Capacity building in the field of climate change adaptation - First experiences from a rural research and development project in Germany

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Abstract

"Adaptation to climate change" as a new field of knowledge challenges agricultural and horticultural (vocational) education and extension. Farmers and horticulturists are confronted with vague scientific findings at best. A broad variety of global climate scenarios is "projected" onto regions and exact predictions are usually not possible. Often, personal observations and experiences seem to contradict scientific assertions. Under this condition farmers and policy makers must decide about future land use.

What does this imply for capacity building? How to transform insecurity into concrete educational measures and programs?

The authors discuss their first experiences within a German R&D network (INKA BB) in which they develop capacity building programs. Two examples from urban agriculture / urban gardening will be used as case studies. Strengths and weaknesses of the development processes and their management will be discussed.

Since the topic is complex and adaptation is a continuous activity, learning in connection with climate change adaptation ideally begins on elementary level, continues in higher and vocational training, and does not end with extension. In other words: "learning chains" must be developed which enable life-long learning in formal, non-formal and informal learning environments.

Competencies are needed beyond classical technological and economic skills. Problem solving - from problem perception, analysis, generation of alternative solutions, to implementation and evaluation - with a key competence in critical analysis and reflection of contemporary research findings - gain in importance.

In INKA BB, participation is seen as axiomatic. As a consequence, an action-oriented, participatory approach has been chosen which enables mutual learning among partners from research, formal and informal, elementary, higher and vocational education.

A crucial point is the question of "Who could be the bridge between science and the educational practitioner?" In INKA BB, a specific working group (the subproject on "Knowledge Management and Transfer") facilitates the development processes and therefore plays a liaison role between theory and practice. In the long-run, sustainable ownership of this process must be achieved. A combination of network building, mutual learning in permanent work groups, provision of technical trainings, and joint planning, testing, monitoring and evaluation is seen as a precondition.

1. “Adaptation to climate change”: a challenge for agricultural and horticultural extension and education

Even if the existence of a man-made climate change is nowadays not questioned neither in science nor in society, the main concern still is on mitigation and not on adaptation. Only recently the focus is shifting. Assuming that adaptation will be *“... one of the most important tasks dealing with climate change*” in future, the German ministry for education and science (BMBF) is giving support to seven large research and development networks within its research priority "KLIMZUG – Managing climate change in the regions for the future": „*Even with a successful climate protection strategy a short-term reduction of the expected climate change is not possible. Therefore there is an urgent demand for society, economy and politics to develop new and improved methods for climate change adaptation*” (KLIMZUG).

The main problem in this context is uncertainty. Nobody knows and can predict when, in which intensity and how exactly changes will happen, neither on global nor on regional level nor at a specific location (farm, city etc.). Uncertainty hereby covers amongst others insecure scientific knowledge, misleading communication of the effects, and inconsistencies between scientific knowledge and individual experience.

The reasons for insecure science-based knowledge are manifold (Dessai and van der Sluijs, 2007). They may lie in the variety of scenarios themselves, in statistical variances - changes therefore can only communicated as probabilities -, in a general lack of knowledge which might be partly non-reducible (large chaotic systems might not be model-able at all), and in so-called “unknown unknowns” of causal relations between climate factors and future development of technologies and societies. An example for the latter might be the awareness of climate change itself: only few years ago many scholars assumed a next ice-age in the near future.

Another factor for uncertainty is the communication of the results. Nowadays we all are being confronted with a wide range of “scientific” scenarios, impact models and theories. Even if communicated in a rigid manner stressing assumptions and probabilities: what is perceived by a lay audience is often inconsistent or even contradictory. Particularly people without scientific background might easily be confused by the multitude of statements. Furthermore, these findings, particularly extreme scenarios, are often delivered by the media (and not only in the yellow press) as facts. Meanwhile a diverse picture of scientific and semi-scientific statements confuses more than informs people on the state of research. One effect of this might be that people not take climate change seriously anymore and thus remain inactively (Grothmann, 2005).

Finally, climate and therefore climate change cannot be observed in daily life. Climate itself is a complex concept, usually defined as a 30-year average of indicators such as temperature, humidity, precipitation and others. It is weather which humans experience. All too often, personal observations and experiences seem to contradict scientific assertions. An example might be relative cold and rainy summers during the last years.

Under this condition of insecurity actors must decide about future land use. It is certain that the “adaptability” of individuals differs (Grothmann, 2005). Furthermore there seem to be two different basic strategies to adaptation, namely the scenario-based decision-making (actors search solutions for “what happens if”) and a strategy which might be described as “broad positioning” in which actors are prepared for “almost no matter what happens”(nordwest2050, 2010). Whatever their basis strategy and their adaptability is, decisions must be made for concrete situations and usually in social groups, i.e., usually they have to be negotiated and compromises have to be found.

What does this imply for capacity building? The main challenge for education and extension is to qualify various actors for this kind of decision-making, often in groups, under uncertainty and without concrete scientific recommendations. Since climate change is a long lasting topic, actual and future decision-makers are to be qualified, i.e., capacities are to be built in extension as well as in youth education.

In this paper, the authors discuss their first experiences within a German R&D network (INKA BB) in which they develop capacity building programs. Two examples from urban agriculture / urban gardening will serve as case studies. The approach as well as strengths and weaknesses of the development processes and their management will be discussed.

2. The INKA BB approach towards capacity building

2.1. The Project

The objective of the *Innovation Network Climate Change Adaptation Brandenburg Berlin* (INKA BB) is to develop adaptation strategies and strengthen adaptability of actors in the field of land and water management *"... to ensure the sustainability of land and water use in the region under changing climatic conditions and to promote climate-adapted health management*" (cf. INKA BB). Interdisciplinary and transdisciplinary communication and participation are working principles and a close collaboration between researchers and stakeholders has been established on different organizational levels.

The general aim of the network can be defined as capacity building, seen as joint learning on climate change adaptation amongst various stakeholders of science and practice. It takes place at different levels with specific focuses:

- Partners from science and practice jointly develop solutions for specific subjects in the sub-projects; capacities are built in subject matter as well as in transdisciplinary communication;
- The sub-projects are also responsible for knowledge exchange with experts such as farmers, extension workers and politicians in their respective field of knowledge through measures such as demonstrations, field days, seminars etc.

Furthermore, a working group has been established in order to accompany, supervise and systematize knowledge transfer processes and communication with the main objective of methodology development. A number of pilot projects are established and specific research is carried out in the development of communication and learning platforms as well as in curricula development.

In the following, our basic assumptions and principles regarding knowledge transfer and education are shown. They concern education/learning processes, environment and organization of learning situations, and communication and cooperation among the actors:

2.2 Knowledge transfer, education and learning

The management of knowledge transfer is a tricky thing, firstly because many forms of knowledge exist such as theoretical, scientific and experience-based knowledge. From the research perspective, the main issue might be how to transfer scientific knowledge. Such knowledge usually is more or less abstract and has often no clear distinctions between book knowledge, hypotheses, and more or less testified theories. Practitioners usually need practical knowledge.

There is still a big discussion whether knowledge transfer can follow the line from research via dissemination to the end-user or it must be bi-directional communication. In our opinion, the paradigmatic discussion between "transfer of technology" or "dialogue of all stakeholders" is somehow misleading even if we think the latter is a must concerning the research process dealing with complex and badly defined problems such as climate change. Communication with and to an extra-consortium audience depends on the issue and the target group itself. In case of easy technology packages a linear transfer might be suitable which is certainly not sufficient when it comes to changing a farming system.

There is one basic fact which often is neglected when considering education: Knowledge is a highly individual matter. Information can be transferred but knowledge is information perceived and valued by an individual and therefore principally not transferable. “Knowledge transfer” is therefore rather a matter of individual or social learning. And it is always the learner and not the teacher who decides about how and what is learned and insofar “... the main purpose of education … is not to teach that subject but to help the students to learn that subject. There is no point in teaching if the students are not learning” (ROGERS and TAYLOR, 1998). This has consequences for the learning process, the role of the educator, and for the learning arrangements.

Firstly, education units must fit to the needs of the learners. This demands a need-assessment when planning the curricula. Participation in this stage is crucial. The more learners or end-users of knowledge are involved in the definition of what, when and how to learn, the more they have ownership on learning and the more sustainable are the curricula.

Secondly, learning is more than only acquiring new or changing existing knowledge. Theoretical knowledge must be tested against experience and repeatedly reflected, in other words, all learning is experiential (KOLB, 1984). Such learning is always driven by the individual. Therefore the role of the teacher is to facilitate the learning process rather than tell the audience what and how to learn or how to behave.

Thirdly, learning is a continuous process (UNESCO, 2009). There are different ways and settings of education (ROGERS and TAYLOR, 1998):

- Formal education usually is based in official learning institutions such as schools and universities. Learning as well as curriculum development is highly organized and terminal, i.e. examination oriented. Usually the end-users are not involved in curriculum development;
- Non-formal education is provided by a range of organizations, it is usually open-access, can be located anywhere, is application-oriented with changing content, and therefore often a continuing approach;
- Informal education by its nature “... does not occur in a planned way but rather as a by-product of other activities” (ibid.); therefore usually it does not have a formal curriculum.

Due to its complex and ill-defined nature, learning in connection with climate change adaptation ideally begins on elementary level, continues in higher and vocational education, and does not end with extension. In other words: “learning chains” must be developed which enable life-long learning (DELORS, 1998, MEDEL-AÑONUEVO, 2001, RYCHEN & SALGANIK, 2003, ALLMENDINGER et al., 2011). Additionally to this vertical integration we see a need in “horizontal integration”, i.e. networks and cooperation of formal, non-formal and informal learning (OUANE, 2003).

This leads to the concept of competencies. Even if learning of an individual is successful, this does not necessarily lead to behavioral change and development. “The competent performance or effective action implies the mobilization of knowledge, cognitive and practical skills, as well as social and behavior components such as attitudes, emotions, and values and motivations” (RYCHEN & SALGANIK, 2003, emphasis added). Key competencies include particularly the ability to jointly solve problems in various social groups and the ability to learn (RYCHEN et al., 2003). With respect to climate change adaptation, competencies are needed beyond classical technological and economic skills. “*Gestaltungskompetenz*”, i.e., *“... drawing conclusions on environmental, economic and social developments in their interdependence, on the basis of*

analyses of the present and studies of the future, and then using these conclusions to take decisions and understand them before implementing them individually, jointly and politically" (DE HAAN, 2007), enables problem solving - from problem perception, analysis, generation of alternative solutions, to implementation and evaluation.

It has to be stressed that in our view generalizing competencies makes less sense. Competencies are always specific to a certain task. Since tasks are manifold and changing, one competency is of special importance: "Learning to learn implies the assessment of how new tasks can be tackled, the capacity to transfer competencies to a new situation, and the readiness to engage in a task-oriented activity" (Ouane, 2003). Thus capacity building aims at the ability and motivation to learn, learning itself, and the competencies to solve problems individually and in groups.

2.3. Participatory curricula development and action-oriented research

The INKA BB approach follows the principles of participatory curricula development. A curriculum is hereby in contrast to a syllabus seen in its broad sense, dealing with the content, methods of teaching and learning, with the aims and objectives but also the ways in which its effectiveness is measured (ROGERS AND TAYLOR, 1998). In order to develop science-based and practice-oriented curricula along the learning chain a close cooperation with specific partners from educational practice and science – particularly with researchers from the respective INKA BB sub-projects – is a precondition. Interdisciplinarity and transdisciplinarity thus are seen as axiomatic. While interdisciplinarity usually is oriented towards the generation of knowledge, transdisciplinarity goes one step further and aims at solving the problem. Transdisciplinary research therefore usually is a form of action research (KLEIN et al., 2001).

Participation is seen as an interactive process which enables all participants to formulate their interests and objectives within a dialogue, which leads to coordinated decisions and activities as far as possible (AGILNP, 1995). If transdisciplinarity describes the communication and cooperation amongst relevant actors, participation describes much more the underlying decision-making processes. Concerning the development of educational programs, it is necessary to "*... involve the participants as far as possible in making decisions about their own education, such as what to learn, when, where, how and in what order*" (ROGERS & TAYLOR, 1998).

This raises the question of who are the actors and target groups of our research. It was the explicit objective to develop a series of learning units along the education chain. Therefore it may not be possible to involve all the end users. Another aim was to develop programs in a way that they are transferable models towards other situations. Here the concept of multipliers is to be introduced: Multipliers are experts in their educational field and furthermore interfaces to other social groups and/or the end-users of a certain program. This can be a teacher who facilitates learning of students, an environmental educator, an activist of an informal group or an engaged student who motivates others.

With respect to the participatory development of educational units which enables individual learning in different stages of the learning chain, an action-oriented methodology has been chosen, a mutual iterative learning process of situational analysis, planning, implementation, evaluation and re-planning of various educational "building blocks". These processes and results are documented for further scientific studies.

5. Case one: Climate-adapted educational gardens

The objectives of this project in the field of non-formal and informal learning consisted in participatory development of educational methods and materials to sensitize and educate children and youth as well as interested people from the neighborhood. The staff of a children and youth club should be empowered to plan and use these measures independently.

Together with young members of the youth club and social workers the fallow behind the club was turned into a garden which highlights different aspects of climate change adaptation. Six learning stations could be established so far: In station 1, “Tomatoes”, a small experiment compares the growth and harvest of three varieties of tomatoes combined with two different irrigation methods. Station 2, “Exotic plants” demonstrates several exotic plants, such as chili, artichoke and cape gooseberry, reflecting future changes in crop growing. “Mobile science” in station 3 consists of mobile boxes with two different varieties of salad which are cultivated in two types of soil. Illustrating differences on water demand of several herbs, an “Herbal spiral” makes up the forth station. Station 5, “the green facade” demonstrates an assortment of suitable plants and broaches the importance of “green in the city”. It is planned to add a sixth station on cereals, comparing irrigated and non-irrigated plots. As a seventh station the topic of water-storage might be included.

The garden and particularly joint work in the garden is a vehicle for learning. Furthermore, various learning units are offered which are used to illustrate climate change adaptation practically. Meanwhile, the garden also serves as a medium for teaching adolescents who take a gap year to do voluntary work in the environmental sector. So far eight project days have been implemented, two of them with international young people. These project days involve team work and reflections on the importance and possibilities to adapt to climate changes.

Strengths and weaknesses

In general the objectives could be achieved. The main target groups of the project are multipliers who are in this case the social workers, educators and volunteers of the children and youth club. All of them have participated in all stages of the project cycle. They are involved in garden networks and they have received special training on climate change and adaptation. Educational programs, tools and methods have been conceptualized, successfully implemented and therefore tested. Especially the “climate-garden” encounters very positive feedback by educational educators, garden practitioners and the relevant city authority. The feedback from participants of the project-days was very positive. An increased awareness of and engagement in climate change adaptation seem to be achieved.

On the other hand, somehow unrealistic objectives have been set at the beginning. Originally it was intended also to cooperate with a school. After three meetings with the director and several teachers the cooperation had to be canceled mainly due to a lack of resources of the school staff which was engaged in restructuring their general educational concept.

The input from our site (the “knowledge management and transfer” team, in particular Eva Foos) has been quite high not only for process facilitation but also in implementation activities and support. It consisted in planning, coordinating, documenting and moderating the planning and evaluation meetings. Records are kept which serve for the multipliers as reminders. In the planning step the processor gave advice concerning the didactic design of educational measures. Practical support was given in implementation activities, keeping an eye on the time-schedule, the priority setting, designing methods and material and financing gardening equipment. We moderated the first project-days and still give lectures on climate change at the project days.

Furthermore we are responsible for the monitoring of the developed educational measures and the development of necessary evaluation material and methods and we analyze and present the outcomes of evaluation.

So far the process-management and partly implementation activities relied mainly on us. The partners appreciate regular meetings for planning and evaluation concerning the different measures. The coordination and the participating process binds many resources of the whole project team. Especially on-the-job-training of new volunteers and the garden set-up take much time and efforts. With time passing, these investments seem to pay back. The partners of the youth club mean-while coordinate and realize more independently the implementation of the garden and realize the learning units. Members of the youth club started autonomously to initiate new co-operations and projects on the topic of climate change education and participate in urban garden networks and groups. They started to get involved in public relation measures, present the project in public events and develop concerted material. Thus the development process has become a routine among the stable multipliers. “Ownership” of multipliers obviously has increased and we are able to concentrate our activities on core issues such as advice concerning the garden and the project days and the development of adequate material to simplify the incorporation of new volunteers and to enable the staff to realize the measures on their own. Nevertheless we try to stay informed on the ongoing activities and plans in the club and are available for supervision if demanded.

A main strength is the inner-network cooperation with researchers from other sub-projects, in this case the one on “climate change adaptation in horticulture”. Our partners are giving advice concerning practical issues on gardening as well as how to conduct research-based learning experiments.

A weakness is the persistence of group membership and dynamics in participation of partners. Members fluctuate and the engagement is unsteady, especially that of the volunteers. As a consequence, inaccuracies in communicating the concept of the garden occurred especially by new members, such as putting the main focus on the practical gardening neglecting the issue of climate change adaptation.

6. Case two: The working group on urban gardens

It was intended to establish an informal work group on “Educational Gardens on Climate Issues” in order to a) raise awareness to the need for adaptation to climate change, b) to develop adaptation strategies by means of practical learning and c) develop transferable concepts for educational gardens to convey the topic of climate change adaption to different end users.

The group originally consisted of multipliers from different garden projects, namely researchers from the INKA BB-project “Climate Change Adaption in Horticulture”, a teacher who is active in school gardens, a gardener who works with mentally disadvantaged people and one of the founders of a hybrid “enterprise/community garden”.

According to the basic idea of action research, the first step consisted of a preliminary diagnosis on the base of a first situation analysis mainly in form of informal talks in the core group. Several meetings and bilateral discussions have been held for action planning of a first activity, the “Mobile Science” project (which later on has been integrated in the educational garden, see above). This was then implemented at different sites by three different partners. Towards the end of the growing season, an evaluation was conducted in the form of open interviews.

The evaluation of the experiment showed a need for more principled discussions. In the course of the following meetings a strategy for the group has been elaborated: the aims of the group shifted towards a more free interpretation of the adaptation topic and the exchange between educational garden projects concerning their educational methods and other concrete issues such as plant genetic resources. During the next growing season, a series of trainings on climate change adaptation and plant genetic resources was conceptualized which are meanwhile being implemented.

Strengths and weaknesses

There was an almost immediate output with the first prototype of the “Mobile Science” crate which then could be used for other transfer measures of INKA BB such as the INKA BB presentation at an international agricultural fair. The further development of concrete material and various presentations was likewise fast proceeding. Participants show a very high appreciation for the possibility to network and communicate on a semi-formal level during the meetings.

Flexibility and dynamics of the working group has enabled to adjust on participants' needs. They have shown a high interest particularly in the trainings which is shown by an increasing number of members of the group. For example the topic of plant genetic resources on the practical level of old varieties´ seed propagation draws attention and makes the complex issue of climate change adaptation more tangible. It also allows the participants to combine various interests in the working group.

The type of the group´s organization stimulates the participants´ momentum since the researcher in the role of the facilitator only organizes and facilitates the meetings but does not oversee the participants´ individual projects. The ideas and the basic structure of the group and the meetings are also a product of the participants themselves.

As in the first case, our input was higher than originally intended. Apart from facilitating the process and conducting evaluation we (respectively Julia Jahnke) are also involved in implementation activities in this case feeding in basic information on educational Gardens and communication of climate change adaptation and about the concepts and preliminary results of INKA BB. Limited resources of the facilitator due to other responsibilities in the project are certainly a hindering factor. Theoretical and practical experience of the facilitator might be helpful in communication with multipliers since she has worked in the urban gardening scene for 10 years knows many of the gardens, the parameters and quite a few of the actors.

One particular strength is seen in the already existing multiplier-effect. Partners from very different learning sites - school gardens, a youth club, a therapeutic institution, community gardens, intercultural gardens, small enterprises, and a volunteer group with a new approach on organizing the commons - communicate the issue to their respective campaigners and colleagues.

One weakness again is persistence. The work on the complex subject (the topic climate change adaptation itself, and communicating it on top of that) is demanding a certain degree of intensity, especially concerning the timely input of participants. Many participants are not able to regularly attend the meetings. The fact that averagely half of the group is changing at each meeting makes it more difficult to work consistently and build the meetings up on each other. Nevertheless a core group of actors enables a continuous discussion.

7. Discussion

The communication problem concerning abstract knowledge on climate change as precondition for planning adaptation strategies is still remaining. We see a necessity to narrow down the issue to very concrete and practical subjects such as the experiment with soil and salad varieties in order to gather practical experience. Theoretical knowledge must be transferred, too, for which provision of trainings and presentations seem to be quite useful and usually accepted if not demanded by multipliers.

Climate change adaptation hereby seems not to be an educational topic which can stand alone. Participants often have other priorities in action and in learning, in our case the gardening itself, on which adaptation issues nevertheless can be added. Urban gardening seems to be a good medium to vividly communicate adaptation issues to the lay audience.

The method of participatory planning and evaluating in recurrent circles seems to fulfill the objective of “learning to learn”, especially learning how to analyse ones’ own actions, actions of others and develop new strategies from that.

This leads to the question of how to transfer experiences in other fields of farming and horticulture and particularly to more formal learning such as vocational training and extension activities. The two examples from urban gardening and mainly non-formal and informal education have been chosen due to practical issues; these two projects are relative far developed.

We are pretty sure that the basic action-oriented learning approach is transferable. In the long-run, a high level of ownership of this process must be achieved. Actors engage themselves the more in climate adaptation issues the more they can influence the whole process, in particular the situational analysis which is a key to need-orientation. In our opinion, multipliers should particularly be in charge for all forms of implementation of educational units. This often is not yet achieved due to a lack of resources for such experimenting, particularly in the formal system. Joint and ongoing planning, implementing, monitoring and in particular evaluation allows flexibility and adjustment to school organization and needs of learners even if syllabuses often do not leave much space and might be adjustable only in the long run. the other side of the coin is the enormous time and personal resources needed in such a process which might be a criterion for exclusion in the field of formal education

Vocational education might demand the existence of more clear research findings. The critical analysis and reflection of these and self-organized development of solutions for their daily and professional life seem to be of crucial importance.

For institutionalization of educational units, motivation and willingness of the multipliers to institutionalize the work beyond the INKA BB project is crucial. Personal sympathies between the partners and for each other´s projects create a very positive and supportive atmosphere at the meetings and also allow to easily integrate newcomers. A crucial point within transdisciplinary research networks such as INKA BB is the question of “Who could be the bridge between science and the educational practitioner?” In INKA BB, a specific working group (the sub-project on “Knowledge Management and Transfer”) facilitates the development processes and therefore plays a liaison role between theory and practice. In future, this function might have to be institutionalized within the educational system.

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