PERSPECTIVES

Challenges to participation in action research

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SUMMARY

In order to understand and take action in complex health and environmental issues, we intend to analyse the conditions that are needed for those at risk to participate in research and intervention projects. In this study, we describe and discuss an action research experience carried out with an indigenous community in the Brazilian Amazon that suffers from serious sanitary problems, where cultural aspects in the relationship with the environment and health are particularly relevant. Different types of tools were deployed and combined and were subsequently classified according to their dialectic efficacy and ability to both conduct and steer the research and encourage the participation of social actors within a process of feedback. Even tools that were considered to be non-dialectic proved to be important sources of feedback. We present a research flow as a model of analysis and a framework for implementing action research, in which challenges to the participation of social actors are classified according to their priority through a critical review of the methodology developed. These challenges are social mobilization, co-operation, appropriation and a proactive stance. We conclude that a cyclic combination of dialectic and non-dialectic tools can increase participation, which though difficult to achieve is nevertheless necessary. During the development of this process, social mobilization is a prerequisite, whereas a proactive stance, the highest level of participation, requires continuous effort and the successive deployment of a variety of tools.

Key words: action research; empowerment; health promotion discourse; community-based participatory research

INTRODUCTION

It is thought that health and illness are shaped by socio-ecological contexts, characterized by the relationship between mankind and their environment with different cultural and practical values, self-organization, feedback by means of stimulation, different types of organizational levels and high degrees of uncertainties and weaknesses, as well as other aspects inherent to complex systems. Therefore, it is both appropriate and opportune to conduct academic research in order to understand the complexity of specific realities (Morin, 2006). This type of research aims at engaging social actors exposed to multifactorial risks—also named here as participants of research or just social actors, the non-academic partners—in the process of interpreting, appropriating and producing joint knowledge, as well as in developing strategies and policies to deal with and/or solve environmental problems, which affect human health (Israel *et al.*, 1998; Waltner-Toews, 2001; Ravetz, 2004; Wallerstein and Duran, 2010), thus moving beyond the traditional reductionism of science.

Our proposal is to contribute in a critical way in order to overcome the challenges and understand the experiences related to participation. The promotion of participation has been considered to be fundamental in academic movements, which aim at intervening in real situations. Post-normal science (Funtowicz and Ravetz, 1993; Ravetz,

2004) argues for the need of extended peer communities to be involved in the production of knowledge and the management of uncertainties. This is also the case with an ecosystem approach to health, known as Ecohealth, based on the pillars of transdisciplinarity, participation and equity, where the aim of participation is to foster co-operation and reach a consensus, not only within the local community and among scientific researchers and decision-makers, but also between these different communities (Lebel, 2003).

In fact, when faced with the task of defining participation, List (List, 2006) argued that there are different forms of participants involvement that can be graded into seven levels of participation from step 1—manipulative co-option, to step 6—interactive co-learning and finally to step 7—self-mobilization and empowerment.

In this article, we have adopted to use a methodological approach based upon action research, a type of community-based participatory research—CBPR—where participants must be involved in the search for solutions to specific inter-disciplinary problems; research is developed by constantly reflecting on action and promoting collective learning (Lewin, 1946; Carr and Kemmis, 1986; Barbier, 2002). We opted for action research mainly because it provides the possibility to develop a dynamic process with scientific rigour during each stage (Morin, 2004; Thiollent, 2011), as well as the fact that it is not a rigid model, since it is not predetermining of a necessary flow of tools aiming at promoting participatory processes.

This article is based upon action research conducted in the District of Iauaretê, an indigenous community in the Brazilian Amazon near the Colombian border that is undergoing a process of urbanization, causing significant damage to the environment and provoking health risks due to a serious sanitary crisis. This is primarily because of the lack of services related to water and sewage and the collection and disposal of solid waste, as well as the continuing use of sanitary practices, which are not adequate to the present size of the urban agglomeration. Apart from the problem of sanitation, which is commonplace, there are further significant factors in this locality such as traditional indigenous practices and knowledge, pluriculturalism, the continuity of subsistence practices closely linked to natural systems, indigenous conceptions of urbanization, contact with the surrounding society and its postulates about health and disease and the re-signification of

these ideas through mythological re-interpretation (Giatti *et al.*, 2007; Toledo *et al.*, 2009).

When these issues are seen in the light of the preliminary study used as background, the demand for a research model capable of intervening and contributing to a reduction in health disparities is legitimized. Indeed, the growing importance of participatory approaches is demanding to promote the relationship between kinds of knowledge diametrically different from scientific Western thinking. Although in this reported case, the differences of the indigenous knowledge are very clear, we considered the arguments of Santos (Santos, 2007) as this kind of abyssal thinking is current, intense and widespread between the classic science and the large variety of alternative knowledge segregated by the contemporary cartography of social exclusion and new forms of social fascism. For example, the urban distribution of social exclusion shows a new arrangement for the colonial condition of intense asymmetry between the metropolis and the colonies.

In summary, the aim of this article is to instigate reflection on the challenges and experiences of social actors' participation by combining different research and intervention tools. We also hope to make a significant contribution offering a framework for analysing and planning participatory research processes of a systemic and dialectic nature. This article does not bring the descriptive scenario of the public health-related problems in the place of study, not even the specific methodological approach for the original research findings; these aspects were already published in different papers (Toledo and Pelicioni, 2009; Toledo *et al.*, 2009, 2012; Giatti *et al.*, 2007; Rios *et al.*, 2007). Indeed, herewith we try to summarize and discuss the structure of methodological application flow by the combination of several research and intervention tools applied to strengthen the participation of social actors. Within our proposal, this structure of methodological application constitutes a framework that can support to the implementation of a cyclical process for action research (Lewin, 1946), as well as it can point out challenges and reveal differences between certain intervention tools towards their perspective of promoting a dialectic process (Freire, 1987).

METHODOLOGICAL APPLICATION

The administrative centre of the Iauaretê district is situated in the heart of the Indigenous Territory

of Alto Rio Negro, in the Northwest of the state of Amazonas, Brazil, near the border with Colombia and at the confluence of the Papuri and Waupés rivers. It differs from other indigenous lands because of its high population concentration. There are around 2700 inhabitants from 15 ethnicities (the majority are Tariano or Tukano) and they are distributed among 10 villages or communities (seven on the left bank of the Waupés river and three on the right bank) and 440 households, representing a significant process of transformation from a 'ribeirinho' pattern—a type of settlement dispersed along riverbanks—to a nucleus with urban features. This situation has resulted in profound changes in the traditional way of life and is exposing the population to numerous health problems, mainly due to three factors: the precarious manner in which human stools and solid wastes are disposed of; the consumption of contaminated water; and the continuation of sanitary practices, which are incompatible with the present socio-environmental situation (Giatti *et al.*, 2007).

In view of this scenario, the aims of the background action research project were to (a) identify relevant sanitary and socio-environmental issues, which directly interfere with the quality of life of local inhabitants, (b) promote educational interventions adapted to the socio-cultural reality, using both local popular knowledge and the scientific knowledge that guides this problematic situation combined with the solutions these can provide, and (c) draw up a proposal for improving sanitary conditions appropriate to the Iauaretê district, taking into account existing resources and functional aspects in order to meet the needs and characteristics of this indigenous population.

Because action research is an open and dynamic methodology, it favours the combined use of a variety of research and intervention tools, since the direct involvement of members of the community affected by this problematic situation in all stages of the process—with their needs, worries, values and knowledge—that will inevitably lead to methodological adaptations throughout the process. With regard to this, Lewin (Lewin, 1946), one of the main precursors of action research, considers three fundamental phases developed in a model that is similar to a cyclic spiral: (1) *planning*, which involves identifying and acknowledging a situation; (2) *action*; and (3) *fact-finding* about the results of the action that should be incorporated in the

following phase when a new plan is drawn up, starting a new cycle. We stress that this open and flexible system is determined by the different levels of involvement and participation of the social actors in the research and intervention process, which in turn will point to the steps to be taken in view of the demands that arise. Within this context, the role of the researcher should be to contribute towards encouraging participation on the part of social actors, ensuring that socio-cultural diversity is respected while guaranteeing methodological rigour, thus assisting in the attainment of the proposed objectives.

Table 1 provides a brief description of all the tools applied during the field work that took place between 2005 and 2008. It serves as an aid to the debate under discussion in this article, above all, in relation to challenges to participation. The starting point for the majority of the applied tools began in periodic meetings in each of 10 component villages, involving an average of 30 people at each meeting. It occurred specially in relation to the tools 1 to 12 with direct or indirect participation of the social actors, as classified in Table 2 and described below.

As the research was conducted in an indigenous territory, in which the objectives and the methodology of the research were presented, initial contacts took place with local indigenous leaders. As the research involved human beings, it was in line with ethical criteria compatible with international standards such as free and informed consent, voluntary participation and the possibility of withdrawing at any time and assurance of confidentiality of information provided and identity of participants. Although there was a diversity of collective activities as in the community meetings, in which the local social actors interacted among them and with researchers, the confidentiality was assured in terms of analysis, discussion and dissemination of the research outcomes. As a direct benefit, referrals to health care were made in cases where health treatment was required. The Portuguese language was used both during the process of initial contact and throughout the research, as the local indigenous people speak Portuguese. The language used was at a level compatible with the knowledge of the participants of the research. Formal entry into the indigenous territory of Alto Rio Negro—the locality of the study—was sought based on initial contact that was duly authorized by the Brazilian National Indian Foundation—FUNAI (process 0480/04). The research project was then submitted and

Table 1: Methodological description of the tools applied during the action research conducted in the District of Iauaretê, 2005–2008

Tool/period	Application and objectives
1. Questionnaires (March 2005)	Completed by indigenous health agents-AIS—in each of the 10 villages, providing population information about housing and the occurrence of disease
2. Interviews (March 2005)	Conducted with a total of 20 village residents. Interviews provided information and representations of health, disease and the causes and treatment of illness, nutrition and basic sanitation among the indigenous population
3. Participant observation (throughout the whole period)	The researcher shares and directly participates in the day-to-day life of the community being studied, using systematic collection and interpretation of data (Malinowski, 1984)
4. Talking map (March and July 2005)	Graphic representations of residents' reality of life were collectively produced during community meetings held in each of the 10 villages on two different occasions, identifying
5. Photo panel (May 2005)	A number of residents were asked to photograph aspects of their environment and day-to-day practices which, in their view, contributed adversely to the health of the population. These photos were then grouped according to themes during community meetings in each of the villages and fixed on panels. The aim was to determine and discuss causal links and possible solutions for the problems identified (Toledo *et al.*, 2006)
6. Analysis of water sources (May and July 2005)	Microbiological analysis of samples collected on two different occasions, according to the availability of sources for water collection, in order to determine the presence or absence of thermotolerant coliforms (Giatti *et al.*, 2007)
7. Geo-referencing (May 2005)	The development of a geographic information system (GIS) in order to map the villages, streets, water resources and sites for solid waste disposal and local water sampling (Rios *et al.*, 2007; Giatti *et al.*, 2007)
8. Copro parasitological investigation (May 2005)	Carried out with 895 residents, with the support of indigenous health agents, in order to determine the prevalence of intestinal parasites in the indigenous population of each of the 10 villages (Rios *et al.*, 2007)
9. Study of solid waste (May 2005)	Diagnosis to identify the sites with the greatest accumulation of solid waste, their composition and conditions of disposal, including health service waste. Also, to identify by means of specific interviews, the indigenous population's knowledge and practices concerning this aspect
10. Analysis of soil samples (July 2005)	225 parasitological analyses were carried out on soil samples collected in peridomiciliary areas near water resources, schools and other sites with a high level of circulation (Rios *et al.*, 2007)
11. Talks and short courses (July 2005)	Talks were given to health workers and students at the local school on the subject of solid waste, its inappropriate disposal and possible solutions for the community of Iauaretê. A short course was also given to teachers. Another short course was given to 29 students from the Association of Indigenous Women of the District of Iauaretê (AMIDI) on the subject of nutrition and good food manipulation and processing practices, taking into account the regional indigenous food culture
12. Meetings to present and discuss results (May 2006)	Meetings were held with the indigenous population in Iauaretê and representatives of local institutions to present and discuss the main results obtained up to this point, as well as to identify actions to be taken forward Meetings with the same objectives and to provide technical support were held in São Gabriel da Cachoeira with government representatives and other organizations involved with health issues and sanitation
13. Research report (September 2006–June 2007)	Produced by the researchers, but with the direct involvement of the participants of this action research process. It was delivered to Funasa [Brazilian National Health Foundation] in September 2006. In June 2007, copies of this document were made available in Iauaretê and discussed with the residents to assess its relevance as a policy tool
14. Demands—petitions[a] (June and October 2007)	Course students produced two documents containing demands (petitions) that were presented to Funasa via the external researchers. The first requested that a sanitary engineer be contracted to work in the region and the second requested adaptations to the ongoing sanitation works

Continued

Table 1: *Continued*

Tool/period	Application and objectives
15. Community Newspaper[a] (October 2007)	The first edition of a Community Newspaper was collectively produced by the indigenous population in a workshop. Its purpose was to strengthen participants' social mobilization and the co-operative aspect of learning, so as to promote dialogue between readers on a subject of common interest
16. Research on sanitation profile[a] (November to January 2008)	Course participants interviewed residents in their homes and also systematized, analysed and discussed the results obtained. The purpose was to identify possible changes in the local socio-environmental conditions, health and sanitation since the start of the action research process
17. Debate on the role of the indigenous health agent[a] (April 2008)	To encourage debate between Iauaretê's AIS and other students on the course. The aim was to highlight the relevance of the role performed by these professionals, as well as identify the main difficulties they faced

[a]Tools developed as part of the Social Mobilization Course in Health and Sanitation offered to around 30 residents, among them teachers, indigenous health agents (AIS) and local community leaders (Toledo *et al.*, 2012).

assessed, receiving a positive decision from the Brazilian National Committee of Ethics in Research—CONEP (registration no. 10.848), according to CONEP's criteria inscribed in resolution 196/1996, compatible with the Declaration of Helsinki. Informed consent was acquired with signature of the community leaders, but all the ethical concerns were presented to the participants in the community meetings.

EVIDENCES OF PARTICIPATION PROCESS AND DISCUSSION

Having presented the tools applied, we will now interpret them in relation to the feedback dynamics of an open methodological system. The objective of this analysis is to better understand individual roles and the importance of each tool as positive stimulus in the participatory process. Table 2 highlights the contributions each tool brought to the research and intervention in terms of the social actors' involvement, by grouping them according to their similarity, function and reach. The research tools were classified in terms of their feedback in the development of the action research cycle.

It is important to clarify that with regard to the significance of feedback in the participatory process, according to Waltner-Toews (Waltner-Toews, 2001) and Kay *et al.* (Kay *et al.*, 1999), within a perspective of self-organizing systems, certain stimuli perform a decisive role. Attractors, as a result of their interference, encourage feedback into the organization process. In the study in question, with interventions on sanitary practices and representations of health and sanitation, we believe that the intervention process could induce an attractor that is capable of interfering in the socio-environmental system, where a new process of self-organization can facilitate the solution of problems. In this sense, we consider that a successful participatory intervention should result in a proactive stance and this is the key to a self-organizing chain led by the social authors themselves, the subjects of the environmental risk. In other words, it aims at empowering people to promote health (WHO, 1986; Wallerstein, 1992).

The tools applied were classified in Table 2 in terms of feedback and divided into two categories:

– *Direct/immediate feedback*: encourages social actors' participation in real time, as it provides evidence of how the results of the research contribute to methodological adaptations—this was the case of the tools applied with the direct involvement of participants, in this case the construction of collective researchers–participants. We also considered the tools that produced this type of feedback as being dialectic;
– *Indirect/non-immediate feedback*: encourages social actors' participation at a later moment, since the tools involved are not used in direct interactions with researchers–participants. Nevertheless, they encourage feedback because of their capacity in filling important gaps, which are identified during the ongoing process of research and intervention.

We have followed an analytic path within a process to overcome challenges by using the experiences acquired while applying research tools and classifying them according to feedback, and also by taking into account the main objective

Table 2: Tools applied in the action research, their contribution to participation and classification by type of feedback provided, Iauaretê, 2005–2008

Tool	Contribution in dealing with challenges to participation and feedback categories
Talking maps (current situation and future scenarios) Photo Panels Discussions between course students and AIS	Contributed to the *co-operative construction* of knowledge, through reflection (among participants and between participants and researchers), in the discussions about causal links and in the search for possible solutions, assisting in the *appropriation* of constructed knowledge and, consequently, in its dissemination (*interactive co-learning*). These were important in order to develop *participative diagnoses*, to be able to make complaints about irregularities within the environment-health system, as well as to request specific studies in order to deal with *questions of the participants, researchers or both*, such as parasitological examination, analysis of water quality, analysis of parasites in the soil and studies about solid waste disposal.
Participant observation Questionnaires Interviews Geo-referencing	These provided important data about the system being studied, contributing towards the *redeployment* of tools and *decisions* about the research, planning and interventions. Geo-referencing proved to be an important educational tool because it introduced products, which assisted with the spatial interpretation of phenomena being studied.
Water quality analysis Solid waste study Parasitological examination Soil analysis	Provided *answers to the questions* (about water quality, impact of solid waste, intestinal parasitosis, quality of soil), which emerged when using talking maps and/ or photo panels, meeting the demands not only of researchers, but also participants, and thus contributing towards an *increase in the credibility* of the research.
Talks and courses on food and solid waste	These met the demands of participants and provided contributions in order to develop sanitary and health practices consistent with the socio-cultural reality (*interactive co-learning*) and to deal with these issues at the level of local institutions and organizations (schools, meetings, etc.). Furthermore, they contributed to the *improvement of the management* of solid waste and vector control.
Research report	The process of drawing up and discussing the report generated and corroborated the concrete results of the action research and provided contributions to participants, researchers and the political system, both in terms of producing knowledge (*interactive co-learning*) and for decision-making (*self-mobilization and empowerment*).
Producing the petitions	Contributed to *raising self-esteem*, strengthening the group (*empowerment*), and helped its members to believe in the possibility of transformation by using *legal participation tools* in the search for collective solutions.
Community newspaper Research on the sanitation profile	Contributed to *raising self-esteem* and *autonomy*, generating *dialogue* between participants as well as acknowledging and disseminating information about the sanitation problem.

Observation: words and expressions in italic in Table 2 correspond closely to challenges and levels of participation.

Gray shaded rows indicate direct/immediate feedback and others indicates indirect/non-immediate feedback.

of attaining a higher level of participation. In view of their relationship with the development of the participatory process, we categorize these challenges as: social mobilization, co-operation, appropriation (of knowledge, values and skills) and development of a proactive stance in order to address problems. What follows is a proposition of four challenges that have to be overcome in the participatory research process:

(1) Social mobilization: overcoming the initial resistance to research, inertia of the population in the face of a particular problem and low self-esteem. According to Toro and Werneck (Toro and Werneck, 2007), the beginning of a social mobilization process occurs when a group of people, community or society, decides and acts based on common objectives. This first challenge to participation can be more significant when the issue or studied problem is not presented as self-determination by the social actors (Cargo and Mercer, 2008);

(2) Co-operation: identification with the research object and the perception of its relevance by the social actors, adapting tools to the

socio-cultural reality and confronting the welfarism/paternalism. This category is presented based on the circumstances related to the quality of interaction between researchers and social actors. A positive indicator of co-operation can be the social actors' equitable participation in the research process. This level is characterized by the social authors choosing the direction of the research project or with their participation in the analysis of research outcomes (Cargo and Mercer, 2008; Wallerstein and Duran, 2010);

(3) Appropriation: addressing cognitive/re-signification of knowledge, pluriculturalism, keeping to practices incompatible with the present situation, welfarism/paternalism and lack of risk acknowledgement. The main aspect in this sense is to apprehend the local knowledge and the local determinants leading to an authentic hybrid research, producing collaborative knowledge with high potential for application (Wallerstein and Duran, 2010). As List (List, 2006) claims, this can also be named as interactive co-learning. The social actors' self-determination or self-mobilization can be strengthened based on the collaborative knowledge produced along the participatory research, especially when the non-academic partners—social actors—acquire the ownership with the research activities (Cargo and Mercer, 2008);

(4) Proactive stance: confronting lack of policies, lack of militancy, scope/dissemination and welfarism/paternalism. Overcoming these obstacles is possible with self-mobilization and empowerment (List, 2006), when the social actors are appropriated with the hybrid knowledge supported by scientific outcomes. Then there are possibilities for protecting themselves from the risk situation; moving forward in order to push necessary policies/infrastructure/measures for risk mitigation; and working on the elimination/reduction of health disparities (Wallerstein and Duran, 2010). This challenge deals with the social actor's initiatives, thus enhancing the likelihood to translate the research results into action and institutionalized answers (Cargo and Mercer, 2008).

Although the recognition of these four categories presented is possible by their characteristics, the frontiers between them can be fuzzy in the process of participatory research. In Table 2, we stress evidences of overcoming challenges of participation by words and expressions in bold. When discussing these challenges to participation, social mobilization stands out as one of the main prerequisites. Toro and Werneck (Toro and Werneck, 2007) argue that it is a tool for 'evoking wishes' and bringing citizens together so that they can act within the reality they live in. Social mobilization occurs when taking over the development of 'mobilizing participatory projects', the results of which are reached by consensus and accepted by everyone.

Since social mobilization is indispensable to the process of popular participation, it is necessary to provide resources and create necessary conditions, not only that it becomes established, but also that it continues throughout the whole process, raising self-esteem and confidence of social actors in their capacity to transform reality, thus empowering these individuals as social actors, as well as producing and appropriating new knowledge, values and skills that ensure the development of autonomy to address problems (Christopher *et al.*, 2008).

In order to address complex problems, such as health and environmental issues, participation cannot simply be restricted to disseminating or democratizing information, or even to consulting the community. It demands the stimulation of a proactive stance on the part of social actors in relation to decision-making, as well as constant follow-up and assessment. We are therefore dealing with a type of participation that, according to List (List, 2006), starts to take place at level 6 (interactive co-learning) and level 7 (self-mobilization and empowerment), as explained respectively in the third and fourth challenges presented above. In other words, it requires both social mobilization and the production of knowledge about the issue in question, which will ultimately result in interactive co-learning and community strengthening so that at the end of this process, social actors will be able to 'walk unaided' (autonomy/proactive stance), even if public policies are discontinued.

Minkler (Minkler, 2010) stresses that in participatory processes seeking to produce collective knowledge that leads to public policies, an important prerequisite is to strengthen the commitment between partners—social actors and researchers. However, the actual solution to the problems is not always in the hands of participants and researchers. According to Jacobi (Jacobi, 2009), the concept of participation is linked to both

deliberative democracy and the existence of a public sphere; however, in practice, participation is restricted by a number of difficulties, such as a deficit in political education and in the ability to influence decision-making processes. Within this context, Jacobi lists some conditions he deems necessary for participation to be institutionalized: the level of legitimacy and political representativeness of members; the availability of resources for the sector or programme; the level of dissemination of information; the level of commitment towards empowering beneficiaries; and the ability to reconcile conflicts between the social actors involved.

In Iauaretê, issues such as resistance to the research, the inertia of the population in relation to particular problems and low self-esteem were identified and considered to be impediments to social mobilization (Giatti *et al.*, 2007; Toledo *et al.*, 2009). In relation to the initial resistance to research, this was manifested by the indigenous people from the first contact with local leaders, when they made it clear that they were concerned as to how they would actually benefit from the research. They told us that many other studies had already been conducted in the region; however, up to that point, most of these had not led to any real improvements for the population and results had not even been disseminated. Studies such as those by Christopher *et al.* (Christopher *et al.*, 2008) and Cochran *et al.* (Cochran *et al.*, 2008) describe similar situations in which individuals demonstrate resistance, as they are systematically stereotyped and exploited. In this background research, we have sought to address this issue, laying down the initial condition that all proposals for intervention—be they educational or practical, involving, for example, changes in habits—are limited by outright refusal, camouflaged resistance or re-interpretation (Minayo, 2005).

It could be said that there has been some progress in relation to identifying challenges to social mobilization, in the shape of evidence gathered throughout the process by deploying different tools. It is worth highlighting the results obtained by the Community Newspaper and the Photo Panel. The former, due to its dialogic and participatory nature, both during its production and dissemination stages, led to the diffusion of knowledge and greater reflection about the problems under discussion and the concerns of the population, so it contributed in an effective way to mobilization. The aim of building a Photo Panel was to identify causal links and possible solutions to problems. When these were presented, the indigenous people made brief comments in Portuguese in relation to what had been written on the posters and subsequently addressed one another in the Tukano language. The researchers' limited knowledge of this language made it impossible to accurately evaluate the explanations being provided; however, through the content of what was later explained during the concluding stages, it became clear that they were thinking about the problems, causes and solutions. Furthermore, demands were also made by the leaders with regard to the responsibilities of particular individuals. Subsequently, the indigenous people presented the explanations and then asked the researchers to provide legitimacy and validate the presentations by adding their statements—this was conducted in Portuguese, the language of interaction between researchers and participants throughout the whole process. This tool allowed the social actors to reflect upon their situation and, as a result of this reflection, some discussion of and encouragement towards social mobilization on the part of the indigenous people was observed.

Thus, according to Table 2, all the tools deployed contributed in some way to an increase in social mobilization. Some more directly (direct/immediate feedback), due to their reflexive, dialectic and educational nature, such as the talking map, the photo panels, debates, talks and courses, petitions, the community newspaper and the research on sanitation conducted by the indigenous people themselves. Other tools contributed in an indirect way (indirect/non-immediate feedback) such as questionnaires, interviews and specific studies about solid waste, water and soil quality, as well as the parasitological examination. During the presentation and discussion with the indigenous people about the results of these tools, answers to earlier questions were provided that facilitated the credibility of the methodology (lowering resistance) and contributed to the understanding on the part of the population about the relevance of the issues being studied.

In order to better present the relationship between overcoming challenges and feedback of tools with different characteristics, we will take as an example the first approaches in the field study in which, in the process of conducting interviews and developing talking maps, concerns on the part of the indigenous population about the quality of the water and intestinal parasitosis were

observed. These demands were met by specific tools, creating highly positive opportunities: the ability and availability of the research/intervention system to be methodologically adapted, incorporating the demands of the participants; the use of traditional research tools in order to answer specific questions necessary for the advancement of the project; an increase in trust in the researchers/researched relationship; an increase in the self-esteem of participants; the prompt addressing of the population's concerns; and the provision of answers that were greatly valued in subsequent situations—used in the future deployment of intervention tools within a dialectic perspective (Freire, 1987). For Cashman *et al.* (Cashman *et al.*, 2008), researchers and social actors in participatory research have complementary roles and there are periods of greater or less co-operation within certain action research projects. This does not invalidate the participation in the process.

Specifically for geo-referencing and report writing, the production and discussion of these tools assisted with the interpretation and appropriation of hybrid knowledge produced are also considered to be a challenge to participation.

In order for this new knowledge to be appropriated, we highlighted obstacles associated mainly to the local pluriculturalism, as there are around 15 ethnicities in Iauaretê, belonging to three linguistic groups, meaning that they maintain many cultural characteristics despite being in increasing contact with non-indigenous society for over 80 years. Mythological beliefs are still prevalent among the indigenous groups in Iauaretê in the way they relate to each other and with the environment, and in their interpretation of illness and practices of prevention and cure (Toledo *et al.*, 2009). Analysis through the triangulation of the results (Minayo *et al.*, 2005) of the talking maps, questionnaires, interviews and participant observation revealed that the indigenous population has not yet incorporated into their daily lives knowledge about situations of cause and effect in relation to the health risks they are exposed to, although they acknowledge them. In other words, there is a gap between discourse and practice, which in social psychology is known as cognitive dissonance and in anthropology as bricolage or reinterpretation. Furthermore, despite demonstrating that they acknowledge a sanitary chain logic that is able to transmit diseases, there is still a belief that diarrhoeic diseases, for example, are typical of indigenous people and caused by witchcraft or by an

imbalance in the relations between people, the environment, society and spiritual entities (Giatti *et al.*, 2007).

Therefore, the combined analysis of different tools (triangulation) and, in particular, the results of participant observation during the research process, led researchers to acknowledge this re-interpretation based on a mythological logic and consequently the need for methodological adaptations in order to deal with this unique reality. Furthermore, we stress that this process of appropriation of knowledge is favoured by Community-based participatory research—CBPR— such as action research, in particular through the constant exchange of knowledge between researchers and participants concerning the issues under discussion. Thus, while investigating and acting, researchers and participants develop a process of interactive co-learning, since findings uncovered during action research lead to new learning by everyone (Flicker, 2008).

Applying our framework for analysing and classifying the research tools by their feedback made the Lewin's cyclic spiral (Lewin, 1946) better understood. It then became clear, for example, with the participatory diagnosis, using the talking map and the photo panel, classified as providing direct/immediate feedback in the action research process. This is because the results of these tools revealed a need not only of specific actions such as carrying out educational interventions on issues such as solid waste and nutrition, but also the need of new studies to answer questions brought up by both participants and researchers, such as water, soil and solid waste analysis and the parasitological examination.

Figure 1 illustrates the cyclic framework of combining tools of different natures within a conception of development and strengthening of the participative process, where the aim is to foster empowerment and a proactive stance on the part of the social actors. It is important to highlight that the framework in question, for research and intervention projects, is conducted in a sequence steered by the use of dialectic tools that will directly act to overcome challenges to participation, complemented by non-dialectic tools in order to meet the demands generated during the process.

It is therefore clear that dialectic and non-dialectic tools can complement each other in the study and in being able to deal with complex realities. In relation to this, Waltner-Toews (Waltner-Toews, 2001) identifies that both traditional scientific studies and action research are
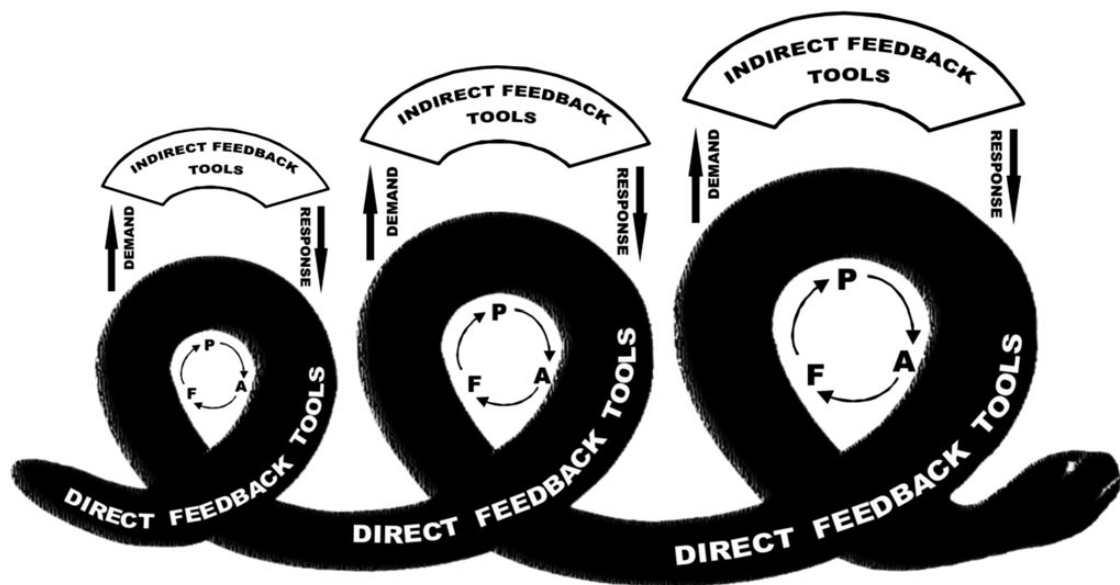
Fig. 1: Framework for combining dialectic and non-dialectic tools for the development and strengthening of the participatory process. Key: an adaptation from Lewin's cyclical spiral (Lewin, 1946), representing the stages of planning (P), action (A) and fact-finding (F) in a continuous process of strengthening participation, specially conducted with the successive use of dialectic instruments (which generate immediate feedback), complemented in a significant way by the use of non-dialectic instruments.
Note: We adapted the design by adding the figure of the snake-boat, a cosmological component of the local culture that represents the mythical explanation of the occupation of the River Waupés.

components of a systemic approach, employed simultaneously in the process of research and intervention. Furthermore, we believe that non-dialectic tools can include the necessary traditional scientific approaches in systemic action research (Morin, 2004), but these types of tools must be applied to attend demands of the cyclic deployment of dialectic tools, which can strengthen the participation of social actors and the feedback process.

As already shown, the results of this action research process revealed a growing social mobilization of the participants, construction of new knowledge, development of new skills and re-signification of values, elements that assist in overcoming challenges to participation. As examples of these achievements, the setting up of petitions and the community newspaper are worthy of note. On the other hand, we acknowledge the limits in Iauaretê in relation to what List (List, 2006) considers to be the highest level of participation, that is, self-mobilization and empowerment. Even if these values are sometimes identified, in order for them to develop into autonomy/pro-activity, there must be profound changes

in the process of policy management so as to foster the institutionalization of participation. This is yet to occur in Iauaretê and we believe that it continues to be a serious obstacle to sustaining this level of participation.

Within the perspective that participatory approaches can promote collective learning through the inclusion of different kinds of knowledge, we consider that this cyclic framework can be generalized also to different contexts as non-indigenous, once we recognize that the contemporary cartography of social exclusion can be expressed even in an urban context where the non-hegemonic ways of thinking are frequently uninvolved (Santos, 2007). As a strong argument for the reproduction of this framework, the identification and combination of direct and indirect feedback orientation can be valued.

FINAL CONSIDERATIONS

Participation is of fundamental importance for three reasons: conducting wide-ranging diagnoses about complex realities; searching for collaborative

solutions to complex problems; and, most importantly, developing a proactive stance among participants so as to provide sustainability to the process of interaction, control, mitigation or elimination of these problems and the respective health disparities.

However, participation is not easy to attain, since different and significant obstacles must be duly understood and dealt with through appropriate interventions. The participatory process can be observed at different levels and, in this article, we have opted to deal with challenges to be overcome by using a scale, which initially, and as a fundamental condition, needs to promote social mobilization, since it is not possible to legitimize any type of social actors' participation without this. Thereafter, a constant effort must be made to sustain mobilization, while seeking to achieve closer collaboration and encourage the appropriation of new knowledge on the part of participants, and ensuring that participants acquire a proactive stance in relation to the problems they face. In order to operate a necessarily cyclic process, we consider the recognition of the inherent challenges relevant as well as argue that the proposed framework can facilitate overlapping the challenges. Particularly, it is important to recognize the different dialectic power among an indispensable variety of tools to be combined in the intervention process.

With the objective of empowering and producing self-mobilization of the social actors (proactive stance), we believe that interventions must be carried out by using a sequence and combination of dialectic tools, which are capable of providing direct feedback. However, this sequence must also be accompanied by tools, which generate indirect feedback, and this can be achieved by using tools, which are common to traditional science in order to obtain accurate results, or simply as an aid to local conditions or to meet the needs generated during the research/intervention. In fact, demands capable of promoting considerable methodological realignment can be generated by the participants, the researchers or both, and they can be used to improve the interpretation of the system in question and to meet, for example, a need or a particular concern of the participants and their life conditions and their relationship with the environment and with current health issues.

Based on this experience, we argue that this framework can contribute to similar projects with participatory approaches, considering that the feedback identification as applied can support an efficient planning and execution for cyclic and dialectic interventions. Considering this experience as a model its applicability is strongly recommended not only for hard to reach realities as for the indigenous groups. This framework can be applied for any situation in which there is a demand to involve popular and traditional scientific way of thinking aiming at health promotion. The constant feedback interactions can be considered useful for any kind of group under health disparities caused by multidisciplinary factors or even in different scales like dealing with system uncertainties and significant stakes, as in the postnormal science proposition of extending the peer communities to cope with the complexity of socioenvironmental and health questions.

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