental issues, with special focus on agroecology and on its philosophical, sociological and anthropological background, and about how it reflects on social knowledge. The study adopted a qualitative approach based on the dialectical method supported by action-research. The research project was submitted to the Research Ethics Committee (University of Cruz Alta), which issued favorable opinion to the development of it. Twenty-one students enrolled in a public school in Tupanciretã County, Rio Grande do Sul State, Brazil, participated in the study. Initially, a focus group was held in order to collect information about students' previous knowledge on the investigated subject. Results of the focus group were used to plan the action-research activities. Based on the dialogues, it is possible saying that students understand the meaning of agroecology, although they mainly associate such concept with animals and plants.

**Keyword:** Teaching; Learning; Environmental Knowledge.

**Published Date:** 10/31/2019

**Page:**321-330

**Vol 7 No 10 2019**

**DOI:** <https://doi.org/10.31686/ijer.Vol7.Iss10.1777>

# **Agroecological Knowledge and the Need of Having an Investigative Dialogue with Elementary School Students**

**Dieison Prestes da Silveira\***

Master's Degree student in Sociocultural Practices and Social Development

**Vania Abreu de Oliveira\***

Professor at the Master's Degree Program in Sociocultural Practices and Social Development

**Jana Koefender\***

Professor at the Master's Degree Program in Sociocultural Practices and Social Development

Professor at the Master's Degree Posgraduate Program in Rural Development

**Juliane Nicolodi Camera\***

Professor at the Master's Degree Posgraduate Program in Rural Development

**Diego Pascoal Golle (Corresponding author)\***

Professor at the Master's Degree Program in Sociocultural Practices and Social Development

Professor at the Master's Degree Posgraduate Program in Rural Development

\*University of Cruz Alta, Cruz Alta, Brazil

## **Abstract**

*Schools are places where the insertion of individuals with different knowledge, experiences and life stories takes place. It is essential promoting the debate on environmental issues, with particular emphasis on agroecology for knowledge improvement, as well as for human, critical and reflective education. Moreover, it is necessary exchanging knowledge through dialogic practices. Thus, the aim of the current study is to analyze the importance of having students exchanging knowledge about environmental issues, with special focus on agroecology and on its philosophical, sociological and anthropological background, and about how it reflects on social knowledge. The study adopted a qualitative approach based on the dialectical method supported by action-research. The research project was submitted to the Research Ethics Committee (University of Cruz Alta), which issued favorable opinion to the development of it. Twenty-one students enrolled in a public school in Tupanciretã County, Rio Grande do Sul State, Brazil, participated in the study. Initially, a focus group was held in order to collect information about students' previous knowledge on the investigated subject. Results of the focus group were used to plan the action-research activities. Based on the dialogues, it is possible saying that students understand the meaning of agroecology, although they mainly associate such concept with animals and plants.*

**Keywords:** Teaching; Learning; Environmental Knowledge.

## 1. Introduction

Schools are formative places that enable the insertion of individuals from different cultures, ethnicities and identities. Students and teachers, who present different knowledge levels and come from different realities, enable meaningful knowledge exchanges observed in several social contexts. However, teachers need to create ways and adopt methods to gain students' attention and to promote the teaching-learning process. Nowadays, the socio-cultural environment presents a whole variety of knowledge resulting from different experiences, beliefs, cultures and ideologies. Thus, exploring this knowledge and making it relevant to students encourage them to engage in social experiences and enable human, critical and reflective education. According to Moreira (2008), classroom investigations and debates help students expressing their knowledge during discussions in order to find the answers they look for.

The knowledge transmitted from generation to generation, in some cases, is confronted by, or added to, the scientific community. This knowledge is built through sociocultural interactions, which assure the diversity and emergence of new knowledge. In addition, the dialogical and reflexive relationship between individuals enables the emergence of new questions and encourages reflective thinking about social environments. Thus, students become critical individuals who act in society.

The school environment enables teachers and students to improve traditional and scientific knowledge based on dialogues and activities that originate new experiences and lead to the implementation of, and reflection about, pedagogical practices. Thus, there is no dialogue without individuals and no new knowledge without interpersonal interactions.

In a global context, criticizing and reflecting about anthropic actions in the environment can help reformulating concepts and sensitizing individuals. Everyday, the media reports several environmental and social disasters affecting different populations. Educational institutions should promote debates about these topics in order to provide a humane, rational and citizenship education to students based on an epistemological perspective about environmental issues associated with sustainability, recycling, agroecology, ecology, among other concepts outspread and embodied by the social environment, but these concepts have little representativeness in daily practices. Overall, the environment is strongly associated with society; thus, controlling anthropocentric practices can help improving the quality of life of all living beings. According to Fernández and Garcia (2001), human beings must improve their understanding about, and attitude towards, nature in order to achieve environmental sustainability.

Students' education process should go beyond the classroom in order to enable the articulation between theoretical concepts and practical activities. It is necessary emphasizing contemporary environmental issues and their association with human, critical and citizenship education processes at the time to investigate elementary students' perception and sensitization about the agroecological-environmental topic. These students are at the early stage of process to acquire scientific knowledge about topics associated with different knowledge fields. This knowledge can lead students towards social and environmental understanding. According to Ribeiro (2013), learning is one of the main ways to improve ecological awareness. Accordingly, Leff (2008) states that environmental education is also a pedagogical process that guides education within the social context and, mainly, in the ecological reality individuals live in. Based on the need of exchanging knowledge through dialogical practices, the aim of the current study was

to analyze the importance of having students exchanging knowledge about environmental issues, with special focus on agroecology and on its philosophical, sociological and anthropological background, and about how it reflects on social knowledge.

## 2. Methodology

According to Fachin (2003, p. 5), “*research is an intellectual procedure through which researchers aim to acquire knowledge by investigating a given reality in order to find new truths about a given fact (object, problem)*”. The current research adopted a qualitative approach, since, according to Marconi and Lakatos (2004, p. 269), the “*Qualitative methodology aims at analyzing and interpreting deeper aspects and at describing the complexity of human behavior.*”

The current research also followed the dialectic approach. According to Gil (2011, p. 13), the history of mankind goes through a dialectical path where contradictions transcend; however, they “[...] *give rise to new contradictions that now require solution*”. Dynamic and totalizing interpretations of reality take place through dialectics. An action-research based on technical procedures was carried out. This research type enables a range of perceptions about, and relationships with, the surveyed individuals. Thiollent (1986) highlights that the action-research focuses the analysis of different forms of action, as well as structural aspects of social reality that should not remain unknown. Action manifests itself in a set of structurally determined relationships.

Action-research turns researchers into active individuals in pursuit of new discoveries. According to Thiollent (1986, p. 15), “*action-research certainly requires a participatory relationship structure between researchers and individuals in the investigated situation*”. Investigating topics associated with school, teaching, curriculum and knowledge in the educational environment enables developing and improving didactic-pedagogical techniques and methods focused on improving the teaching-learning process between teachers and students.

The current research was conducted with sixth grade students in the age group 10-12 years, who were enrolled in a rural school in Tupanciretã County, Rio Grande do Sul State, Brazil. Research instruments comprised an action plan aimed at building a roadmap of developed activities, an audio recorder that was used during the focus groups, several photos, as well as a field diary, which was used to record students’ interest and participation in the developed activities, as well as their commitment and responses to them.

Collected data were subjected to content analysis. According to Bardin (1997), content analysis is a technique focused on analyzing communications. Accordingly, Severino (2007, p. 121) describes content analysis as “[...] *a methodology focused on treating and analyzing information found in a given document, in the form of speeches in different written, oral, imagetic, gesture-based languages*”. Content analysis helps exploring and interpreting data and it is often used in social research.

Before starting the activities, the research project was developed and submitted to the Research Ethics Committee of University of Cruz Alta, which issued a favorable opinion through the Certificate of Presentation for Ethical Appreciation n.04075118.0000.5322. In addition, different forms were taken into consideration, among them, the free and informed consent form, the research confidentiality form and the consent to mitigate harm to the ones participating in the research.

### 3. Results

The dialogue focused on analyzing the previous knowledge of sixth grade students about the investigated topic. It took place in the playroom of the aforementioned school, in April 2019. The conversation session involved 21 students, the researcher in charge and the teacher-mediator of the focus group. The analysis of the first focus group was used as basis to develop the action-research.

Students sat in a circle around the table where the cellphone used to audio record the conversations was placed on. Several questions were asked to encourage debates and knowledge exposure, which were mainly based on experience reports. The first question aimed at investigating whether students knew the meaning of agroecology or even if they had already heard about it. Few students voluntarily, although timidly, answered this question: two students associated agroecology with plants, two did not know about it, one associated it with plants and animals, and another one mentioned the word 'ecosystem'.

With respect to sustainability, one student reported to support it, whereas another one reported to have heard that it has something to do with plants. At this point, the mediator encouraged students to think about their relationship with the planet. This topic made other students start to participate in the debate more openly. According to some students, their relationship with the planet lies on living / existing on it, on collaborating with life itself. Yet, others reported that it has to do with ecology, animals, with not polluting the streets and forests. Only one student among the ones who answered this question reported that she did not know anything about the topic.

As students expressed their ideas, opinions and experiences, they were asked about whether their homes or relatives and / or friends had gardens and whether they had already helped planting something. Most students showed interest in answering this question and they reported their experiences in an organized way. In total, 48% of the 21 participants reported to have a garden at home. With respect to having a home vegetable garden and to who helped planting it, student 2 reported: "*My father, my mother, my two brothers and myself*". Based on this statement, it is possible saying that vegetable gardens are used as an alternative to get healthy food and to follow diets rich in vegetables. In addition, having a vegetable garden helps mitigating costs with food.

Students also reported to have lettuce, arugula, corn, strawberry, tomato, passion fruit, orange and bergamot tree planted in their homes. According to student 7, his family also planted ryegrass, which was used to feed chickens and horses.

The teacher-mediator asked students whether they had watched the news about the rupture of some ore tailing dams in Minas Gerais State. It was done to encourage students to exchange their knowledge about environmental catastrophies, in which man and capitalist ideas are likely responsible for social, environmental, cultural and economic losses. Most students reported to have known about it, whereas two students had not. Thus, an open dialogue about the topic took place to allow students to understand what had happened. Students reported that many people, animals and plants died in that event. According to student 8, because of that event, residents lost "*animals, plants and their lives*" and "[...] *many people were left homeless*". Overall, students' reports have shown that they were sad about the severity of the situation. Thus, it is possible saying that students were, and remain, overwhelmed by the consequences arising from the rupture of tailing dams in Minas Gerais State.

Another question asked to participants by the focus group mediator concerned the definition of environment. Several answers associated with trees, forests, animals, nature, water, air and birds have emerged. According to student 6, environment is “*where we live*”. The exchange of knowledge and experiences among participants enabled a knowledge construction process, based on the knowledge exchange ideology by Freire (1987), according to whom, one learns from the other and builds knowledge.

Students were also asked about whether they knew who the subjects who produce organic products are. Some students responded that they were farmers, whereas others defined them as producers. Based on this question, another question was asked: Why are these food products not valued? Of the 21 participants, four did not know the answer to this question, whereas student 11 reported that: “*The plants are valued because they put food on the table*”.

Another question concerned students' diet. They were asked whether they only eat processed products or vegetables grown in their garden. Most students reported to often feed on food grown in their garden, as well as on food purchased in the market. Only one student reported to not eat plant-origin food. According to one student, his mother used old tires to build the beds in his home garden. He added that his family was helping the environment by reusing materials that could be discarded anywhere. According to the aforementioned dialogues, and to data in the previous table, students made different reports on agroecology, sustainability and environment. These reports were the guiding axis of the current study.

Although participants shyness was visible in the first focus group, it was possible observing that, over time, they were able to contribute to the activity by expressing their experiences. Overall, the word ‘agroecology’ was not observed in the vocabulary of sixth grade students. However, it was possible observing that words such as sustainability, preservation, care for the environment and recycling were part of their daily lives. As the dialogical discussions progressed, students explained facts / circumstances they experienced, such as having a home garden, taking care of the garden, avoiding water waste, among other experiences that underpin agroecology. Thus, these different planned actions are expected to help expanding students' knowledge, as well as to turn them into agents capable of changing society through attitudes and practices based on social values.

The teasing strategies adopted in the first focus group enabled a brief analysis of students' experiences and knowledge. The intention was to make the planned activities meaningful to participants' lives so they can use them to support their daily practices. The first focus group made it possible conducting a survey focused on raising thoughts about future actions, which were planned based on the action-research method. Dialogue, critical thinking, practices developed during meetings and reflections should be part of students' daily lives in order to help mitigating alienation cases and / or disseminating agroecological practices capable of contributing to the environment.

#### **4. Discussion: schools seen as places for human and citizenship education focused on helping better understand the environment**

The merge of knowledge, experiences and life stories happens in several places; however, schools are human, social, critical and reflexive education environments that encourage the practice of dialogue and the construction of new knowledge. Nowadays, thinking about actions capable of benefiting all life



forms triggers the awareness about environmental preservation and maintenance issues. The construction of spaces where knowledge is plural leads to debates about anthropic actions headed towards the natural environment. Thus, the aim of the current chapter is to address the role played by educational environments in individuals' reflection processes and in qualifying them to develop critical and autonomous actions in socio-environmental and cultural contexts.

Schools are environments focused on promoting the teaching-learning process. Teachers and students driven by curiosity exchange experiences and promote the articulation of different concepts and knowledge. The greater the interaction and the pursuit of knowledge, the stronger the likelihood of becoming critical and reflective individuals.

As students broaden their knowledge, the better they understand the role played by them in society, as well as the interweave values and attitudes they must adopt in social practices. Overall, they learn from each other as they talk and share their experiences. Knowledge transferred from generation to generation becomes plural in educational environments. It comprises customs, dances, songs and practices that merge and (re) create new ways of acting in society. Schools are educational environments focused on encouraging the development of ideas, as well as on forming autonomous individuals and citizens.

Past generations have left many legacies for the contemporary civilization. They comprise beliefs, religions and cultures that remain for decades, but even if they change, there is still some originality in them. Teaching is an example of legacy, because, even after years, one still needs to teach someone so knowledge can spread towards collectivity. Overall, discoveries can be shared in a dialogical, practical and expository manner. New knowledge should be shared among several individuals to enable spreading it as much as possible.

In addition to the educational, citizenship and human education process, schools often articulate knowledge through dialogic and practical activities. Teachers are professionals who exercise both pedagogical and social knowledge. Cooperative activities, such as group works, make classes more dynamic and transcend the pursuit of new knowledge. Educational teams should encourage students to find answers to their questions, as well as to find ways to solve challenges affecting the educational field, in order to enable the teaching-learning process.

Students' participation in teaching, research and extension projects reflects on their personal and professional life, since the amount of experience acquired by them ends up contributing to their identity/moral/citizenship construction process. Schools - as environments focused on implementing theoretical and practical activities - should plan and develop several practical activities to be performed with students. Some examples comprise the elaboration of didactic materials, scavenger hunts, educational school games, the construction of a vegetable garden, as well as cultural and integrative activities along with the community and other institutions. Finally, the school environment should enable the connection between students and society in order to help the formative and educational process of different social groups.

It is essential taking into consideration that the world has been experiencing a liquid modernity. According to Bauman (2001), the anthropological thinking is influenced by economic and political forces that make it difficult reflecting about the current reality. Agricultural practices have persisted since the dawn of civilizations in the anthropocene. Thus, men need the soil to plant, harvest, breed animals, build houses,

among others. The natural environment has changed since man started pursuing new horizons such as socioeconomic development. According to Caporal and Costabeber (2004), in the pursuit of building a new knowledge, agroecology has emerged with a new scientific focus capable of supporting the transition from farming styles to a more sustainable practice.

Places addressing environmental topics, such as educational institutions, enable the construction of new knowledge, as well as encourages changes in social practices by (de) constructing concepts and reformulating ways of thinking. School - as the environment for individuals' ethical, social and citizenship education - contributes to the formation of critical-reflective individuals capable of understanding their role in society and of enabling changes. According to Oliveira, Quintas and Gualda (1991, p. 18), *"environmental education enables individuals to build values necessary to live in society and to contribute to the environmental balance"*. Based on Altieri (2000), agroecology refers to the environmental and social perception about agriculture, which has implications in the global context.

Understanding that the environment is not only characterized by trees, rivers and animals remains a challenge for society, since this concept pervades all social groups. Besides new studies, deconstructing and reconstructing the concept of environment requires reflections and an epistemological perspective about this topic. According to Guimarães (2011, p. 13), *"the environment is not only the sum of its component parts, but also the interaction between these parts in interrelation with the whole [...]"*. Thus, all living and non-living beings are part of the biophysical environment, because together, they maintain the environmental balance.

The plurality of social knowledge originates from dialogue and research, i.e., the empirical knowledge of one group should be spread to others in order to bring significance to all individuals. Educational environments are an example of places that enable the exchange of traditional and scientific knowledge, since they value knowledge diversity. According to Eloy et al. (2014), most scientific knowledge emerged from local knowledge, also known as traditional knowledge, so knowledge diversity must be respected and valued. Based on Ribeiro (2013, p. 206), *"learning is one of the ways to improve ecological awareness and reduce several forms of alienation"*. Thus, one realizes the importance of working on these subjects in schools.

This concept of knowledge is embodied by different cultures and it brings along reflections about the need of exchanging knowledge by using dialogue and sociocultural practices, such as group communication mechanisms. Overall, individuals' knowledge derives from experiences they have in their place of living, as well as from habits and traditions perpetuated by the culture of each group. Yet, this knowledge should not be unique to a single group, because the greater the knowledge, the stronger the likelihood of finding answers to social issues affecting the world population.

The ecology of knowledge proposed by Santos (2010) brings along reflections about social, cultural, economic and environmental aspects, since they are part of society's knowledge, although dominated by a minority. One cannot exclude this knowledge or say which knowledge is the correct one. It is necessary thinking about the knowledge necessary nowadays and about how it should be used.

Students should be aware that natural resources must be used in a conscious and sustainable way. According to Fernández and Garcia (2001, p. 17), it is necessary *"having an evolved human being, whose attitude towards nature lies on coexistence rather than on exploitation"* in order to enable sustainability.



Knowledge exchanges in schools generate significant knowledge that is taken for life. According to Altieri (2012), agroecology enables man's wisdom and knowledge based on human interactions with nature.

Addressing knowledge about the environment under the agroecological perspective in educational spaces allows redefining knowledge and changing the social context. According to Leff (2008, p. 257), *"environmental education brings along a new pedagogy, which arises from the need of guiding education within the social context, as well as in the ecological and cultural reality individuals and actors of the educational process live in"*. Environmental education enables individuals to better understand that they are part of the environment and, consequently, that they must preserve it. Based on Almeida and Oliveira (2017), the principle guiding agroecology and its contents (science, technique and practice), lies on the valorization of the life, culture, knowledge and techniques of individuals living in the countryside, as well as their way of living in the agroecosystem. Thus, agroecological contents and practices are of paramount importance in rural schools.

Knowledge exchanges between students and teachers generate an environment where teachers are not the owners of knowledge. According to Freire (1987, p. 9), *"teachers are not only educators; they are also the ones who, while teaching, also learn from the dialogue with their students"*. Thus, dialogue allows all parts to expose their knowledge and to build a new knowledge together. Environmental education, with emphasis on agroecological practices, should be disseminated in individuals' identity development process, since the very beginning of their school life. Students start developing their identity through social interactions; thus, encouraging new experiences may result in meaningful learning.

Enabling practical activities about agroecology may result in socio-cultural (trans) formations, since school experiences are overall significant to knowledge acquisition. Based on the exchange of knowledge and experiences, new environmental knowledge can emerge and enable a human, social and citizenship education based on the dialogue between students and teachers.

Building a vegetable garden in the school by giving attention to the handling of soil and cultivars, as well as to their development process, helps individuals better understanding different knowledge types spread throughout different communities. Students should plan and plant a garden with their teachers.

## 5. Final Considerations

Initial investigations have shown that students overall associate agroecology with plants and animals. Holding debates in the educational environment encourages students to share their experiences and enables teachers to develop didactic-pedagogical strategies to be adopted in the classroom. In addition, topics associated with the environment, such as agroecology and its sociological, philosophical and anthropological background; enable reflecting about the need of forming critical individuals to act in the social environment and to have environmental responsibility.

The sixth-grade students investigated in the current study were very participative in answering the questions, a fact that highlighted the relevance of enabling dialogue in the educational environment in order to enhance the knowledge exchanging process. All students can share their experiences and it is up to the teacher to boost debates in the classroom. The initial dialogue in the present study was used as basis to plan and implement action-research activities.

## 6. Acknowledgement

The current study was partly financed by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brazil (CAPES) – Finance Code 001. The authors are grateful for the scholarship granted by Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul (FAPERGS).

## 7. References

ALMEIDA, Rejane C. Medeiros de.; OLIVEIRA, Eduardo Bonfim de. Agroecologia nas escolas do campo no município de Goiás. In: Cadernos de Agroecologia. Anais do VI Congresso Latino-Americano, X Congresso Brasileiro, V Seminário do DF e Entorno. Brasília, DF, Brasil, 2017.

ALTIERI, Miguel. Agroecologia: bases científicas para uma agricultura sustentável. 3 ed. São Paulo - Rio de Janeiro: Expressão Popular – AS-PTA, 2012.

ALTIERI, Miguel. Agroecologia – a dinâmica produtiva da agricultura sustentável. Porto Alegre: Editora Universidade/UFRGS, 2000.

BARDIN, Laurence. Análise de conteúdo. Lisboa: Edições 70, 1977.

BAUMAN, Zygmunt. Modernidade Líquida. Rio de Janeiro: Editora Zahar, 2001.

CAPORAL, Francisco Roberto; COSTABEBER, José Antônio. Agroecologia e extensão rural: contribuições para a promoção do desenvolvimento rural sustentável. Brasília: MDA/SAF/DATER-IICA. 2004.

ELOY, Cristinne, Costa; VIEIRA, Danielle Machado; LUCENA, Camilla Marques de; ANDRADE, Maristela Oliveira de. Apropriação e proteção dos conhecimentos tradicionais no Brasil: a conservação da biodiversidade e os direitos das populações tradicionais. Gaia Scientiae, Edição Especial Populações Tradicionais, 2014.

FACHIN, Odília. Fundamentos de Metodologia. 4ª ed. São Paulo: Saraiva, 2003.

FERNÁNDEZ, Xavier Simón; GARCIA, Xavier Domingues; DOLORES. Desenvolvimento rural sustentável: uma perspectiva agroecológica. Porto Alegre: Revista Agroecologia e Desenvolvimento Rural Sustentável. v.2, n.2 abr./jun. 2001. (pág. 17-26).

FREIRE, Paulo. Pedagogia do oprimido. 17. Ed. Rio de Janeiro: Paz e Terra, 1987.

GIL, Antonio Carlos. Métodos e Técnicas de Pesquisa Social. 6ª ed. São Paulo: Editora Atlas, 2011.

GUIMARÃES, Mauro. Caminhos da educação ambiental: da forma à ação. São Paulo: Papirus, 2011.

LEFF, Enrique. Saber ambiental: Sustentabilidade, Racionalidade, Complexidade, Poder. Petrópolis, Rio de Janeiro: Vozes, 2008.

MARCONI, Marina de Andrade; LAKATOS, Eva Maria. Metodologia Científica. São Paulo: Editora Atlas, 2004.

MOREIRA, Marco Antônio. Organizadores prévios e Aprendizagem Significativa. Revista Chilena de Educación Científica, v. 7, n. 2, pp. 23-30, 2008.

RIBEIRO, Andrés Maurício. Meio Ambiente & Evolução Humana. São Paulo: Editora Senac São Paulo, 2013.

SANTOS, Boaventura de Souza. A gramática do tempo: para uma nova cultura política. 3ª ed. São Paulo: Cortez, 2010.

SEVERINO, Antônio Joaquim. Metodologia do Trabalho Científico. São Paulo: Cortez, 2007.

THIOLLENT, Michel. Metodologia da Pesquisa-ação. 2. ed. São Paulo: Cortez, 1986.

### **Copyright Disclaimer**

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>).