

Disasters in Brazil? Practices and approaches in education in risk and disaster reduction¹

Desastres no Brasil? Práticas e abordagens em educação em redução de riscos e desastres²

Patricia Mie Matsuo*
Rosana Louro Ferreira Silva*

ABSTRACT

Our society faces simultaneous disasters. In the midst of the pandemic, floods, landslides, and forest fires are a reality for millions of Brazilians. On the basis of references of critical environmental education and risk society, the aim of this work was to analyze the profile of schools and the approaches in *Educação em Redução de Riscos e Desastres* (DRRE) [Disaster Risk Reduction Education] adopted in 127 practices registered in the Campaign #*AprenderParaPrevenir*. DRRE practices were developed mainly in public schools and in all stages of teaching. In order to better characterize these practices, we created a DRRE mandala that presents the didactic modalities and resources adopted in five perspectives of approaches, namely: Expository, Communicative, Experiential, Investigative, and Citizen engagement. In order to educate in societies of risks and disasters, we present some reflections: i) to denaturalize disasters and understand them as a social and cultural construction; ii) to build critical and resilient societies, capable of dealing with life's uncertainties; iii) to adopt a local perspective; iv) to recognize schools as knowledge producers. Learning communities in DRRE established among schools, civil defenses and universities provide

1 Translated by Janete Bridon. E-mail: deolhonotexto@gmail.com. Proofread by Louise Potter. E-mail: louise.potter@yahoo.co.uk.

2 Support from the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

* Universidade de São Paulo. Programa de Pós-Graduação Interunidades em Ensino de Ciências. São Paulo, São Paulo, Brazil. E-mail: pati.matsuo@gmail.com - <https://orcid.org/0000-0002-9121-0542> E-mail: rosanas@usp.br - <https://orcid.org/0000-0002-5787-2331>

learning for all; particularly in this recent and challenging theme in the school context, which has demanded from teachers the production of new pedagogical practices and collaborative efforts among education, generations, and institutions.

Keywords: Environmental education. Risk society. Socio-environmental disasters. Learning communities. Mandala.

RESUMO

Nossa sociedade enfrenta desastres simultâneos. Em meio à pandemia, inundações, deslizamentos de terra e incêndios florestais fazem parte da realidade de milhões de brasileiros. Partindo de referenciais de Educação Ambiental Crítica e Sociedade de Risco, o objetivo deste trabalho foi analisar o perfil das escolas e as abordagens de Educação em Redução de Riscos e Desastres (ERRD) adotadas em 127 práticas inscritas na Campanha #AprenderParaPrevenir. As práticas de ERRD foram desenvolvidas majoritariamente em escolas públicas e em todas as etapas de ensino. Para melhor caracterizar essas práticas, foi construída uma mandala de ERRD que apresenta as principais modalidades e recursos didáticos adotados em cinco perspectivas de abordagens, a saber: Expositiva, Comunicativa, Experiencial, Investigativa e Cidadã. No propósito de educarmos em sociedades de risco e desastres socioambientais, apresentamos algumas reflexões: i) desnaturalizar os desastres e compreendê-los como uma construção social e cultural; ii) formar sociedades críticas e resilientes, capazes de lidar com incertezas da vida; iii) adotar uma perspectiva local e; iv) reconhecer as escolas como produtoras de conhecimentos. As comunidades de aprendizagem em ERRD estabelecidas entre escolas, defesas civis e universidades proporcionam aprendizados para todas/todos, particularmente nesta temática recente e desafiadora no contexto escolar, e que tem demandado de professoras/professores a produção de novas práticas pedagógicas e esforços colaborativos entre os saberes, gerações e instituições.

Palavras-chave: Educação ambiental. Sociedade de risco. Desastres socioambientais. Comunidades de aprendizagem. Mandala.

Introduction

Close your eyes and imagine this scene: a virus spreads across the world and, simultaneously, populations in different regions face forest fires, floods, landslides, as well as outbreaks of other diseases such as measles, dengue and

yellow fever. This could be just another fictional movie script, but it has become a reality for many people.

Ulrich Beck is not witnessing the current context, but he has discussed in his latest book, “*The Metamorphosis of the World*”, that unthinkable events like these have been occurring under a pattern,

[...] what was previously excluded as entirely inconceivable is happening as a global event, usually observable in all living rooms around the world because it is broadcast by the mass media (BECK, 2018, p. 12, our translation).

Such events are no longer an exception and are more constant in our risk society, a concept coined by Beck in 1986 to describe a risk-producing society, based on the wide distribution of socially and culturally constructed side effects. In this way, he challenges us to face these evils generated by the “success” of modern systems and to live with risks, incorporating the “un/in” principles, such as uncertainty, instability, invisibility and integration (BECK, 2011; BECK, 2018).

The COVID-19 pandemic reflects the complex and unsustainable relationship between risk society and the natural environment. It brings to light structural problems and social inequalities in access to basic food, work, education and prevention. New insecurities and scenarios are being created and enhanced with the multiplication and overlapping of these risks and climate events, whose consequences are still unpredictable (LAVELL *et al.*, 2020).

Extreme weather events that trigger disasters such as droughts, floods and windstorms became more constant in Brazil from 1960 onwards (TOMINAGA; SANTORO; AMARAL, 2015), and forecasts indicate an increasing trend in the frequency and intensity of these disasters due to climate change (IPCC, 2014). In addition, more than 8.2 million Brazilians are exposed to floods, flash floods and landslides in all Brazilian regions (IBGE, 2018). This scenario makes us return to the condition that we are in the era of risk and disaster societies.

Among the multiple meanings for disaster risk, Wisner *et al.* (2003) define it as the combination of factors that determine the potential of people to be exposed to natural threats. This exposure depends on how “[...] social systems and their associated power relations impact on different social groups (through their class, gender, ethnicity, etc.)” (WISNER *et al.*, 2003, p. 7).

These aspects are in line with Douglas's (1992) cultural perspective on risks, in which he proposes a holistic approach that goes beyond the probabilistic view and includes a political, moral and sociocultural dimension.

Taking these perspectives into account, we will adopt the term "social and environmental disasters" throughout this work, as we understand disasters as a social construction, generated from a set of natural processes associated with social, political and economic issues (WISNER *et al.*, 2003; GIDDENS, 1999).

Having pointed out some theoretical references, the objectives of this paper were to analyze the school practices inscribed in a national mobilization process for *Educação em Redução de Riscos e Desastres* [Disaster Risk Reduction Education] (DRRE) Education in Risk and Disaster Reduction – the *#AprenderParaPrevenir* [Learn to Prevent] Campaign, and to bring reflections for an education in a society of social and environmental risks and disasters. In the first part of the work, we discuss aspects that converge from the perspective of Environmental Education with that of Education in Risk and Disaster Reduction. Then, we contextualize the investigated Campaign and analyze the profile of the schools and the didactic approaches adopted. Finally, we present the mandala as a proposal for a flexible representation of practices in risks and disasters.

Risk and disaster dialogues with Environmental Education

Education is an essential element for creating and strengthening a culture of risk and disaster prevention. In this sense, Elmore and Roth (2005) presented some necessary skills to live in a risk society. Among them, we highlight: i) solidarity and empathy; ii) making responsible choices in the complex world; iii) adapting to the constant changes in the world; iv) living with uncertainties and ambivalence (global/local, individual/collective); and v) participation in collective decision-making processes.

Disaster Risk Reduction Education (DRRE) is a process of building an understanding of the causes, nature and effects of risks, while contributing to the promotion of a series of skills and abilities that allow society to actively participate in disaster prevention (SELBY; KAGAWA, 2012).

The first educational activities on Risk and Disaster Reduction in the world are found in the Science and Geography disciplines, from contents unrelated to the local context, such as earthquakes, volcanoes and tsunamis (PETAL, 2008). This disciplinary approach was the main strategy adopted in the inclusion of Risk and Disaster Reduction in the school curricula of 30 countries. The mapping

carried out by Selby and Kagawa (2012) also identified integrations related to textbooks, pilot projects, events, skills development and symbiotics.

The symbiotic approach can be understood when two theoretical perspectives are similar to each other. In the case of Latin America, the DRRE finds similarities with Environmental Education, due to its history and strong performance in our region. Connections between the DRRE and Environmental Education are identified in the Treaty on Environmental Education for Sustainable Societies and Global Responsibility (FÓRUM GLOBAL DAS ONGS, 1992), in particular when dealing with global issues, promoting dialogue and cooperation between individuals and institutions. Complementarily, we identified other associations of the DRRE with the critical current of Environmental Education (Text Box 1).

TEXT BOX 1 – SIMILARITIES BETWEEN DRRE AND CRITICAL ENVIRONMENTAL EDUCATION PERSPECTIVES

- ✓ Roots based on social justice, democratic and emancipatory values.
- ✓ Deconstruction of the socio-environmental reality in search of a transformation of the causes of problems.
- ✓ Formation of social groups capable of identifying, problematizing and acting in search of solutions to social and environmental issues.
- ✓ Adoption of participatory and reflective processes.
- ✓ Formation of sustainable and resilient societies.
- ✓ Strengthening the sense of citizen engagement responsibility and local belonging, based on political, ethical and ideological assumptions.

SOURCE: Carvalho (2004); Loureiro and Cunha (2004); Sauvè (2010) and Silva and Campina (2011).

Another synergistic aspect is that socio-environmental disasters demand an integrated approach in the knowledge construction process, through the valorization of different forms of knowledge and the disruption of the structures that generated the hierarchy and compartmentalization of knowledge (JACOBI, 2014). In this line, the perspective of complexity, one of the bases of critical Environmental Education, stands as a new path (LOUREIRO, 2004; GUIMARÃES; VASCONCELOS, 2006).

The idea of establishing new forms of knowledge construction, integrating different views of the world and knowledge, is fundamental for the transformation of these risk and disaster scenarios. This requires the development of alternative, flexible, dynamic, emancipatory educational processes that promote dialogue, question structural causes, as well as the unequal distribution of risks and impacts arising from disasters (BONIL; JUNYENT; PUJOL, 2010; JACOBI *et al.*, 2011).

Large complex themes, such as climate change and Risk and Disaster Reduction, when connected with an Environmental Education approach,

promote reflections and questions for the transformation of the current political and economic system, with discussions of causes and consequences and with the necessary transformations to influence public policies that contribute to the construction of sustainable societies (JACOBI *et al.*, 2011; TAMAIO, 2013).

DRRE in the Brazilian school context

When looking at the context of our country, we come across almost 2,500 schools located in areas at risk of hydrological and/or geological disasters, most of them public (MARCHEZINI; MUÑOZ; TRAJBER, 2018). This preliminary diagnosis highlights the urgency of public policies aimed at strengthening resilient school communities.

The first formalization of the DRRE in the Brazilian curriculum took place in 2012 with the National Policy for Civil Defense and Protection, by establishing the development of a culture of disaster prevention. It established support for teachers, the preparation of teaching material and the inclusion in the Lei de Diretrizes e Bases da Educação Nacional [National Education Guidelines and Framework Law] (known in Brazil by the acronym LDB) the paragraph: “[...] the elementary and secondary education curricula must include the principles of civil defense and protection and environmental education integrated with mandatory content” (BRASIL, 2012, our translation).

However, in 2017 there was a setback with the removal of this paragraph, so that the Risk and Disaster Reduction theme is currently optional in state and municipal education systems (BRASIL, 2017). If we analyze the Base Nacional Comum Curricular [Common National Curriculum Base] (known in Brazil by the acronym BNCC), we have minimal references to learning objectives related to risks and disasters, as in the 8th Grade Science and Geography curriculum: “[...] discussing initiatives that collaborate to reestablish the environmental balance based on identification of regional and global climate changes caused by human action” (BRASIL, 2018, p. 349, our translation); and “[...] analyzing socio-spatial segregation in urban environments in Latin America, with special attention to the study of slums, flooded areas and risk zones” (BRASIL, 2018, p. 391, our translation).

Carniatto *et al.* (2017) elaborated 16 proposals for the construction of public policies in Environmental Education, climate change and Risk and Disaster Reduction, such as the creation of a National System of Environmental Education in Climate Change and Disaster Prevention with Sustainability. However, little

progress has been made in the implementation of these proposals, mainly due to the dismantling movement of social and environmental public policies that we have been experiencing since 2019, among them we highlight the extinction of Environmental Education sectors that constituted the *Órgão Gestor da Política Nacional de Educação Ambiental* [Management Body of the National Environmental Education Policy] (known in Brazil by the acronym PNEA).

Despite the structural challenges in working the Risk and Disaster Reduction theme in Basic Education, several initiatives were implemented, mainly through the movement of technical-scientific institutions involved with Risk and Disaster Reduction within school spaces.

Taking into account the role of schools in redefining cultural policy, especially in relation to the construction of knowledge, classroom pedagogy and consideration of the voice of the student, it is essential to have the understanding of the teachers as transformative intellectuals (GIROUX, 1997). In a critical way, the author highlights:

[...] the need to defend schools as essential institutions for the maintenance and development of a critical democracy and also to defend teachers as transformative intellectuals who combine reflection and academic practices in order to educate students to be reflective and active citizens (GIROUX, 1997, p. 172, our translation).

Thus, this work starts from the premise of the school as a space for the production of DRRE knowledge from its local context and the experiences of risks and disasters in its school community.

#AprenderParaPrevenir Campaign

The *#AprenderParaPrevenir* Campaign is coordinated by the Cemaden Education Program of the National Center for the Monitoring and Alerting of Natural Disasters [*Centro Nacional de Monitoramento e Alertas de Desastres Naturais* – Cemaden], a research unit of the Ministry of Science, Technology and Innovation. It has been promoted annually since 2016 and it aims to develop interventions and establish spaces for dialogue in the construction of knowledge in DRRE.

Participation occurs through voluntary school membership, civil defenses, universities and non-formal education institutions, through the sharing of reports, photographs and/or videos of educational practices. Due to the innovative nature of this theme, in the first two editions two participation formats were established: a) actions carried out or in progress, and b) new projects.

The Campaign is publicized through Cemaden's media, as well as through channels of partner institutions, such as national collegiate bodies. In the case of schools, the National Council of Education Departments [*Conselho Nacional de Secretários da Educação – Consed*], the National Union of Municipal Education Directors [*União Nacional dos Dirigentes Municipais de Educação – Undime*] and the State Departments of Education.

All reports are shared in the Campaign's DRRE practices database³ and compete for two types of prizes: raffle and merit. All institutions participate in the draw for meteorological equipment and material kits on Risk and Disaster Reduction. In the merit award, a commission analyzes and indicates inspiring practices (PANZERI *et al.*, 2020).

Methodological paths

We established as a *corpus* of this exploratory and longitudinal research, the 206 reports inscribed in the first three editions of the *#AprenderParaPrevenir* Campaign, comprised between 2016 and 2018, and which are available in the Campaign's practices database.

Document analysis went through two processes. In the first, from reading all 206 entries, we selected those that met three criteria: i) initiatives carried out or in progress, ii) related to Risk and Disaster Reduction⁴, and iii) developed in the context of formal education. This first selection resulted in 127 reports. In the second, we identified the profile of the school communities involved and the types of didactic modalities and resources adopted in the registered practices.

Based on the theoretical framework of content analysis (BARDIN, 2016) and from similarities related to the purpose and development of these modalities and teaching resources, we established five dimensions of teaching approaches (Table 1).

³ Available at: <http://educacao.cemaden.gov.br/>

⁴ Although the main theme of the Campaign is disaster risk reduction, we have identified initiatives that have not established a connection with risks and/or disasters.

TABLE 1 – DIMENSIONS OF DIDACTIC APPROACHES

| Dimension | Description |
|--------------------|--|
| Expository | It has demonstrative and unilateral characteristics. |
| Communicative | It provides the development of written, visual, body and artistic communication. |
| Experiential | It provides direct contact with elements of space and experiences in practical situations. |
| Investigative | It promotes contact with research, questioning, monitoring and interpretation stages. |
| Citizen engagement | It promotes social participation, collectivity. |

SOURCE: Elaborated by the authors.

School communities

We directed our first glance to recognize in which spaces these educational initiatives are being built. Regarding the profile of school communities, most were public schools (99%), with 53% from the State network and 43% from the Municipal network. The public school, often unfairly accused of being stagnant and not bringing innovations like private schools, shows in our results its leading role in an emerging and essential theme today. The participation of the four schools in the federal network was linked to the performance in Risk and Disaster Reduction of the Federal Institutes of Education, Science and Technology and Federal Universities. Only one private school was identified.

The adoption of the DRRE theme was found in all stages of teaching. In 85 reports, that is, more than half of the initiatives were developed with young students, namely: 43 with Elementary School II (ESII) and 42 with High School (HS). This result may be related to the guidelines of the first Campaign, which sought the participation of these audiences, and also with the proposal of the Cemaden Education Program to involve HS students in research, monitoring and disaster warning actions.

However, the involvement of younger students was identified in 43 initiatives, 5 of them from Kindergarten (KG) and 38 from Elementary School I (ESI). This inclusion of DRRE activities in the spaces of this child audience allows concepts and practices to be integrated from the first grades of literacy,

thus contributing to the formation of a new critical generation, based on self-protection and resilience.

Although the first Campaign did not plan the involvement of this audience, this openness in welcoming this segment took into account the condition that children are the most vulnerable to disasters (UNISDR, 2006), but they are also the most receptive to learning about protection and prevention (PETAL, 2008).

Activities in the Youth and Adult Education modality were found in only one school. This number reveals a gap and, at the same time, an opportunity for studies and planning of public policies and DRRE actions aimed at Youth and Adult Education, considering that: i) it is an audience composed of 3.2 million students throughout Brazil (INEP, 2020), ii) students can have leadership roles in community self-protection decision processes (church, association, commerce), and iii) students in general are mothers/fathers, aunts/uncles, grandparents and are usually responsible for family decisions.

As for the territories of enactment, we identified the participation of schools from 80 municipalities in 18 states in all regions of Brazil, distributed as follows: North (Acre, Amazonas and Amapá), Northeast (Alagoas, Bahia, Ceará, Maranhão, Paraíba and Pernambuco), Midwest (Mato Grosso and Mato Grosso do Sul), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo), and South (Paraná, Rio Grande do Sul and Santa Catarina).

Despite this regional distribution, participation was concentrated in the Southeast region, and the state of São Paulo stood out with 50 schools. This result is likely to be the result of the joint organization of the first Campaign⁵ with the São Paulo State Department of Education and the São Paulo State Civil Defense and Protection Coordination, as well as other state strategies such as seminars, videoconferences, courses, projects, research and curriculum integration (CARDOSO; DAMIATI; MATSUO, 2020).

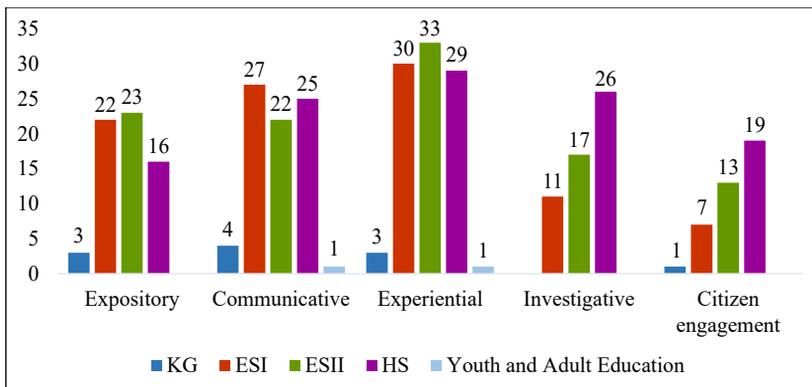
5 The launch took place during the videoconference “Education in Risk and Disaster Reduction” promoted by *Rede do Saber*, with the participation of 2,041 professionals from all 91 Regional Education Departments.

Didactic approaches adopted in DRRE

When looking at educational practices, we identified a diversity of 70 educational modalities and resources, such as expository classes, lectures, marches, simulations, experiments, science fairs, field trips, and creation of warning systems.

According to the characteristics present in the reports, photographs and/or videos, we classified each of these modalities and didactic resources in the five dimensions of didactic approaches established in Table 1. The most implemented approach was the *Experiential*, present in 96 school initiatives. It was adopted by all teaching stages, including KG and Youth and Adult Education, being the most addressed in ESI, ESII and HS (Figure 1).

FIGURE 1 – FREQUENCY OF TEACHING APPROACHES BY TEACHING STAGE



SOURCE: Elaborated by the authors.

In this approach, we identified modalities and didactic resources such as thematic workshops, models, experiments, creation of meteorological stations, rain gauges, planting, vegetable gardens, evacuation simulation, field trips, among others.

The field trip was identified in 38 reports, the second most developed activity in all didactic approaches. It presented a more illustrative perspective, with the recognition of the elements that make up the local landscape, the

presence of waste on the banks of rivers, conditions of riparian forests and identification of risk areas, as well as a more analytical perspective, aimed at collecting information, interviews with residents of risk areas and interpretation of situations encountered along the way.

These field trips play a fundamental role in the teaching of Risk and Disaster Reduction, as they enable students to analyze the landscape construction process from the observation of the space they live in and the relationships with physical, biological and social factors. Likewise, they allow the deconstruction of the socio-environmental reality in search of dialogues and transformations of the causes of problems (SAUVÈ, 2010) that contribute to the scenarios of social inequalities and urbanization in risk areas.

The production of rain gauges with PET bottles was developed by 27 schools. Several adaptations were created in order to facilitate reading, level the base of the PET bottle and prevent the proliferation of insects in the water. All these strategies were part of a process of testing, observation and comparison of the observed results and are closely linked to the research process developed in the Investigative approach, which will be discussed shortly.

The *Communicative* approach was the second most adopted by 79 initiatives and at all stages of teaching (Figure 1). It added 21 modalities and didactic resources that provided the development of written (text production), artistic (posters, leaflets) and body (songs, dances, dynamics, games) communication.

The most active participation of students was identified in the construction of digital communication tools, such as cell phone videos, a blog to alert residents of the floods in the neighborhood and a radio program for risk prevention at school. In addition to stimulating the development of reading, writing, artistic and technological skills, these productions can become instruments for education and communication of risks in their communities.

Young people demonstrate willingness to collaborate in disseminating information about disasters and other current issues such as climate change. Associating these interests and skills can bring this audience together in the development of new ways to learn and build knowledge in Risk and Disaster Reduction, an aspect that is even more present in this period of remote learning.

The third most adopted didactic approach was the *Expository* approach, identified in 66 schools, mainly from the ESI and ESII, which developed didactic modalities and resources such as expository classes, lectures, seminar presentations, showing films and videos (Figure 1).

Lectures were the most performed activities among all approaches and were given mostly (81%) by professionals from partner institutions, such as Civil Defense, Fire Department, Environmental Police and universities. This

relationship with social actors who have knowledge and experience in the Risk and Disaster Reduction area is essential for the creation of learning communities or learners, understood as horizontal spaces for dialogues for the exchange of ideas, discussions, cooperation, collaborative research, in short, experiences in which one can learn from another (ORELLANA, 2002; BRANDÃO, 2005).

However, the use of terms such as “transmitting” and “passing on” knowledge in some of the reports highlights the importance that daily school life is not only a place for reproduction, but also for the construction of social values that constitute the new realities and knowledge (FREIRE, 1996; GUIMARÃES *et al.*, 2009).

The *Investigative* approach was adopted by 55 schools from ESI, ESII and HS (Figure 1). In this category, we identified modalities and teaching resources such as monitoring, interviews, mapping of risk areas and analysis of collected data.

Monitoring was carried out by 20 schools and involved a variety of objects of study. From physical parameters linked to meteorology, such as the level of the river, to water quality and the consumption of water and food in schools.

Another activity identified in 16 reports was socio-environmental mapping or social/affective cartography. Risk mapping enriches DRRE’s learning processes and allow for the exchange of knowledge, experiences and emotions.

[...] students mapped the surrounding socio-environmental risk areas and also thought about disaster prevention strategies [...] after studying the potential and weaknesses of the location and analyzing the maps, satellite image and aerial image, we produced a participatory thematic map in which strategies (possible escape routes, easily accessible streets, possible shelter) were highlighted through drawing, symbols, colors and lines (CEMADEN EDUCAÇÃO, 2016) [*Harmonia* School, our translation].

This relationship of knowledge construction presents itself as a new form of science, recognizing technical, scientific and school knowledge. From a perspective that considers the school as an environment in which knowledge is produced by the subject immersed in his/her local culture and not just as a space that reproduces a culture (GUIMARÃES *et al.*, 2009).

And finally, the *Citizen engagement* approach was developed from KG to HS (Figure 1), but was the least adopted. We identified 39 reports with actions such as science fairs, campaigns, creation of collectives such as clubs, Community Center for Civil Defense and Protection [*Núcleo Comunitário de*

Proteção e Defesa Civil – NUPDEC] and Commission for Disaster Prevention and Life Protection [*Comissão de Prevenção de Desastres e Proteção da Vida* – Com-Vidação].

Some schools presented proposals for sharing data from the monitoring of artisanal rain gauges with the Civil Defense or research institutions belonging to the Civil Defense and Protection System, which maintain a historical record of rainfall and weather events.

[...] develop an alert system with a mechanism to record data from the rain gauge and relate them to the previous conditions in which disasters occurred, issuing an alert to populations in vulnerable areas (CEMADEN EDUCAÇÃO, 2017) [*Integração* School, our translation].

Aggregating this data in local monitoring systems could not only enrich the disaster risk management process of their school communities, but also recognize teachers and students as building agents of this knowledge.

New scenarios, new representations: the DRRE mandala

During the analysis process, we identified that several modalities and teaching resources could present characteristics of more than one approach, according to the description provided in the reports. As an illustration, we will use the case of the didactic resource of the mock-ups.

The mock-ups were used in different contexts by 12 institutions. When the mock-ups enabled the direct contact of students with elements of a particular landscape in a practical and interactive way, they were categorized in the Experiential approach (Figure 2).

Furthermore, when it was possible to identify the active participation of students in the process of building these representations of experienced spaces, such as the neighborhood or the watershed, from photos, images and cartographic base, the mock-ups were classified both in the Experiential and in the Communicative approach(es) (Figure 3).

FIGURE 2 – INTERACTIVE MOCK-UP OF LANDSLIDE, CLASSIFIED IN THE EXPERIENTIAL APPROACH



SOURCE: CEMADEN EDUCAÇÃO (2018) [*Circular School*].

FIGURE 3 – HYDROGRAPHIC BASIN MOCK-UP, CLASSIFIED IN EXPERIENTIAL AND COMMUNICATIVE APPROACHES

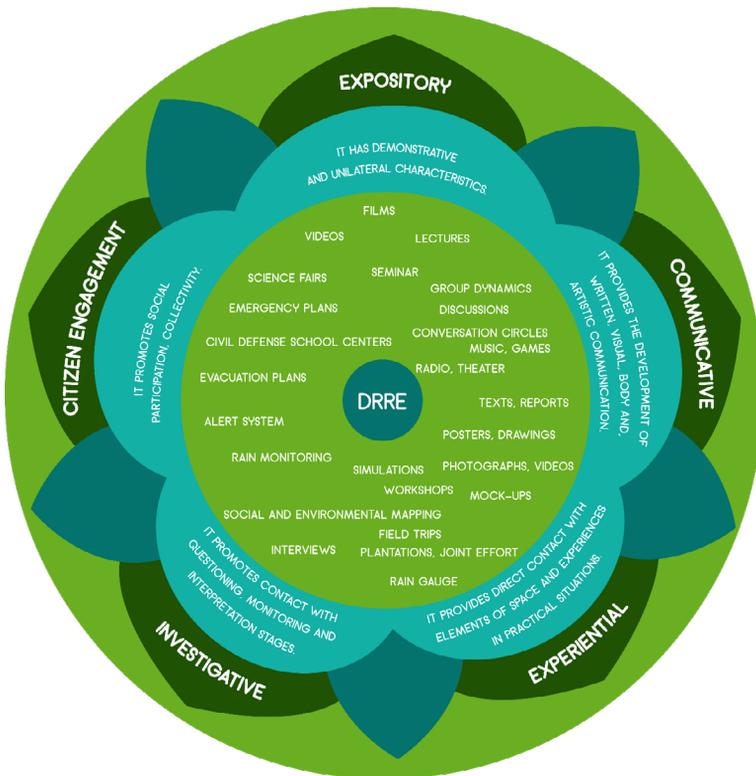


SOURCE: CEMADEN EDUCAÇÃO (2018) [*Movimento School*].

This multidimensional condition motivated us to look for an alternative representation for Table 1. A less traditional diagram, with greater flexibility and possible openings and that would allow classification in more than one approach.

With this intention and inspired by oriental cultures, we created a representation in the shape of a mandala. The term “mandala” originates from Sanskrit, an ancient language with Indian roots, and means circle, integration and harmony (DAHLKE, 1985). It is made up of four surrounding areas (Figure 4). The two external areas were divided into five symmetrical parts with the names of the categories of didactic approaches and their respective descriptions. The central region does not have divisions and the main modalities and teaching resources were arranged in the area close to the approach that presented the strongest relationship. Those that proved to have more than one approach stayed in the region between them. Finally, the acronym DRRE was placed in the center of the mandala.

FIGURE 4 – MANDALA OF DIDACTIC APPROACHES IN DRRE, DESCRIPTION AND EXAMPLES OF THE TEACHING MODALITIES AND RESOURCES FOUND IN THE #APRENDERPARAPREVENIR CAMPAIGN INITIATIVES



SOURCE: Elaborated by the authors and final art by Yuri Design.

Initially, the mandala allows us to visualize the character of integration and complementarity of the multiple approaches contained in the DRRE practices included in the #AprenderParaPrevenir Campaign. The mandala is undergoing adjustments and improvement, however, we have already identified new possible adaptations, from the inclusion of new elements, such as the scalar level of activities, to the possibility of analyzing longitudinally the adoption of the approaches of a given institution.

Final considerations

Although the number of school communities dealing with this reality is still small and especially concentrated in the Southeast, the development of DRRE practices at all stages of teaching and with a diversity of modalities and teaching resources show that there are possible and promising paths.

Regarding didactic approaches, the various dimensions identified in the DRRE mandala, from the most conventional to the most thought-provoking, show the possibilities of dealing with negative and complex themes – risks and disasters – in a creative and adaptive way.

Even with setbacks in DRRE public policies, teachers are building didactic activities and knowledge about DRRE. The Risk and Disaster Reduction theme may have awakened in these teachers, particularly from public schools, an interest in mediating more active activities, marking their role as protagonists in a process of social change and exercising their intellectuality as autonomous subjects and producers of significant knowledge and connected with the local reality.

However, in order to educate in socio-environmental risk and disaster societies, we point out some reflections that strengthen the DRRE in dialogue with the Environmental Education:

- Denaturalize disasters, understand that there is a complex network of generating factors that contribute to the maintenance of unsustainable scenarios of social inequalities;
- Going beyond behavioral concepts and procedures, promoting the formation of critical, resilient citizens who are able to live with uncertainties;
- Dealing with disasters from a local perspective, based on the reality experienced and with a more direct participation of students in their living spaces;

- Understand school communities as producers of knowledge experienced in Risk and Disaster Reduction and integrate them into participatory management processes in these territories.

The DRRE theme in the school context is recent and challenging, which requires collaborative efforts between different knowledge, institutions and generations. DRRE learning communities created between schools, Civil Defenses and universities can provide meaningful dialogues, exchanges and learning for all audiences. Firstly, the Civil Defenses, based on their practical experiences, share their technical and empirical knowledge about prevention, mitigation and responses to frequent disasters in the municipality. Secondly, universities add scientific knowledge and allow basic education students to have contact with stages of scientific research. And, finally, schools bring affective reports experienced in disasters, in addition to knowledge and methodologies on DRRE produced in these educational spaces.

Our work presents a pioneering overview of DRRE practices developed in formal education at a national level. Although we recognize some limitations, since we only consider those practices registered in the Campaign, and there are certainly initiatives that have not been registered, the research demonstrates the power of our schools, systematizing data and analytical structures that can expand educational possibilities.

The lack of research on DRRE in the field of Environmental Education in Brazil can also be pointed out as a limitation. In this sense, we indicate some inspiring questions for future investigations: How do school communities perceive, coexist and protect themselves from the risks and disasters present in their spaces of coexistence? What elements of critical Environmental Education are present in school projects? What forms of citizenship and social participation are being developed?

The scenes from fiction movies are now knocking on the doors of our homes, schools and communities. But together we can rewrite the script as a more adaptive and resilient society, transforming these crisis scenarios into opportunities to recreate knowledge construction processes based on CO-laboration, CO-participation, CO-responsibility, CO-production and CO-acting.

Acknowledgments

We thank the teachers who shared their practices in the Campaign, the Cemaden Education Program, Rafael Damasceno Pereira and Bruna Yuri.

REFERENCES

- BARDIN, Laurence. *Análise de conteúdo*. São Paulo: Edições 70, 2016.
- BECK, Ulrich. *Sociedade de Risco: rumo a uma outra modernidade*. 2. ed. São Paulo: Ed. 34, 2011.
- BECK, Ulrich. *Metamorfose do mundo: novos conceitos para uma nova modernidade*. Rio de Janeiro: Zahar, 2018.
- BONIL, Josep Gargallo; JUNYENT, Mercè; PUJOL, Rosa María. Educación para la sostenibilidad desde la perspectiva de la complejidad. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias*, Cádiz, v. 7, n. extra, p. 198-215, 2010. Available at: <https://revistas.uca.es/index.php/eureka/article/view/2644>. Accessed on: Oct. 14, 2020.
- BRANDÃO, Carlos Rodrigues. Comunidades Aprendentes. In: FERRARO JÚNIOR, Luiz Antônio (org.). *Encontros e Caminhos: formação de educadores/as ambientais e coletivos educadores*. Brasília: MMA/DEA, 2005. p. 83-92.
- BRASIL. Presidência da República. *Lei nº 12.608, de 10 de abril de 2012*. Institui a Política Nacional de Proteção e Defesa Civil – PNPDEC [...]; e dá outras providências. Brasília, DF: Presidência da República, 2012. Available at: http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/112608.htm. Accessed on: June 5, 2021.
- BRASIL. Presidência da República. *Lei nº 13.415, de 16 de fevereiro de 2017*. Altera as Leis nº 9.394, de 20 de dezembro de 1996, que estabelece as diretrizes e bases da educação nacional, e 11.494, de 20 de junho 2007, [...]; e institui a Política de Fomento à Implementação de Escolas de Ensino Médio em Tempo Integral. Brasília, DF: Presidência da República, 2017. Available at: http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2017/lei/113415.htm. Accessed on: June 5, 2021.
- BRASIL. Presidência da República. Ministério da Educação. *Base Nacional Comum Curricular*. São Paulo: Fundação Carlos Alberto Vanzolini, 2018.
- CARDOSO, Andréia Cristina Barroso; DAMIATI, Sergio Luiz; MATSUO, Patricia Míe. A educação em redução de riscos e desastres nas escolas da Rede Estadual de Ensino do Estado de São Paulo. In: CONGRESSO INTERNACIONAL DE RISCOS, 5., 2020, Coimbra. *Resumos [...]* Coimbra: Associação Portuguesa de Riscos, Prevenção e Segurança, 2020. Tema: Contributos da Ciência para a redução do risco. Agir hoje para proteger o amanhã. p. 60. Available at: https://www.riscos.pt/wp-content/uploads/2018/Outras_Pub/livros_resumos/eBook_Resumos_VCIR_v2.pdf. Accessed on: Oct. 15, 2020.
- CARNIATTO, Irene *et al.* Propostas de Políticas Públicas em Educação Ambiental, Mudanças Climáticas e Redução de Riscos de Desastres no Brasil. In: GUERRA, Antonio Fernando Silveira; FIGUEIREDO, Maria Lúcia (org.). *Diálogos de Saberes e Fazeres: Uma releitura dos 25 anos da trajetória da Educação Ambiental brasileira*. São José: ICEP, 2017. p. 253-277.

CARVALHO, Isabel Cristina de Moura. Educação ambiental crítica: nomes e endereçamentos da educação In: LAYRARGUES, Philippe Pomier (coord.). *Identidades da educação ambiental brasileira*. Brasília: Ministério do Meio Ambiente, 2004. p. 13-24.

CEMADEN EDUCAÇÃO. *Campanha #AprenderParaPrevenir 2016*. São José dos Campos, 2016. Available at: <http://educacao.cemaden.gov.br/aprenderparaprevenir2016>. Accessed on: Oct. 14, 2020.

CEMADEN EDUCAÇÃO. *Campanha #AprenderParaPrevenir 2017*. São José dos Campos, 2017. Available at: <http://educacao.cemaden.gov.br/aprenderparaprevenir2017>. Accessed on: Oct. 14, 2020.

CEMADEN EDUCAÇÃO. *Campanha #AprenderParaPrevenir 2018*. São José dos Campos, 2018. Available at: <http://educacao.cemaden.gov.br/aprenderparaprevenir2018>. Accessed on: Oct. 14, 2020.

DAHLKE, Rüdiger. *Mandalas: formas que representam a harmonia do cosmos e a energia divina*. São Paulo: Pensamento, 1985.

DOUGLAS, Mary. *Risk and blame: Essays in cultural theory*. London: Routledge, 1992.

ELMOSE, Steffen; ROTH, Wolff-Michael. Allgemeinbildung: readiness for living in risk society. *Journal of Curriculum Studies*, Londres, v. 37, n. 1, p. 11-34, 2005. Available at: <https://www.tandfonline.com/doi/abs/10.1080/0022027041000229413>. Accessed on: Oct. 12, 2020.

FÓRUM GLOBAL DAS ONGS. *Tratado de Educação Ambiental para Sociedades Sustentáveis e Responsabilidade Global*. Conferência das Nações Unidas para o Meio Ambiente e o Desenvolvimento. Rio de Janeiro, 1992. Available at: www.rebea.org.br/index.php/a-rede/tratado-de-educacao-ambiental. Accessed on: Nov. 20, 2020.

FREIRE, Paulo. *Pedagogia da autonomia: saberes necessários à prática educativa*. 18 ed. São Paulo: Paz e Terra, 1996.

GIROUX, Henry A. *Os professores como intelectuais*. Porto Alegre: Artes médicas, 1997.

GIDDENS, Anthony. Risk and responsibility. *The Modern Law Review*, [S. l.], v. 62, n. 1, p. 1-10, 1999. Available at: <https://www.jstor.org/stable/1097071>. Accessed on: Jan. 21, 2021.

GUIMARÃES, Mauro *et al.* Educadores Ambientais nas escolas: as redes como estratégia. *Cad. Cedes*, Campinas, v. 29, n. 77, p. 49-62, 2009. Available at: <https://www.scielo.br/j/ccedes/a/WB8qznYGTNS6QDhzcmmwWKHk/?lang=pt>. Accessed on: Oct. 14, 2020.

GUIMARÃES, Mauro; VASCONCELLOS, Maria das Mercês N. Relações entre educação ambiental e educação em ciências na complementaridade dos espaços formais e não formais de educação. *Educar em Revista*, Curitiba, v. 22, n. 27, p. 147-162, 2006. Available at: <https://www.scielo.br/j/er/a/p8y9Hr36xKxzYYLhGn4rG3q/abstract/?lang=pt>. Accessed on: Oct. 15, 2020.

IBGE. *População em áreas de risco no Brasil*. Rio de Janeiro: IBGE, 2018. Available at: https://agenciadenoticias.ibge.gov.br/media/com_mediaibge/arquivos/6d4743b1a7387a2f8ede699273970d77.pdf. Accessed on: Oct. 10, 2020.

INEP (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira). *Censo da Educação Básica 2019*: notas estatísticas. Brasília: INEP, 2020.

IPCC (Intergovernmental Panel on Climate Change). Core Writing Team; PACHAURI, Rajendra K.; MEYER, Leo (ed.). *Climate Change 2014*: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland: IPCC, 2014.

JACOBI, Paulo Roberto. Mudanças climáticas e ensino superior: a combinação entre pesquisa e educação. *Educar em Revista*, Curitiba, v. 30, p. 57-72, 2014. (Número Especial 3). Available at: <https://www.scielo.br/j/er/a/5JtnTPB8mgdCWmq7F89wLfc/abstract/?lang=pt>. Accessed on: Oct. 10, 2020.

JACOBI, Paulo Roberto *et al.* Mudanças climáticas globais: a resposta da educação. *Revista Brasileira de Educação*, Rio de Janeiro, v. 16, n. 46, p. 135-268, 2011. Available at: <https://www.scielo.br/j/rbedu/a/NpT7tTmr66dmNprkstjvspG/?format=pdf&lang=pt>. Accessed on: Nov. 5, 2020.

LAVELL, Allan *et al.* The Social Construction of the COVID-19 pandemic: disaster, risk accumulation and public policy. *Red de estudios sociales en Prevención de desastres en América Latina (LA RED)*, Publicaciones. Ciudad de Panamá, 2020. Available at: <https://www.desenredando.org/covid19/Social-construction-of-the-COVID19-pandemic-disaster-risk-accumulation-public-policy-RNI-LA-RED-22-04-2020.pdf>. Accessed on: Oct. 25, 2020.

LOUREIRO, Carlos Frederico Bernardo; CUNHA, Cláudia Conceição. Educação ambiental e gestão participativa na explicitação e resolução de conflitos. *Gestão em Ação*, Salvador, v. 7, n. 1, p. 37-50, jan./abr. 2004. Available at: <https://www.scielo.br/j/asoc/a/xT99ttVXqTpmS5Y3XcZvYfMv/?format=pdf&lang=pt>. Accessed on: Oct. 6, 2020.

MARCHEZINI, Victor; MUÑOZ, Viviana Aguilar; TRAJBER, Rachel. Vulnerabilidade Escolar frente a Desastres no Brasil. *Territorium*, Vilarinho, v. 25, n. II, p. 161-177, 2018. Available at: https://impactum-journals.uc.pt/territorium/article/view/1647-7723_25-2_13. Accessed on: Nov. 13, 2020.

ORELLANA, Isabel. Buscando enfrentar los desafíos educativos contemporáneos: la estrategia pedagógica de la comunidad de aprendizaje en educación ambiental. In: SAUVÉ, Lucie; ORELLANA, Isabel; SATO, Michèle (ed.). *Sujets choisis en éducation relative à l'environnement*. D'une Amérique à autre. Textos escogidos en educación. Montréal: ERE-UQAM, 2002. p. 221-223.

PANZERI, Carla Gracioto *et al.* Campanha #AprenderParaPrevenir: inspirações para reduzir riscos de desastres. In: MAGNONI JÚNIOR, Lourenço *et al.* (org.). *Redução do risco de desastres e a resiliência no meio rural e urbano*. 2. ed. São Paulo: Centro Paula Souza, 2020. p. 10-26.

PETAL, Marla. *Disaster prevention for schools: guidance for education sector decision-makers*. Switzerland: UNISDR - Thematic Platform for Knowledge and Education, 2008.

SAUVÉ, Lucie. Educación científica y educación ambiental: un cruce fecundo. *Enseñanza de las Ciencias*, Bellatera, v. 28, n. 1, p. 05-18, 2010. Available at: <https://raco.cat/index.php/Ensenanza/article/view/189092>. Accessed on: Oct. 9, 2020.

SELBY, David; KAGAWA, Fumiyo. *Disaster Risk Reduction in School Curricula: Case Studies from Thirty Countries*. Geneva: UNESCO; UNICEF, 2012.

SILVA, Rosana Louro Ferreira; CAMPINA, Nilva Nunes. Concepções de educação ambiental na mídia e em práticas escolares: contribuições de uma tipologia. *Pesquisa em Educação Ambiental*, Rio Claro, SP, v. 6, n. 1, p. 29-46, 2011. Available at: <https://www.revistas.usp.br/pea/article/view/55932>. Accessed on: Oct. 9, 2020.

TAMAI, Irineu. *Educação Ambiental & Mudanças Climáticas: diálogo necessário num mundo em transição. Parâmetros e diretrizes para a Política Nacional de Educação Ambiental no contexto das Mudanças Climáticas causadas pela ação humana*. Brasília: MMA, 2013. (Série EducAtiva).

TOMINAGA, Lídia Keiko; SANTORO, Jair; AMARAL, Rosângela (org.). *Desastres naturais: conhecer para prevenir*. 3. ed. São Paulo: Instituto Geológico, 2015.

UNITED NATIONS OFFICE FOR DISASTER RISK REDUCTION - UNISDR. *2006-7 Disaster Reduction Begins in Schools*. Geneva, 2006. Available at: www.unisdr.org/knowledge-education. Accessed on: Nov. 14, 2018.

WISNER, Ben *et al.* *At Risk: natural hazards, people's vulnerability and disasters*. 2. ed. London: Routledge, 2003.

Text received on 12/04/2020.

Text approved on 06/07/2021.