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Capacity building for adaptive management: a problem-based learning approach

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Abstract

As natural resource issues become more complex, particularly in developing world contexts, there is a growing need for adaptive management solutions. However, the skills necessary to deal with these increasingly complex situations are not always forthcoming in many low-income countries. There is also a growing recognition that capacity building activities are limited in their effectiveness. This article suggests a problem-based learning (PBL) approach to capacity building. Using the example of training courses developed to help natural resource management in Guyana, this article highlights how PBL can help enhance the capabilities needed for adaptive management.

Introduction

Natural resource management is a complex business. Today, in many parts of the world, particularly biodiversity-rich developing countries, we are dealing with increasingly dynamic ecosystems, made even more so principally as a result of direct and indirect human interventions at a range of scales. The social systems that manage, depend upon and affect these ecosystems are also experiencing a shift away from top down, single agency/community governance, and are moving towards increasingly complex multifaceted and unpredictable relationships and behaviours amongst a wide range of stakeholders, from local to global levels. Current thinking in natural resource management has linked these two systems, natural and social, into integrated social-ecological systems (Berkes and Folke, 1998, Berkes *et al.*, 2003), whereby there is an explicit and intimate interdependence between the two systems (indeed, an ecocentric worldview would state that the social is merely a subsystem of the ecological).

At the same time, there has been a move away from expert-led approaches towards greater participation of local communities (Pain, 2004; Leal, 2007), and more recently an emphasis on stakeholders at all levels, in the form of co-management (e.g. Borrini-Feyerabend *et al.*, 2004; Armitage *et al.*, 2007). At the heart of all this is the recognition that complexity, uncertainty and change is inherent in social-ecological systems and many problems emerging from these systems could therefore be described as 'wicked' (Rittel and Webber, 1973). A wicked problem is characterised by an issue that manifests itself only as you try to engage and change it, and in doing so, the problem in turn changes; there is no definite solution that people could aim at; no case history to draw upon; no right or wrong approach to take which would make every stakeholder equally happy; and there is no way to anticipate the consequences of people's actions or environmental change. The best way to tackle a wicked problem is to constantly learn about the changing situation and adapt one's goals, plans and actions accordingly.

Adaptive management, or learning by doing, has been the response to dealing with the complex and unpredictable nature of natural resource management and conservation issues (Gunderson and Holling, 2002; Berkes *et al.*, 2003). Being 'adaptable' requires a range of skills as well as a knowledge base on which to build upon (Mistry *et al.*, 2009a). Key skills needed for adaptive management include risk management, initiative, critical and systemic awareness and reflective practice, and as the number of and/or mistrust between stakeholders involved in management processes increases, skills of negotiation, conflict management and empathy become increasingly important. As there has been calls for a significant shift away from top down, expert (usually foreign) led decision-making, strengthening local and institutional capacity for adaptive management through enhancement of these skills can, as Rodriguez *et al.* (2006) point out, help people in biodiversity-rich developing countries to take the lead in finding long-term sustainable solutions to their own natural resource management and conservation/poverty dilemmas.

Historically, capacity building and training activities, the core of many developed world donor funded natural resource management, conservation and development projects and interventions, have focused much more on delivering a 'product' and trying to provide local people with 'prescriptive advice' rather than developing their abilities to work through the wicked problems themselves (Kaplan, 2000; Black, 2003). Reasons for this include the short timeframe within which many of these

projects run, thereby restricting innovative learning approaches and the development of 'soft' skills that evidently take time to develop, as well as the agendas of funding bodies and researchers (see Mistry *et al.*, 2009b). There is also a need for a change in facilitator mindset; with a move away from dependency on past solutions and trained behaviours, and instead freeing participants to respond uniquely to unique situations (Kaplan, 2000). Armitage *et al.* (2008) propose that capacity building for adaptive (co-)management should "create enabling conditions for learning which...involve a concern with issues of power, culture, institutions, worldviews and values" (p96). Also, as Eade (2007) points out, real capacity is only built when it contributes to enabling participants themselves to change their own realities.

One particular approach through which one can develop the soft skills necessary for adaptive (co-) management is Problem-Based Learning (PBL). PBL can be defined as "a development and instructional approach built around an ill-structured problem that is a mess and complex in nature; requires inquiry, information-gathering and reflection; is changing and tentative; and has no simple, fixed, formulaic, 'right' solution" (http://www.samford.edu/ctls/pbl_background.html, nd). "Problems do not respect disciplinary boundaries" (Pawson *et al.*, 2006, p105), and as such, PBL requires a holistic and integrative consideration to the management and synthesis of knowledge. As with any learning approach, PBL has its strengths and weaknesses (see Table 1 in Pawson *et al.*, 2006, p107), yet it can lay the groundwork for life-long learning (Dochy *et al.*, 2003) which in terms of capacity building for adaptive (co-) management, is essential.

In this paper, we report on and discuss a capacity building initiative developed within an integrated conservation and development project focused on the North Rupununi region of Guyana. A PBL approach was taken to developing training courses for Guyanese staff working in local, district and national organisations and for local indigenous communities to promote adaptive management of their natural resources. This is not necessarily a 'new' approach, since it could be argued that traditional or indigenous knowledge is a form of adaptive management, as the knowledge and skills have been acquired over time in response to changing circumstances (Berkes *et al.*, 2003). However, even for the most remote communities, regional, national and global driving forces, whether they are locally led economic development or foreign extractive activities, as well as global phenomena such as climate change, are bringing new challenges and stakeholders into the frame. The evolution of traditional adaptive management practices, therefore, needs to be complemented and fortified with other forms of knowledge and skills.

The context of the PBL courses

The North Rupununi District is in south-west Guyana, and is the homeland of the Makushi and Wapishana peoples. The savanna, forest and wetland ecosystems support an extremely high terrestrial and freshwater biodiversity (e.g. Wetlands Partnership, 2006). Extensive biodiversity surveys are limited in this region, but surveys undertaken have identified, over four hundred fish species, which in turn supply a food chain to endangered species such as the Black Caiman (*Melanosuchus niger*), Giant Otter (*Pteronura brasiliensis*), Giant River Turtle (*Podocnemis expansa*) and recovering populations of the largest freshwater fish in the world, the Arapaima (*Arapaima gigas*). These species are not only important for conservation but also

supply local people with a range of livelihood activities including subsistence fishing, ecotourism and the aquarium fish trade.

However, Guyana is economically poor, and natural resource exploitation through logging and mining, particularly by foreign investors, is rapidly moving into the country, especially as these resources become exhausted in other regions of the world. With this has come pollution, over harvesting, irresponsible hunting, and unregulated/poorly regulated mining and logging that are resulting in the loss of species in general, as well as more specifically, the destruction of sustainable traditional livelihoods.

Current land tenure in the area includes limited titled Amerindian lands, while most of the region is carved up as state-owned forests, logging concessions and conservation concessions. Many different stakeholder groups are concerned with natural resource management within the North Rupununi – government bodies, non-governmental organizations, local communities, commercial interests and individual people. However, the major issues restricting the proper management of the North Rupununi are the limited (scientific) knowledge (in that traditional ecological knowledge is not taken seriously by non-indigenous stakeholders), high levels of poverty, chronic health issues, low levels of literacy, conflicting and overlapping roles of stakeholders, inadequate land rights for local communities, the current lack of legislation/appropriate legislation on natural resources, and the limited capacity for statutory agencies and communities to monitor and uphold the law (Wetlands Partnership, 2008a).

Our integrated conservation and development project, termed the NRAMP (North Rupununi Adaptive Management Process), was developed to facilitate and build capacity for effective and appropriate natural resource management to promote and sustain human and ecological health in the face of increasing social and environmental change (see Wetlands Partnership, 2008b for full details). The NRAMP is underlined by a number of key principles (see Figure 1) and promotes adaptive management using a 'learning cycle' approach (see Berardi *et al.* 2009). The cycle is simplified into five steps of goal-setting, observing, evaluating, planning and acting. Goal-setting takes place according to stakeholder aspirations and through a process of negotiation. Background information is collected (observed) to help set a baseline to determine whether the goals are achievable and then this information is evaluated according to the goals. Future actions are planned in order to support positive change or reverse negative change, and these plans are put into action by allocating responsibilities and resources. Changes that are taking place through action are observed and evaluated on whether they are in accordance with the agreed plans. The NRAMP involves continuous iterations between these steps, and has been implemented for social and ecological monitoring in the North Rupununi, to support the development and promotion of local livelihoods such as ecotourism, and for capacity building at school, community, institutional and postgraduate level.

Figure 1. A cartoon dialogue illustrating the key principals of the NRAMP (developed by Indranee Roopsind as part of the community course)

Here we report on the community and institutional level courses which build capacity for NRAMP implementation (all materials for these courses can be freely accessed at

www.nrwetlands.org.gy). The level of the community course needed to be appropriate for people who had only completed education to school level and the institutional course was directed at people who had completed some further education course (e.g. diploma, undergraduate degree) or had significant work experience in the field of natural resource management. The courses were designed and developed by Guyanese researchers working on the NRAMP project, supported by UK-based researchers (also the principal investigators of the project). Prior to the development of the courses, the Guyanese researchers had undergone several training courses including ecological monitoring, participatory methods and oral/written communication. They all also had several years of work experience either within their own communities and/or national conservation/development institutions with young people and adults on education, community-based natural resource management and wildlife/environmental monitoring. In addition, they had all significantly contributed to the development of the NRAMP itself, both in intellectual content and written material. The UK-based researchers had a similar skills set, but also had experience of teaching at university level on various courses implementing PBL.

The nature of the PBL courses

The community level course

The main aim of the community course was to strengthen the capacity of community members to develop adaptive strategies for the management of their natural resources and livelihoods. Consultations during the development phase of the community course identified key issues common to many of the communities living in the North Rupununi. These were used as the basis of the problem-based learning approach for the course. Five problem scenarios were used as follows:

- 1) Animal/human conflict – Populations of the protected black caiman (*Melanosuchus niger*) are on the increase, and this increase has led to the crocodilians taking livestock and hunting-dogs, as well as a number of attacks on community members, with many fatalities, especially children.
- 2) Overharvesting/exploitation – Communities have noted a decrease in the abundance of certain natural resources that they subsist upon, including fish and specific plant species, such as the Ite palm (*Mauritia flexuosa*) which is used for thatching of dwellings. At the same time, many community members feel that younger generations do not fully understand and/or appreciate traditional forms of natural resource management.
- 3) Staple-food security – In the North Rupununi, communities are sometimes faced with situations where their farms are damaged when the seasonal rains come too soon and are heavier than expected (a phenomenon which anecdotal evidence indicates a marked increase of late). The flooding damage to farms in turn affects the availability of cassava (the staple food source) and cassava-associated products such as farine and cassava bread (both of which can also be sold for additional income).
- 4) Ownership – Local communities are sometimes taken advantage of by outsiders because there is not enough awareness of the legal rights of communities to manage their traditional lands and the resources found in these areas. To be able to handle and ensure that people are within the remit of the law, awareness of these rights is primary. Awareness also comes with knowledge of the limitations of the law, which would also encourage more effective lobbying for their improvement.
- 5) Livelihood enterprise development - Managing community natural resource business initiatives is an important component of community development. Communities often step into enterprises without first critically analysing the situation

and developing a process for ensuring that the business meets community development aims and is socially, economically and ecologically sustainable in the long term.

Each scenario was developed with a set of resource sheets, outlining key concepts and ideas particular to that scenario (see Table 1), and the NRAMP manual serving as a general guide to adaptive management principles and methodology. Activities were developed for exploring and understanding the key issues associated with each scenario while at the same time developing a range of soft skills including communication (oral and written), team working, critical and systemic awareness, use and management of information, reflective practice and empathy with regards to other perspectives. The course concurrently facilitated the participants to go through the learning (adaptive) cycle for the particular scenario and develop action plans which could then be implemented (see Figure 2 for an example used during the course). The course also fed into the development of livelihood activities being initiated by the communities, including ecotourism, handicraft making, giant river turtle egg harvesting and aquaculture.

Figure 2. Example of learning cycle based on feeding a family (developed by participants on community course).

Table 1 Key topics covered in each scenario of the community course

Each 'problem' was worked on over three to five days, with a couple of weeks in between each training period. This enabled course participants to reflect on what was learnt from the previous scenario and ensured that the implementation of the course did not cause participants to neglect or forsake their individual and community livelihoods and commitments while pursuing the course. Each training event was facilitated by three people, two of which were community members and Makushi speakers. The training events took place in the actual villages, and on average ten people participated from each of the six villages where the course was conducted. Each day concluded with an evaluation of the course by participants (through written questionnaires) and feedback from facilitators on progress.

The institutional level course

The institutional level course aimed to build the capacity of technical staff working in various governmental and non-governmental organisations to undertake an adaptive management approach for natural resource management. This course could also be taken up as a follow-on training course for individuals who had successfully completed the community course. The institutional level course was divided into different sections according to the phases of the learning (adaptive) cycle, namely goal-setting, planning, acting, and evaluating. The various techniques and methods needed in each of these phases, such as scenario and stakeholder analysis, biophysical/social monitoring and data analysis, representation and dissemination, and action plan development, were explored using the PBL approach. The particular scenarios used were mining, logging explorations, ecotourism activities and conservation management (all identified in the course development phase).

As participants worked in groups through the different phases of the learning cycle, they were presented with a distinct scenario. For example, the scenario of a mining

operation was used to encourage participants to think about the 'health' of a river system and the indicators that can be used to monitor the health, as well as the thresholds for each indicator which ought to raise concern. This exercise would then feed into further activities underpinning the observing and evaluating phases of the learning cycle. Figure 3 gives a diagrammatic example developed by participants of a first iteration of the learning cycle for a scenario on Tapir (*Tapirus terrestris*) conservation. As with the community course, the institutional level course explicitly aimed to also develop abilities in a range of key competencies for adaptive management. Teaching and learning methods aimed to foster systemic thinking, ability to manage complexity, critical awareness, conflict management, group working, communication, reflectiveness and empathy. Each day of the course had designated readings on key concepts and ideas, and reference to particular sections within the NRAMP manual. The course was assessed through daily individual assessment exercises and a final group PBL assignment presented in the form of an individual oral presentation and a written group report. Evaluation of the course took place through individual participant reflective diaries for assessing their own progress, a graffiti board for posting comments to facilitators, and a daily feedback form.

Figure 3. Example of learning cycle based on Tapir conservation (developed by participants on institutional course).

The course was implemented over six days and facilitated by two people; one had a position within the governmental environment agency and the other in a district level non-governmental organisation representing the various communities of the North Rupununi and a Makushi/Wapishana speaker. Participants of the course (fifteen in total) came from district and local level non-governmental organisations working in the North Rupununi and national level governmental and non-governmental organisations with a focus on conservation and development.

Reflections on the PBL approach for capacity building

Participation in the community course was excellent, with 95-100% participants attending all five training events. This is a major achievement considering that all participants were engaged in local livelihood activities and therefore had to abandon these temporarily while volunteering to undertake the course. The institutional level course also had 100% participation over the six days. Participants on both courses showed high levels of energy and motivation during the training events, and feedback to the course facilitators was positive and constructive (see Table 2 for participant comments gathered from daily evaluations). This positive feedback is in line with other studies carried out on the use of PBL, though restricted to the academic arena. These emphasise the more enjoyable, challenging and satisfying nature of PBL and the significantly higher attendance of participants (Albanese and Mitchell, 1993; Langen and Welsh, 2006), both leading to long-term retention of knowledge and skills developed (Dochy *et al.*, 2003). In our case, we used real-life problems that community members and technical staff in organisations were tackling. For community members, this provided the impetus to acquire knowledge and skills, in addition to those they already possessed through their traditional activities. This empowered course participants to immediately experiment with change in their problematic situations, which boosted their enthusiasm and motivation throughout the course. Technical staff working within institutions could also directly relate to the scenarios presented as they captured some of the major issues that they were

contending with within their professional lives. As one participant commented “the problem-solving scenarios were good, they showed me how problems are solved in the real world”.

Table 2 Some of the comments made by participants on daily evaluation forms and the graffiti board that highlight the importance of group working and learning

The holistic nature of PBL meant that many participants in the institutional level course were forced to deal with disciplines and areas which they had no formal education in or experience with. On the other hand, local community participants were much better acquainted with the interdisciplinary nature of many of the problem scenarios (their worldviews clearly recognised the integrated social-ecological landscape). Some technical staff participants who came with distinctly natural science backgrounds and/or were not acquainted with the interior/rural parts of Guyana, were less able to do so. As Kainer *et al.* (2006) point out, conventional graduate training related to conservation and development has typically separated the two fields of social and natural science, whereas on entering the workforce, people are required to work beyond the boundaries of the discipline they were trained in. For the technical staff participants, the PBL approach gave them the opportunity to explore, learn and understand the relevance of topics that were outside their past academic education and experience but vital in their present jobs. As an example, Table 3 illustrates the diverse range of indicators developed by participants during group discussions on the effects of mining on social-ecological health.

Table 3 Indicators for effects of mining on social-ecological health developed by participants

Fazey *et al.* (2005) propose that adaptive learning comes about through experimentation with practice and through reflection and thinking. They highlight the importance of trying to look at a problem from different perspectives as a crucial element of experimentation and reflection that needs to be practiced. Being open to understanding how other people perceive an issue makes better learners, and practicing applying ideas to a wide range of circumstances develops flexibility in dealing with new situations (Fazey *et al.*, 2005). Experiential, transformative and social learning are all necessary for effective adaptive (co-)management (see Armitage *et al.*, 2008), and PBL provides a platform for these different learning processes to take place. The institutional level course, in particular, with its diverse range of participants, brought about interesting and very lively debates on the problem scenarios of the course. For example, the problem scenario on logging exploration involved considerable debate, negotiation and reflection among the participants coming from conservation agencies, government bodies and local community NGOs. They all had very distinct opinions and assumptions which were continuously challenged by the PBL activities. As well as highlighting the diverse perspectives, these discussions gave attention to the power relationships among stakeholders, and the skills necessary to reach shared understandings and consensus (e.g. Suchet-Pearson and Howitt, 2006).

This diversity in perspectives further underlines the range of ‘soft’ skills critical for working at the conservation and development interface and for adaptive management.

Ability to learn outside your immediate discipline, think in terms of integrated/nested socio-ecological systems, work in teams, negotiate among competing interests, communicate in a variety of ways and to different audiences and reflect on your own values and that of others (Kainer *et al.*, 2006; Martinich *et al.*, 2006) were all actively promoted in the PBL approach of the courses. Participants in both the community and institutional level courses showed significant progress and improvement during the courses in many of these soft skills, as monitored during the daily assessments, allowing them to be more effective in addressing future complex and messy problems. Nevertheless, further monitoring and evaluation of the participants would be necessary to substantiate the effectiveness of the PBL approach for long-term learning and impact on the ground resulting from the courses. However, at the community level, the PBL approach allowed communities to develop real action plans for immediate implementation based on adaptive management principles. Some of these related to the village level, where for example, one village decided to start regular monitoring of giant river turtle eggs to help ecotourism activities in the nearby wetlands. In another village, working through the food security scenario revealed the increase in several pest species, such as ants, which were significantly affecting crops in fields. This village then decided to focus on this issue as their 'problem'. In other cases, such as the Black Caiman/human conflict issues, action plans from the community course were taken to a national level stakeholder forum which included representation from major government departments and non-governmental organisations, as well as community members. A further iteration of the adaptive learning cycle at this forum led to the application and successful funding of further research on the populations of Black Caiman in the North and South Rupununi. This information, together with socio-economic data already collected, will be used to present a case to the IUCN Crocodylian Specialist Group to lower the status of the Black Caiman, thereby allowing sustainable harvesting and management of the black caiman around human settlement. Both these cases illustrate that a PBL approach to capacity building can have the potential to make immediate and practical changes to participants' lives.

Although a PBL approach to capacity building activities can be extremely rewarding (for both participants and facilitators), it takes time to develop and implement, and depends heavily on the attitude and skills of the facilitator. Time is a major issue; in the context of a country such as Guyana. Effective capacity building cannot take place within the timeframe of normal conservation and development projects of three to five years, but require long-term commitment and support to be successful (Baral *et al.*, 2007; Mistry *et al.*, 2009b). In fact, most of the negative feedback comments by participants, of both the community and institutional courses, were that more time was needed. The courses described here took over a year to develop and were championed by in-country researchers on the NRAMP project. However, as the future facilitators of the courses, it was vital that these Guyanese researchers had first-hand experience of developing the courses. This ensured their own understanding of knowledge and skills required for adaptive management while building their capacity to present teaching materials and activities in forms that were appropriate for the social and cultural backgrounds of the likely participants. Running the capacity building events, particularly the community course, was not straight-forward or pre-set in a fixed plan, and took place over a number of months. This was to account for the availability of community members, the weather (seasonality of rains and the disruption this brings to communication and transportation links) as well as allowing enough time for

community members to reflect on their learning in between training events. This took considerable commitment on behalf of the facilitators. However, the facilitators of the courses have a long-term commitment to social justice and ecological sustainability in Guyana. This guaranteed their high motivation and contact with participants despite having to contend with daily working conditions of inadequate communication networks, uncomfortable environmental conditions and risks to health. This strongly resembles the 'friendship work' approach to capacity building advocated by Girgis (2007).

Crucially, the PBL approach relies on excellent facilitation skills. Hagmann and Chuma (2002) describe facilitation as "asking the 'right' questions at the 'right' time in order to enhance peoples' critical self-reflection, discovery and self-awareness without pre-empting the responses. Facilitators lead the process but not the outcome and direction" (p27). The facilitators of the two courses described here were the in-country researchers who had developed the courses. Although all of them had prior facilitation experiences and had passed through the education system in Guyana, some to graduate level, their abilities in areas such as written/oral communication, reflection and, critical analysis were still underdeveloped in many ways. This is highlighted by the National Development Strategy for Guyana (2002) which concluded that many students completing school and university education still had low levels of literacy and little or no opportunities for developing into functionally literate citizens (for more details see Wetlands Partnership, 2008a). Critical thinking was a particular area in which facilitators found difficulty. We found that a frequent misunderstanding of 'critical reflection' skills is that these are seen as equivalent to 'complaining'. But, as Foley (2008) defines it, critical thinking is about "learning to think differently, to be inquisitive, to ask questions – and to be able to discriminate what is important or useful from what is not" (p775). He goes on to say "it takes time and a lot of coaching and on-going development" (p775). And in fact, the facilitators of these courses did improve their own facilitation skills through the process of developing and implementing the courses, setting up facilitation feedback sessions where problems could be aired, shared and discussed, and "a commitment to learning as *intrinsic* to...interventions to build the capacities of others" (Eade, 2007, p634).

Conclusion

Some form of training or capacity building is included in nearly all projects for integrated conservation and development. Yet much of this is still focused on the transfer of technical and discipline-specific skills (Garnett *et al.*, 2007). Adaptive (co-) management as an approach to dealing with the conflicts and challenges of the conservation and development interface requires technical/discipline-specific skills, but also, and probably more importantly, a whole range of 'soft' and personal skills. Using PBL in capacity building can help to enhance the capabilities in these soft skills, but will require a longer term commitment to individuals, communities and institutions. And fundamentally, there is a need for a shift in approach; from delivery of expertise to facilitating others' process of discovery and learning. However, as Eade (2007) points out, "you can't build capacities in others that you don't have yourself. And if you can't learn, you can't teach either" (p637). The NRAMP project was therefore also a learning experience for the project's researchers and facilitators, as well as the UK-based principal investigators, who at times had to struggle with their own lack of capacity (Mistry *et al.*, 2009b). Nevertheless, as Eade concludes: "disengagement is not an option" (Eade, 2007, p637).

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