

Chapter 16

Improving Disaster Risk Reduction and Resilience Cultures Through Environmental Education: A Case Study in Rio de Janeiro State, Brazil

Marcos Barreto de Mendonca, Teresa da-Silva-Rosa, Tulio Gava Monteiro, and Ricardo de Souza Matos

Abstract Landslide disasters are increasing in frequency, magnitude and degraded territory as a result of disorganised land occupation and extreme rainfall events. Consequences such as deaths, injuries, homelessness and social harm are much worse when they occur in vulnerable communities. Socio-environmental disasters occurring in Brazil have highlighted environmental education as key to disaster risk reduction strategy. Based on the idea that the urbanisation process in Brazil contributes to socio-environmental vulnerability and environmental injustice, this chapter discusses the contribution of environmental education projects as an example of strategy for landslide disaster risk reduction since they can motivate inhabitants to participate in disaster risk reduction activities and, hence, to practice participatory risk management, empowering citizenship and strengthening community resilience. The studied project consisted in a non-formal education experience and took place in a landslide risk community in Niterói, a city situated in the metropolitan area of Rio de Janeiro, Brazil. The project involved geotechnicians, researchers of different backgrounds, young residents and members of a local non-government organisation and aimed to analyse this experience as an effort to face climate impacts.

Keywords Disaster risk reduction • Resilience • Vulnerability • Environmental injustice • Environmental education

M.B. de Mendonca (✉)
Civil Construction Department, Polytechnic School, Federal University of Rio de Janeiro (UFRJ), Rio de Janeiro, Brazil
e-mail: mbm@poli.ufrj.br

T. da-Silva-Rosa • T.G. Monteiro • R.d.S. Matos
Post-Graduate Programme in Political Sociology (PPGSP), Vila Velha University (UVV-ES), Espírito Santo, Brazil
e-mail: tsrosaprof@yahoo.com.br; tuliogava@hotmail.com; ricardomsouza83@gmail.com

Introduction

In Brazil, landslide and flood disasters due to the association of environmental characteristics to human agglomeration are nothing new (Brandão 1992). Nevertheless, according to IPCC (2012), the increase in magnitude and frequency of mass movements is greatly related to consequences of climate change, namely extreme rainfall events. In recent decades the frequency of disasters has risen, and the 2011 event in the Mountain Region of Rio de Janeiro State is noteworthy (World Bank 2012; Avelar et al. 2013)—considered a mega-disaster—and the floods and landslides of December 2013 in the State of Espírito Santo (A Gazeta 2013). Located on Brazil’s coastal belt (Fig. 16.1), these areas are highly influenced by different geographical, geomorphological and geological factors and human actions resulting from uncontrolled urban sprawl (Mendonca and Guerra 1997). The aforementioned factors are important conditioners of the environment’s degree of susceptibility to different events. Therefore, in light of expectations that improper land occupation will continue, along with the State’s difficulty in reducing degrees of risk in the short or medium term, the directly affected population needs be mobilised and empowered to participate in mitigation of the problem.

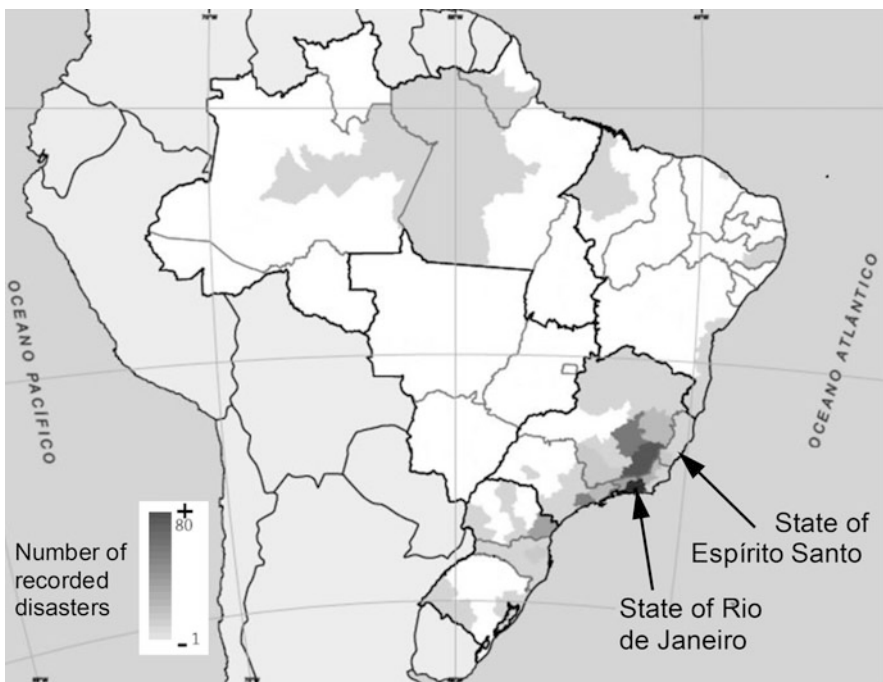


Fig. 16.1 Location of states of Rio de Janeiro e Espírito Santo on the mass-movement disaster map in Brazil during the period 1991–2010 (CEPED/UFSC 2012, modified)

In order to achieve this aim, education in disaster risk reduction (DRR) has a fundamental role in light of its capacity to bring about a shift in values. Environmental education (EE) can be seen as a strategy for mobilising and empowering society with the aim of encouraging a citizenship conscious of its role in respect of ecological sustainability. Taken as the *new* outlook on the real situation, such education emerges as a strategy to aid DRR. In this sense Anderson and Holcombe (2013) state that it is cost-effective to educate communities about the risks they face, providing them with access to knowledge and resources in order to develop community-based preparedness and disaster risk mitigation programs. Nevertheless, it is necessary to discuss the content, methods and specific objectives that DRR education actions should adopt, and specific studies around the issue are required.

This chapter describes and analyses a non-formal EE project run in an area at landslides risk, with a population rendered vulnerable by historically established socio-environmental conditions—the Maceió Community in the city of Niterói, Rio de Janeiro Metropolitan Region, Brazil. It is therefore hoped that this chapter will lead the reader to reflect upon the urgency of actions involving populations living in situations of socio-environmental risk and the possibility of their being vectors of significant shifts towards DRR in the face of those meteorological events that continue to afflict them.

Modernity, Cities and Environmental Injustice: General Backdrop to DRR

Socio-environmental vulnerabilities among communities are, historically, born of a process of development and urbanisation characterised by intervention and domination of a biogeophysical base. Transposing the idea of Santos (2002) on neglect by the positivist tradition, one might say that the “modern city” ignores the biogeophysical structure on which it is built through a development process which inherently leads to socio-environmental inequalities. The case of Brazilian metropolitan regions illustrates the aforementioned assumptions when one associates negligence of the physical environment and local human characteristics with urbanisation to international city standards (Santos 1985), from the 1960s on. Through development and urbanisation, much-coveted Modernity brings “progress” to such land areas, which may be viewed as a vector of annihilation of such a location (Morin and Kern 2010). At times this may happen quickly and possibly also slowly, but always leads to the destruction of local traditions and wisdoms as if there had never been any *Other*, a pre-existing *Subject*.

Transferring this idea to the case of processes in slowly developing areas, urbanisation in Brazil gives rise to unequal land occupation, with no market value

achieved for the socio-environmentally vulnerable population. During such a process, land occupation becomes *unsustainable* and, as it is brought about by unjust development, social exclusion of portions of the population in large metropolises is superimposed onto naturally sensitive areas, such as permanent preservation areas, mangroves, sandbanks, river banks and hillsides (Brasil 1988).

Considering such a situation, the modern city is seen as a hegemonic alternative, “disparaging other possible alternatives” pre-existing in such areas. The modern city fragments the local reality, affecting spaces and exposing its populations to risk, reflecting the western way of thinking and leading to an interpretation of the world which ignores the biogeophysical bases of a given location. What can be observed on the land is the materialisation of a hegemonic, dominating rationale, which breaks with other pre-existing rationales—the case of environmental rationale (Leff 2006). The modern city is imposed upon this “vacuum”, revealing an “indolence of reason” (Santos 2002). Modern *planning* is viewed as being guided by a specific project which becomes social in nature and brings, within its scope, progress—a project aimed at imposing solutions upon a certain “disorganisation”, based on the concept of homogenised spaces rather than a natural tendency for “self-diversification”, a post-modernist characteristic (Harvey 2004).

Destabilising homogeneity resulting from the modern city project brought by development initiatives becomes evident through socio-spatial segregation, largely involuntary, on the part of less favoured social groups (Da-Silva-Rosa and Mattos 2012). In this way, the modern city intervenes in the biogeophysical space to enable expansion of the city itself—straightening rivers, reclaiming hills or mangroves and occupying hillsides. On one hand, this provides for value addition to new spaces and, on the other, leads to a devaluing of spaces in which the market has no interest. Such spaces become the targets of an array of socially vulnerable individuals, placed involuntarily in situations of environmental vulnerability owing to the difficulties faced by, or inability of government in responding to public demands, giving rise to destabilisation by disorganised occupation.

The differing levels of vulnerability among a social group to possible impacts caused by a geohydrological event reveal the environmental inequality between different groups. Some are able to prepare and react more readily than others, such as those with their assets insured. What generally happens is that the more afflicted population comprises that *army of highly socio-environmentally vulnerable individuals*, occupying hillsides, riverbanks or mangroves. When they become the target of more socio-economically vulnerable groups, such areas provide a new facet for the injustice afflicting them. Environmental issues and risks are thus associated to social problems, thereby constituting environmental injustice. Torres and Marques (2001) attest to the assumption of environmental risk overlapping with poor socio-economic conditions in their study on the city of São Paulo.

It is specifics such as these that demonstrate the uniqueness of environmental injustice in Brazil, a movement which emerged in the United States in the 1980s as an aspect of the “wave” of environmentalisation of social struggles in line with a higher proportion of environmental damage in areas occupied by black people (Acsehrad 2010). Only at the end of the 1990s did the movement spread to Brazil

following creation of the Brazilian Environmental Justice Network where, in the twenty-first century, the concept of environmental injustice is overlaid by an outlook focused more on traditional communities and on more socio-environmentally vulnerable social groups. As such, environmental injustice, according to Acsehrad et al. (2009), is the unequal manner in which environmental harm caused by the productive system is distributed, concentrating such aspect on more socially vulnerable populations. Conversely, environmental justice has generally taken the form of minimising environmental inequality, primarily in respect of appropriation and use of resources or exposure to risk.

It is in this context of the urbanisation process and environmental injustice that reducing the risk of disasters, as provided for in the objectives of the Brazilian National Prevention and Civil Defence Policy (Brasil 2012), involves understanding of the complexity inherent in the process of historical vulnerability construction. Priority must be given to prevention actions involving populations of higher socio-environmental vulnerability, and such prevention encompasses all the complexities in the relevant context—identifying education as a DRR strategy to achieve a sustainable, resilient and fair society.

Environmental Education for Disaster Reduction

In the light of such a context, development of a participation culture becomes a necessity, with priority given to cross-contamination of knowledge between academia and local communities with a view to raising awareness and developing proactive attitudes among populations that historically live in a situation of high socio-environmental vulnerability. EE emerges as a strategy to contribute to encouraging active participation of such populations in DRR-based decision-making processes, as such education contributes to

[...] assist us in understanding the environment as a set of social practices permeated by contradictions, problems and conflicts which weave the intricate network of relations between human life habits and their particular ways of interacting with the physical-natural elements around them, of giving them meaning and of managing them. (Carvalho 2008)

In the DRR context, therefore, understanding of the interactions between communities and the natural elements is crucial. It is believed that from this perspective, communities will be enabled to participate in the process of formulating DRR strategies, as they will come to have an understanding of them. A proposal of the Stockholm Conference Final Declaration, structured on the Tbilisi Conference (UNESCO 1977), EE emerges as an innovative, challenging aspect, seeking to encourage citizens to assume their responsibilities, rights and duties and to understand their close relationship with the environment in which they live. To this end, the Declaration seeks to define a new world and human vision, this latter to be understood as part of nature, which will make for an understanding of human activities within the natural system (Da-Silva-Rosa 2009). Such vision raises

questions on analysis of the real situation through the interdisciplinary aspect of its initial proposal (*id.*). Within this reflection, Jonas (1995) contributes with his concept of responsibility as the primary moral element before materialisation of human actions in a technological context (Da-Silva-Rosa 2009).

In Brazil, the National Environmental Education Policy (Brasil 1999) establishes the public authority's obligation to promote such education at all levels of schooling, along with public awareness-raising for environmental conservation as a means of encouraging participation, a fundamental principle of the Tbilisi Declaration (UNESCO 1977). According to Loureiro (2012), "Transformational Environmental Education emphasises education as a constant, everyday and collective process by which we act and reflect, transforming the reality of life". So that EE is not enough merely to make its content available to the citizen, but rather that it should stimulate reflection on the values and skills required to construct a human-environment relationship on new building blocks—in this context, meaning DRR education in risk areas.

On this basis, the National Prevention and Civil Defence Policy (Brasil 2012) carry the paradigm of prevention, putting the idea of resilience firmly at the forefront of the Brazilian DRR agenda. As a risk management component proposed by the Hyogo Framework for Action (UNISDR 2007) and reaffirmed by the Sendai Framework (UNISDR 2015), this paradigm elevates DRR to a new level, requiring that actions be defined, as Jonas (1995) suggests, *before* the event occurs. Noteworthy among the five priorities, DRR actions proposed by the Hyogo Framework for Action (HFA) are awareness of risks in order to achieve readiness for action and the requirement to understand and be mindful of the risk situation in order to react to or tackle it. The educational process is an integral part of DRR, and it is believed that only in this way will communities be prepared to act in the event of imminent disaster. Finally, the close relationship between this theme and EE is observed.

In this way, the involvement of different actors among the population becomes a more primordial risk management aspect, reinforcing EE as an essential strategy for awareness-raising and environmental citizenship based on critical, inter-disciplinary reflection on the complexity of the environmental crisis in contemporary life and its relationship with the development model, which is at the origin of construction of socio-environmental vulnerabilities. Environmental awareness among citizens should therefore be reinforced as the fruit of an educational process to understand the complexity inherent to the development-nature relationship and construction of vulnerabilities, in which the human being is an inherent part of the risk management process.

It is worthy of mention that, despite the efforts outlined in HFA, reports on national progress in Framework implementation in the period 2009–2011 indicate that few countries reported the inclusion of DRR-related themes and topics in teaching, revealing a lack of understanding regarding the nature of DRR in curricula and of how it should be developed and implemented (Selby and Kagawa 2012). It was observed that educational activities analysed in such reports basically consisted of including the theme in some curricular disciplines, with little evidence

of interdisciplinary action and community involvement, highlighting the need for interactive, participative and practical learning on the subject. Furthermore, “day-to-day social and pedagogical practices need to be considered as possible spaces for future projects, redefinition of the political dimension of our existence” (Reigota 2008). What therefore becomes evident is a requirement for advances towards definition of a methodology or an educative process for DRR through critical studies on the real situation and more practices in the light of what was previously revealed.

The three modes of education—formal (regular school), non-formal (outside educational institutions) and informal (daily activities related to work, family life or leisure)—can incorporate disaster education (Shaw et al. 2011). According to these authors, knowledge on DRR can be transformed in risk-reducing behavioural change when disaster education involves family and community learning associated to school education. Lidstone (1996) suggests that instead of the current emphasis on the physical nature of disastrous events, disaster education (DE) should concentrate on the student’s involvement in the context of disasters in order to encourage them to regard themselves living in a dynamic physical environment and be engaged in the real-world problems in their communities. Therefore, it must confer great importance for non-formal and informal education in order to develop a culture of disaster preparedness in the communities.

Experimental Educational Project in the Community of Maceió, Niterói

General Characteristics of the Project Implementation Region

Educational practices were developed in the Maceió Community (Niterói, Rio de Janeiro Metropolitan Region), affected by landslides disasters (Fig. 16.1). Such practices were implemented following the occurrence of severe disasters in the decade commencing in 2010.

The community is situated in the central region of Niterói (approximately 700,000 m²), with relief in the form of a valley contained in the *Maciços Costeiros* (Coastal Massifs) geomorphological context, with abrupt southerly slopes and sharp rocky peaks, where land occupation, primarily in hillside areas, is significantly disorganised, with evidence of deforestation, cut-and-fill for construction of housing and roads and sewage discharge direct onto the land. With approximately 4500 inhabitants (2010), the community finds itself in a precarious situation in terms of basic infrastructure: 71 % of residences receive their water supply from wells or springs; 53 % have a septic tank; waste and rubble is frequently dumped onto the land and most of the dwellings are precarious. Consequently, the natural characteristics associated with this land occupation give rise to significant landslide events, noteworthy among which were those of April 2010 following a period of

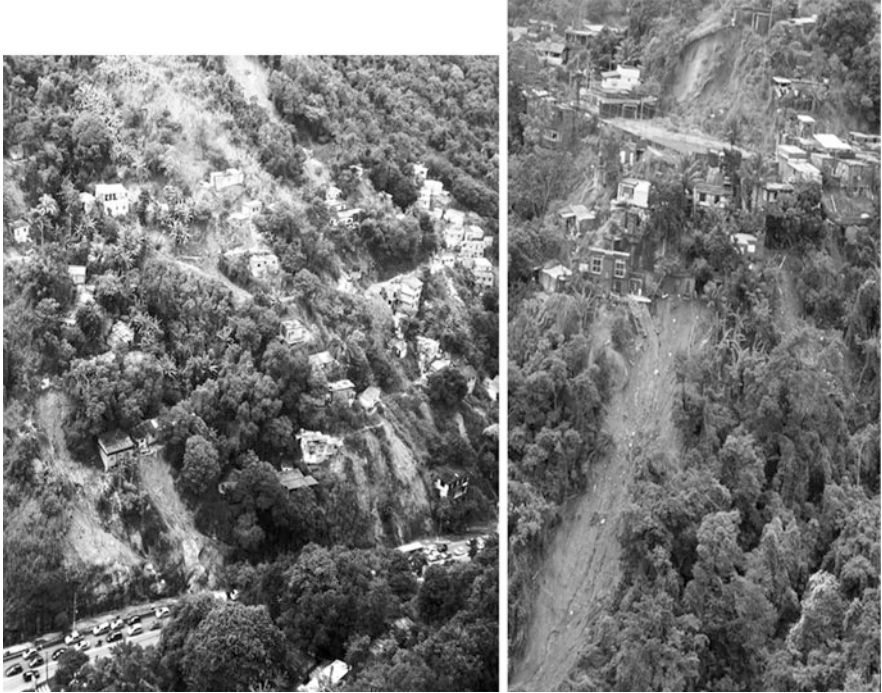


Fig. 16.2 Landslide scarring in the community studied following the events of April 2010

heavy rainfall, causing loss of life, material losses and serious adverse social effects (Fig. 16.2).

Methods and Activities

The disaster education (DE) project presented in this chapter was completely independent of any official disaster management institution. It was run outside formal educational institutions (non-formal mode) and the main purpose was to study pedagogical tools considering real-life context of the community having academicians, local institutions and local populations working together. It was assumed that DE should break the school boundaries and be linked to the community and family (Shaw et al. 2009).

The work was carried out in partnership with the local non-governmental organization (NGO) *Oficina do Parque*, which acts in the area of artistic and vocational education. This partnership made use of the NGO's physical structure and instructors to run the activities with the residents. The project's basic methodology was primarily based on prior knowledge on how residents deal with the topic

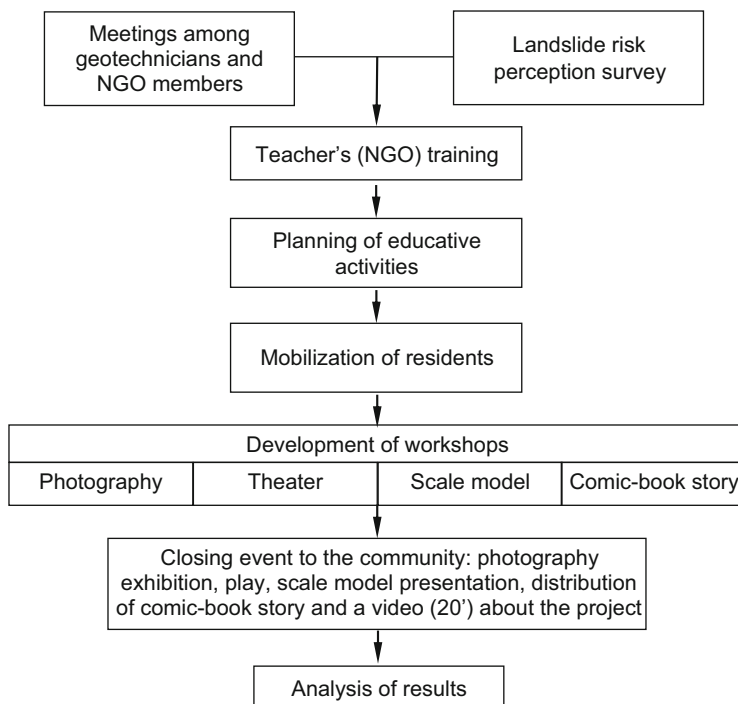


Fig. 16.3 Scheme of DE stages carried out in Maceió Community

of landslide disaster; interaction with the NGO; planning of educational activities; training of teachers, carrying out workshops and a closing event (Fig. 16.3).

In order to approximate to the reality of residents, and have a better idea of how they deal with risks and engage with other stakeholders actors involved in this theme, a risk perception survey was conducted in the community, which enabled gathering of information to aid planning of educational activities (Mendonca and Pinheiro 2012). A questionnaire was applied to a total of 50 residents with a view to gauging opinions and conduct in respect of landslides, their causes, the influence of human actions, the ranking of this type of threat against others to which the population is exposed and personnel/institutions responding in emergency situations. The population has not been previously involved in any mode of disaster education.

To this end, this work revealed the following:

1. Playing down of the landslide risk by residents, without their going so far as to fully deny it—70 % of residents cited such hazard in periods of heavy rain—comparing everyday problems: lack of basic sanitation, deficient public transport—and opportunities available in the location—77 % highlight the advantage of the community being a peaceful place to live;

2. Despite 92 % of residents having experienced landslide disasters, they attach little importance to such type of hazard—only 10 % believed such a threat to be important;
3. Little importance given to certain human actions such as deforestation and hillside cut-aways;
4. Distancing and abandonment by public agencies involved in disaster management; and
5. The impotence of residents in execution of DRR prevention actions.

Before planning the activities and pedagogical tools, training session was held by Geotechnics teachers from the Federal University of Rio de Janeiro (UFRJ)—Polytechnic School together with members of the NGO, covering the general context of the problem, a general view of landslides, human actions inherent in disorganised occupation, signs of imminent landslides, prevention and the general attitude of the population to the issue. This stage aimed to train the NGO teachers on this specific subject as they normally give classes about artistic activities. After that, UFRJ and NGO teachers worked together in order to design the educational activities and their tools. Workshops were then planned with a view to fostering critical thinking among students on their daily lives. Before starting the workshops, the community leaders were contacted and an opening event was held aiming to sensitize the population to participate in the project.

Educational activities were run with formation of community resident groups interested in theatre, art, photography and model workshops, with landslide disasters as the central theme, at the NGO headquarters. Based on Lucena (2008), efforts were made to generate new approaches drawing on skills in the community itself and bring about the formation of a disaster risk reduction culture. In classes of between 6 and 11 students, primarily young people between 10 and 14 years of age, activities ran for 2–4 months. In all workshops, scientific language was avoided, drawings were intensively used and the content depended on the students' knowledge and their own experiences.

The activities were aimed at encouraging a better understanding among these young people of their problems and surrounding area, enabling reflection on their own life situations, as suggested in the Tbilisi Declaration (UNESCO 1977). Freire and Shor (1986) state that, in this context, “individuals take charge of their own lives through interaction with others, generating critical thinking about the situation, favouring construction of personal and social abilities and bringing about the transformation of social relationships of power”. In addition, efforts were made to create a channel of communication between workshop instructors and young people to enable their development through association of respective knowledge, thereby seeking to reflect on the theme and encourage participative management in DRR actions. Despite the theme being established and guided by a technical team, the final products of each workshop were shaped in an integrated, interactive manner involving the residents themselves. In the theatre workshop, a text was produced from discussions held and situations experienced by the young participants, in which actors represented fatalities as a disaster consequence and government

Fig. 16.4 Photos of the interactive model constructed during community activities



neglect of the issue was highlighted. During the photography workshop, participants produced photographic records of their interest areas based on discussions with the Geotechnics teachers, in respect of scarring from previous landslides, their consequences, different human actions contributing to instability on hillsides and signs of imminent land rupture noticed during field trips in the community. In construction of the scale model (Fig. 16.4), material elements of the site (physical geography, topography and hydrography) were drawn upon to provide a basis for fun and reflective group discussion involving participants as suggested in Valencio et al. (2009). It was an important tool to understand the dynamic process of human occupation and how it affects landslide susceptibility. An actual $250\text{ m} \times 250\text{ m}$ area of the community was reproduced to scale 1:150, with existing features—rivers, rock masses, land cutaways, houses, streets, steps, disposal of wastewater and landslide events. The art workshop opted to create a comic-book story on the theme (Fig. 16.5) where residents were encouraged to elaborate a story closer to their reality.

To close out the project, an event was held in which all activities were presented to the community, thereby serving to raise awareness among the community and



Fig. 16.5 Comic-book story produced during the art workshop: (a) cover (b) one of the inside pages

invited public authorities on the theme, in addition to a video illustrating the different stages of the project with testimonies from residents, technicians, a social assistant and educators.

Discussion on Outcomes

It is worth highlighting a number of points regarding educational activities carried out, namely:

- The training stage made possible the first step of exchanging experiences as NGO teachers were used to the community reality. Beyond being experts in the workshops, they transformed the technical point of view of academicians into a more affective language.
- The methodology used enabled integration of DRR into fun-based educational activities normally used in educational processes. These could be adapted to the theme, provided the personal skills of participants are demonstrated.
- The practical, reflexive learning, experience-based characters of educational activities and the consideration of local knowledge, held during workshops is in line with the recommendations of Shaw et al. (2011).
- Joint construction involving technicians from the university, members of the NGO and residents favoured direct action by the latter in an “enterprise” linked to their own daily life and land area.
- Interaction and reflection on daily life were included as necessary stages for the transformation of individuals and their relationship with their surrounding area. In this way young people could acquire the skills to better understand their role within the community, an important aspect of DRR action.

- The interactive model enabled grouping of the different educational aspects involved, such as natural conditioners, human actions, signs of imminent landslide and the consequences of landslide occurrence. Such instructive resources facilitated understanding of the dynamics in the entire process from commencement of land occupation to the occurrence of disasters, covering the full circle of the issue, in line with Lidstone (1996) and Valencio et al. (2009).
- It was possible to develop a risk communication process (Shaw et al. 2009) where the workshops were considered two-way interactive tools for sharing risk information amongst researchers, NGO teachers and local people. This was an effort to achieve the proposition by Shaw et al. (2009) that communication between scientists and local people should be facilitated in order to enhance research practices.

Finally, it is worth emphasising that these activities were geared towards contributing to empowerment of young people through enhancement of individuals as social actors, fostering participation in transformation of their social environment in the quest for improved environmental and social equality (Wallerstein 2006). In this sense, the products were aimed at expressing the individual and collective experience of this community through its young people.

Final Considerations

In Brazil, the high degree of social vulnerability among certain groups as a result of the late development process has made it difficult for them to settle in areas with better infrastructure and access to public social policies. This, coupled with neglect by the State, has to some extent forced such inhabitants of Brazilian urban centres to occupy low market value areas.

In this particular case, the risk perception survey demonstrates the finding that such groups, in the light of their social conditions, tend to play down the risk in relation to the everyday difficulties to which they are subjected. Feeling abandoned by those public agencies responsible for execution of DRR actions, they feel incapable of changing their situation. Such helplessness puts the citizen's conscience in check—the recognition of oneself as an agent of change, finding oneself in a certain situation and being capable of making significant difference. DRR provides discourse on prevention weighted by the necessity for changes in the conditions of socio-environmental vulnerabilities, historically constructed by a socially unjust, ecologically unsustainable development model. To this end, it becomes essential for such vulnerable groups to take part in socio-environmental educational projects with an end to establishing a channel of communication on the theme of risks and to equip them to better deal with their living conditions.

Educational activities provided in the Maceió community (Niterói, RJ, Brazil) enabled the setting up of a channel of communication on landslide risks between different actors—academicians/local teachers and local teachers/residents.

Pedagogical tools and activities were provided in a joint effort with residents, with such integration producing results. Efforts were made to practice a proximity management model so that all considered the real-life context and felt they could be agents of change in respect of DRR, empowering people for participative management. The tools consisted in developing fun-based educational activities with landslide disaster as the main theme.

The interaction among different actors involved in this kind of experience allows us to say that a disaster education can occur both externally and internally, where internal education is based on the exchange of experiences among members of the local community; while the external aspect is based on the exchange of experiences between them and members of external institutions (academicians and public managers), as similarly observed by Ivanov and Cvetković (2014).

The final results showed that this kind of educative project is feasible through association among academicians and local institutions with public support. This non-formal education should be carried out in conjunction with formal and informal education in order to be transformed into risk-reducing behavioural change, as suggested by Shaw et al. (2004) and finally raise a DRR culture. In the DRR context, environmental education has the potential to provide a new outlook on facing disasters, in which future generations must be the protagonists. Despite their experimental nature, projects such as that in the Community of Maceió can contribute to the proposition of a continuing action methodology in the DRR arena of education.

Acknowledgements The authors thanks to Faperj—Rio de Janeiro State Research Foundation, to Fapes—Espírito Santo State Research Foundation and to CNPq—National Research Council for Scientific and Technological Development. We also thanks to Mark Thompson for translating to English.

References

- Acelrad H (2010) Ambientalização das lutas sociais—o caso do movimento por justiça ambiental. *Estudos Avançados* 24(68):103–119
- Acelrad H, Mello CCA, Bezerra GN (2009) O que é Justiça Ambiental? Garamond, Rio de Janeiro
- A Gazeta (2013) Chuvas de Dezembro de 2013. *Gazeta on line* http://gazetaonline.globo.com/_conteudo/2013/12/noticias/cidades/1472976-dobra-o-volume-de-chuva-no-espírito-santo-nos-proximos-tres-dias.html. Accessed 3 July 2013
- Anderson MG, Holcombe E (2013) Community-based landslide risk reduction: managing disasters in small steps. World Bank, Washington, DC
- Avelar AS, Netto ALC, Lacerda WA, Becker LB, Mendonça MB (2013) Mechanisms of the recent catastrophic landslides in the mountainous range of Rio de Janeiro, Brazil. In: Margottini C, Canuti P, Sassa K (eds) *Landslide science and practice*, vol 4. Springer, Berlin, pp 265–270
- Brandão AMPM (1992) As alterações climáticas na área metropolitana do Rio de Janeiro: uma provável influência do crescimento urbano. In: Abreu MA (ed) *Natureza e sociedade no Rio de Janeiro*. Secretaria Municipal de Cultura, Turismo e Esportes, Departamento Geral de Documentação e Informação Cultural, Divisão de Editoração, Rio de Janeiro, pp 143–200

- Brasil (1988) Constituição: República Federativa do Brasil. Senado Federal, Brasília
- Brasil (1999) Lei nº. 9.795/99. Dispõe sobre a educação ambiental, institui a política nacional de educação ambiental. Câmara dos Deputados, Brasília
- Brasil (2012) Lei nº 12.608/12. Institui a Política Nacional de Proteção e Defesa Civil. Câmara dos Deputados, Brasília
- Carvalho ICM (2008) Educação Ambiental: a formação do sujeito ecológico, 3rd edn. Cortez, São Paulo, 163
- CEPED/UFSC (2012) Atlas Brasileiro de Desastres Naturais—1991 a 2010: volume Brasil. Centro Universitário de Estudos e Pesquisas sobre Desastres. CEPED UFSC, Florianópolis
- Da-Silva-Rosa T (2009) Os fundamentos do pensamento ecológico do desenvolvimento. In: Veiga JE (ed) Economia Socioambiental. SENAC, São Paulo, pp 25–46
- Da-Silva-Rosa T, Mattos R (2012) Exclusion, vulnerabilities and climate change. In: Proceedings of the XXX international congress of the Latin American Studies Association/LASA, 2012, San Francisco
- Freire P, Shor I (1986) Medo e ousadia: O cotidiano do professor. Paz e Terra, Rio de Janeiro
- Harvey D (2004) Condição pós-moderna. Loyola, São Paulo
- IPCC (2012) Managing the risks of extreme events and disasters to advance climate change adaptation. In: Field CB, Barros V, Stocker TF, Qin D, Dokken DJ, Ebi KL, Mastrandrea MD, Mach KJ, Plattner G-K, Allen SK, Tignor M, Midgley PM (eds) A special report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, pp 582
- Ivanov A, Cvetković V (2014) The role of education in natural disaster risk reduction. *Horiz Int Sci J Ser A Soc Sci Humanit* 16:115–130, Year X, University St. Kliment Ohridski-Bitola
- Jonas H (1995) Le princepe responsabilité: une éthique pour la civilisation technologique. Flammarion, Paris
- Leff E (2006) Racionalidade ambiental: a reapropriação social da natureza. Civilização Brasileira, Rio de Janeiro
- Lidstone J (1996) Disaster education: where we are and where we should be. In: Lidstone J (ed) International perspectives on teaching about hazards and disasters. International Geographical Union, Channel View Publications, Adelaide, pp 7–17
- Loureiro CFB (2012) Sustentabilidade e Educação. Um olhar da ecologia política. Cortez, São Paulo
- Lucena R (2008) Mobilização social para a redução de vulnerabilidades. In: Gestão e Mapeamento de Riscos Socioambientais. Ministério das Cidades/UFPE. http://www.cidades.gov.br/images/stories/Arquivos/SNPU/Biblioteca/PrevencaoErradicacao/Curso_Gestao_Mapeamento_Riscos_Socioambientais.pdf. Accessed 5 Apr 2015
- Mendonca MB, Guerra AT (1997) A Problemática dos Processos Geodinâmicos frente à Ocupação de Encostas. In: Annals of the 2nd Panamerican symposium on landslides, Rio de Janeiro, vol 2, pp 935–940
- Mendonca MB, Pinheiro MTG (2012) Estudo da percepção de risco associado a deslizamentos no bairro do Maceió, Niterói, RJ. *Revista de Comunicação e Educação Ambiental* 2:78–94
- Morin E, Kern AB (2010) Terre-Patrie. Ed. Du Seuil, Paris
- Reigota MAS (2008) Cidadania e Educação Ambiental. *Revista Psicologia & Educação Ambiental* 20:61–69, <http://www.scielo.br/pdf/psoc/v20nspe/v20nspea09.pdf>. Accessed 5 Feb 2015
- Santos BS (2002) Para uma sociologia das ausências e uma sociologia das emergências. *Revista Crítica de Ciências Sociais (Online)* 63:237–280, <http://rccs.revues.org/1285>. Accessed 15 Feb 2015
- Santos M (1985) Técnica, espaço, tempo: globalização e meio técnico-científico informacional, vol 25. Editora Hucitec, São Paulo
- Selby D, Kagawa F (2012) Disaster risk reduction in school curricula: case studies from thirty countries. United Nations Children Fund (UNICEF)/United Nations Educational, Scientific and Cultural Organization (UNESCO 7)

- Shaw R, Shiwaku K, Kobayashi H, Kobayashi M (2004) Linking experience, education, perception and earthquake preparedness. *Disaster Prev Manag* 13(1):39–49
- Shaw R, Takeuchi Y, Shiwaku K, Fernandez G, Gwee Q R, Yang B (2009) 1-2-3 of disaster education. United Nations International Strategy for Disaster Reduction (UNISDR), European Union and Kyoto University—International Environment and Disaster Management Laboratory
- Shaw R, Takeuchi Y, Gwee QR, Shiwaku K (2011) Disaster education: an introduction. In: Shaw R, Shiwaku K, Takeuchi Y (eds) *Disaster education (community, environment and disaster risk management)*, vol 7. Emerald, Bingley, pp 1–22
- Torres HG, Marques EC (2001) Reflexões sobre a hiperperiferia: Novas e Velhas Faces da Pobreza no Entorno Municipal. *R B Estudos Urbanos e Regionais* 4:49–70
- UNESCO (1977) Intergovernmental Conference on Environmental Education—Final report. Organized by UNESCO in co-operation with UNEP. Tbilisi (USSR)
- UNISDR (2007) United Nations & International Strategy for Disaster Reduction Hyogo Framework for Action 2005-2015: building the resilience of nations and communities to disasters. Geneva. http://www.unisdr.org/files/1037_hyogoframeworkforactionenglish.pdf. Accessed 15 Dec 2014
- UNISDR (2015) United Nations & International Strategy for Disaster Reduction (Sendai Framework for Disaster Risk Reduction 2015-2030). http://www.wcdrr.org/uploads/Sendai_Framework_for_Disaster_Risk_Reduction_2015-2030.pdf. Accessed 3 Apr 2015
- Valencio N, Siena M, Marchezini V (2009) Maquetes Interativas: fundamentos teóricos, metodológicos e experiências de aplicação. In: *Sociologia dos Desastres: Construção, Interfaces e Perspectivas no Brasil*, Rima Editora, São Carlos, pp 199–215
- Wallerstein N (2006) What is the evidence on effectiveness of empowerment to improve health? WHO Regional Office for Europe, Copenhagen, Health Evidence Network report, <http://www.euro.who.int/Document/E88086.pdf>. Accessed 1 Feb 2006
- World Bank (2012) Avaliação de Perdas e Danos: Inundações e Deslizamentos na Região Serrana do Rio de Janeiro—Janeiro de 2011. Report compiled by the World Bank with backing from the Rio de Janeiro State Government. Coordination: Joaquin Toro. World Bank, Brasília

Marcos Barreto de Mendonca is Civil Engineer from University of Rio de Janeiro State (UERJ—1987) and holds Master (M.Sc., 1990) and Doctorate (D.Sc., 2000) in Geotechnics at COPPE—Federal University of Rio de Janeiro (UFRJ), Brazil. He is Associate Professor in the Civil Construction Department of Polytechnic School at Federal University of Rio de Janeiro. He is professor of Civil Engineering graduation, Environmental Engineering Post-Graduate Program (PEA) and Urban Engineering Post-Graduate Program (PEU) at UFRJ. He also teaches in the Master Program in Civil Defence at Fluminense Federal University (UFF). His main research and teaching areas include geotechnical engineering, geosynthetics, microbiological clogging, landslides disaster risk reduction, risk perception and disaster education. CV: <http://lattes.cnpq.br/9219077334380862>

Teresa da-Silva-Rosa PhD on Socioeconomics of Development, École des Hautes Études en Sciences Sociales/EHESS-Paris (2005); MSc on Ecological Design, The Robert Gordon University-Aberdeen (1997); MSc on Comparative Researches on Development, École des Hautes Études en Sciences Sociales/EHESS-Paris (1998); Undergraduate Degree on Geography, Fluminense Federal University (UFF, 1979); Post Doctorate on Sociology, Rural Federal University of Rio de Janeiro (UFRRJ, 2007); “Capixaba Researcher” Scholarship (FAPES-ES); CNPq Researcher (National Council of Scientific and Technological Development/CNPq, Brazil); Professor at the Post-Graduate Program in Political Sociology (PPGSP) Vila Velha University (UVV-ES, Brazil); Professor at the International Relations and Psychology undergraduate courses, Vila Velha University (UVV-ES); Coordinator of the Centre for Urban and Socio-Environmental Studies (NEUS, UVV-ES); Associated Researcher at research centers in Brazil (CINAIS, UFRRJ; and NEPDA, UEPb); Supervisor of several MSc Students and Undergraduate students;

Main research and teaching areas include disaster risk reduction in developing areas; environmental sociology, environmental policies and sustainability; scientific knowledge and complexity in Sciences; reviewer of several Brazilian and international scientific journals; CV: <http://lattes.cnpq.br/5488672627941326>

Túlio Gava Monteiro holds an undergraduate degree in Geography from Federal University of Espírito Santo (2010) and is currently a master (M.Sc.) student in Political Sociology, Vila Velha University (UVV-ES), Brazil. He is researcher at the Centre for Urban and Socio-Environmental Studies (NEUS, UVV-ES). His main research includes environmental injustice issues, urban environmental risks and participation and collective mobilization due to public environmental problems. CV: <http://lattes.cnpq.br/0411194796466934>

Ricardo de Souza Matos holds an undergraduate degree in Law from Faculdade Brasileira (UNIVIX, 2007) and Master Degree in Political Sociology (2015) from Vila Velha University (UVV-ES), Brazil. He is researcher at the Centre for Urban and Socio-Environmental Studies (NEUS, UVV-ES) and his main research interests include environmental education and disaster risk reduction in developing areas. CV: <http://lattes.cnpq.br/0289783653011634>