14 Experiential Training of Farmers and University Diploma Students in KwaZulu-Natal and the Southern Cape

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Abstract
This practitioner reflection reports on 30 years of training agroecological farmers in various African contexts. It argues that good theory should be drawn out of good practice, to help farmers to adapt to climate change while producing nourishing food sustainably. Currently, training is often provided by agribusinesses with an interest in promoting the use of their inputs, rather than concentrating on empowering farmers to develop environmentally sound farming systems using locally available resources. Three organic training systems are examined. On-farm systems exposed trainees to farm management and marketing, but not in their familiar context. Training on-site at community gardens was effective only when there was good mentorship and project support. In a university diploma context, 18 months of theory with regular practical activities prepared students for a year of on-farm practical learning. This was supported by guided reflection, and followed by 6 months back in the classroom, integrating theory and practice. In all three systems, learners were challenged with practical activities, after which theory was developed. Organic systems were found to help learners to use locally available resources, especially water, more efficiently. Exposure to good practice, and guided reflection on this, helped learner farmers to understand and integrate good theory into their practice, while practical challenges helped learners to understand what theory means, and how it should be adapted to the local context.

Introduction

> Trainee: I have attended an organic farming course.
> Farmer: So, can you feed yourself?
> Policy maker: If not, why not, and can it feed the world?
> Economist: But do you have a market? Is it viable?
> Politician: This is an expensive investment; what spin will it give me?

How can the interests of the multiple stakeholders above be met in farmer support programmes, given climate change, food insecurity, poor infrastructure and declining food quality? This chapter will argue that farmer training should assist farmers to understand agroecological principles through guided practical experiences. By drawing good theory out of good practice, farmers adapt to the challenges of climate change while producing nourishing food sustainably. This chapter is a practitioner reflection, which applies the above process by showing how three training approaches each yielded insights which informed conceptual shifts strengthening participation and community development. The gap between the promise and the reality of

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 Organic Food Systems: Meeting the Needs of Southern Africa (ed. R. Auerbach)

participation and community development has been well documented (Carpenter *et al.*, 2016); closing this gap requires structured experiential learning processes.

Addressing food insecurity in times of climate change involves multiple stakeholders. The technical goal of learning about sustainable soil management is at the heart of farmer training, along with plant and animal production skills. These are the tools of the trade of productive farmers the world over. Policy makers are looking for interventions which are 'game changers', where there will be maximum impact on regional food security. Economists tend to be sceptical about unproven interventions unless there is evidence of a growing market, and of profits to be made from products for which there is a demand. Unless political support is forthcoming, local initiatives are unlikely to receive government funding, and may instead attract opposition (UN, 2015). In particular Sustainable Development Goals 2 (zero hunger), 12 (responsible consumption and production), 13 (climate action) and 15 (life on land) require agroecological approaches (UN, 2015). Farmer training therefore has to equip learners to understand the valid concerns of all of these stakeholders.

Climate change imposes a number of new constraints on agricultural production, in terms of adaptation strategies (Elbehri, 2015). Already economically and/or socially vulnerable communities have a new set of challenges to deal with: (i) flooding; (ii) higher temperatures; and (iii) drier crop production conditions (Ayers and Forsyth, 2014). The role of carbon in soil and the atmosphere, decreasing availability of water, dangers of environmental pollution by agrochemicals and fertilizers, the need for conservation of non-solar energy, difficulties of producing food in a warmer environment, and with less stable rainfall patterns, political uncertainties brought about by increasing numbers of climate refugees and the social instability associated with the rising price of food, are all issues which modern farmers will have to deal with (IPCC, 2014; Chapter 7, this volume).

Farmer training takes many forms. Short courses provide detailed technical information about innovations. Government extension services provide some guidance to small-scale farmers. In South Africa (SA), extension study groups often involve large-scale commercial farmers in comparative learning with peer groups of similar progressive farmers; this allows comparative economic analyses so farmers can assess their own performance against that of comparable nearby farms. For small-scale farmers, combinations of short learning programmes, farmers' days, study groups and longer in-depth courses have been found effective, in combination with problem-solving research.

Much of the training on offer is currently provided by agribusinesses, as they have an interest in promoting the use of agricultural inputs such as fertilizers, agrochemicals, seeds, tractors and other farm inputs. Often, these sectoral interests promote environmentally dangerous short-term technologies. Policy makers should be promoting sustainable approaches which do not destroy the resource base from which they emerge. In the context of climate change, carbon needs to be sequestered in the soil as soil organic matter (SOM), rather than contributing to global warming in the form of methane (CH_4) or carbon dioxide (CO_2). Profitable organic farming systems which use water efficiently, recycle plant nutrients, sequester carbon in the soil, use energy efficiently and promote biodiversity while being good for the environment do not often use high levels of agricultural inputs, and therefore lack investor support. However, if it can be shown that these organic systems promote food security, there is political gain in promoting techniques which are environmentally sound, which relieve poverty and which promote health through reduction in poison use and improved nutrition.

Finding effective ways to train farmers so that they gain practical skills, find viable markets, are able to scale up their impact and which are popular with the electorate will be a major part of bringing about sustainable development interventions in the next decade. This requirement then begs the question: How can aspiring farmers gain farming and marketing experience, so that they draw out of this experience ecologically sound production approaches which attract young farmers and farm employees, and which are economically profitable?

The aim of this chapter is to report on practical approaches gleaned from the past 30 years, during which I have developed learning materials for agroecology in various contexts.

As Research Co-ordinator of the Farmer Support Group at the then University of Natal, I was a pioneer of participatory rural appraisal (PRA) in 1991, compiling the first draft of our early PRA manual (Participants, 1993). My work on integrated catchment management led to publication of my doctoral research as a book (Auerbach, 1999). As founder director of the Rainman Landcare Foundation, I developed farmer training curricula in the first decade of this millennium. For 7 years, Rainman trained farmers, sometimes on our farm near Durban, and sometimes *in situ* on various community farms, mostly in KwaZulu-Natal (KZN). We then shared our research and training materials with international organic trainers (see www.ifoam.bio and www.fibl.org). On joining the Nelson Mandela University in 2010, I took on the management of the Experiential Learning programme at the George Campus.

Considering the various approaches available, what has been learned is that good theory should be drawn out of good practice. Successful farmers are right by virtue of their practical success, whether theory agrees or not. Usually, the best way to help learners to explore best practice is to give a few exploratory guidelines, to set up practical learning situations where learners have to find ways of solving problems, and then to assist them with structured group reflection, where some of the learnings from the activities can be recognized and explored (Röling, 1988). This can be followed with the extraction of theoretical principles from practice, and comparisons with the experiences of various case studies. Professor Richard Bawden was able to contribute to the transformation of Hawkesbury Agricultural College in Sydney, Australia in the 1980s, by introducing a business project at the start of first year, compulsory for all students (Bawden, 1992). This allowed students to explore business and production alongside their more formal agricultural studies.

This chapter reports on three approaches to integrated learning for trainee farmers and university diploma students. The various approaches to combining theory and practice in farmer training are evaluated, and the experiences interpreted in the light of adult learning and agricultural extension theory, and throw light on the challenges which climate change will present to farmers.

Theoretical Perspective

Lessons gleaned from experiences in a variety of contexts can contribute to more effective farmer training for agroecology in Africa. Adult learning theory and various theories of extension will be discussed before the introduction of the three case studies. During a sabbatical with us, Bawden helped the Farmer Support Group to incorporate the idea of '**praxis**' into our work with small-scale farmers and showed how experiential learning can link the process of finding out to taking action: what has been found out affects what will be done, and what has been done will affect future ways of finding out (Bawden, 1992; Auerbach, 1994). Praxis is based on Aristotle's idea of the three realms of human activity: *theoria*, *poiesis* and *praxis* (Arendt, 1998); these correspond to theory, production and action, respectively. While Hannah Arendt felt that philosophers should be more involved in practical life, Paulo Freire (1970) defined praxis as reflection and action aimed at the structures to be transformed. David Kolb (1984) argues that praxis is a recurring passage through a cyclical process of experiential learning.

To understand Bawden's conception of praxis, I will start with examining Dr David Kolb's ideas about the adult learning process. In Fig. 14.1, my adaptation of his experiential learning cycle is shown, giving four stages: (i) experience; (ii) reflection; (iii) conceptualisation; and (iv) experimentation. After an experience (which is an actual, concrete, subjectively perceived experience), one may think back on this experience a little later in time. This process of reflection is still subjective (one thinks about a personal experience), but it has now been taken into the abstract world of thought. Having considered carefully what actually happened, one may try to understand the importance of this experience: what does it mean for the future? What can one learn from it? This process of conceptualisation can lead to the formation of an idea about the significance of the experience, which in turn, can lead one to try out ideas, giving rise to further experiences. The conceptualisation is still abstract, but it is no longer subjective. Concepts fit into a wider world of theoretical speculation. A scientific concept will often lead to the formulation of a working hypothesis, leading to a formal experiment.

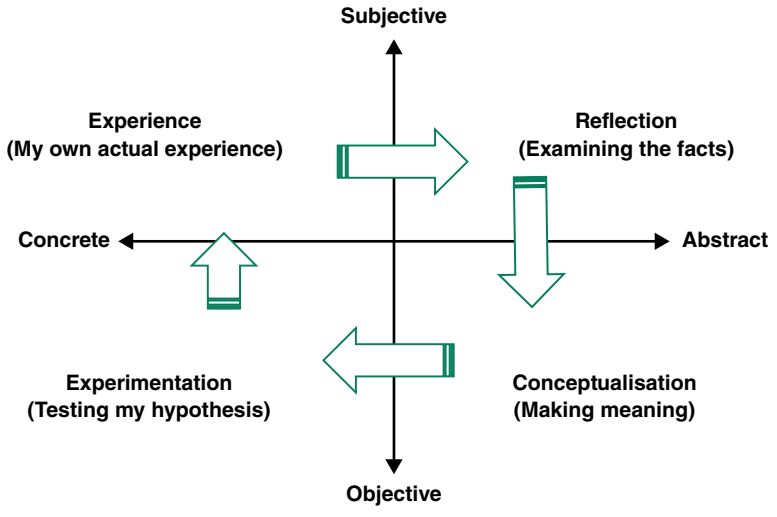

Fig. 14.1. The experiential learning cycle. (Adapted from Kolb, 1984.)

An example is the apocryphal story of Sir Isaac Newton who sat in an orchard in the 17th century, and after seeing several apples falling (experience), reflected on the fact that the apples always fall towards the ground, and then developed the concept of gravity, which he formulated into the Law of Universal Gravitational Attraction according to a book review in *New Scientist*:

> [The Royal Society has re-published] *Memoirs of Sir Isaac Newton's Life* written by William Stukeley, an archaeologist and one of Newton's first biographers, and published in 1752. Newton told the apple story to Stukeley, who relayed it as such: '*After dinner, the weather being warm, we went into the garden and drank tea, under the shade of some apple trees … he told me, he was just in the same situation, as when formerly, the notion of gravitation came into his mind. It was occasion'd by the fall of an apple, as he sat in contemplative mood. Why should that apple always descend perpendicularly to the ground, thought he to himself?*' After his famous experiments (dropping feathers and iron balls from a tower and measuring how long they took to reach the ground), the working hypothesis was confirmed.
>
> (*New Scientist*, 2010)

If this is indeed how adults learn, teachers and trainers should be putting considerable effort into a learning structure which encourages guided experience, careful reflection on the actual experience, followed by conceptualisation (helping learners to examine what an experience means to them in practice), and perhaps a willingness to unlearn some of the prejudices of the past (MacWilliam, 2013 cited in Erasmus and Albertyn, 2014). Erasmus and Albertyn (2014) continue by pointing out that Kolb's experiential learning theory suggests that learning combines grasping and transforming experiences, implying that change is an integral aspect of the learning process. Adapting experiences to a new context can give rise to innovative solutions.

In my experience, many adults do not spend much time examining the facts and reflecting on them, but often jump to a conclusion based on previous experiences and beliefs. This is how racial, gender and religious stereotypes persist in spite of numerous examples of individuals who do not conform to the stereotype (so, for example: 'Yes, but he's a good Jew/Muslim/black person'; or 'That is pretty good for a woman'). Thus my experience may lead straight to my conceptualisation, without any reflection, skipping Kolb's second stage shown in Fig. 14.1. If higher education is to engage in changing prejudiced attitudes, a part of our pedagogy must engage with helping learners to observe afresh what actually happens in challenging practical situations. Often, this is best done through group reflection. When time is given to examining what happens in a group setting with other learners, new knowledge and beliefs can emerge. This process of joint reflection led to Professor

Niels Röling's theory of 'Platform building for resource use negotiation' (Röling and Wagemakers, 1998; Auerbach, 1999). Röling argues that only after a diverse group of stakeholders has been brought together to consider the legitimate needs and activities of other stakeholders who share resources, does a 'platform' of shared concepts and perspectives begin to emerge. Then it may be possible to negotiate reasonably about use of shared resources.

Let us examine Röling's ideas in the context of classical extension theory. The World Bank, in the 1960s and 1970s, adopted the Training and Visit (T&V) system of extension management, based on the theory of Benor and Harrison (1977). The T&V approach is summarized in Fig. 14.2. Head office develops an extension message, based on knowledge generated from research results. Every month, extension officers are called in and given specific training on what the farmers should do with a specific crop that month. The extension officers then visit client farmer groups and deliver the extension message. The assumptions here are that head office is the owner of the knowledge, and that simply by conveying a series of messages to farmer groups through the extension officer, all problems will be solved, and production will increase.

The T&V system was applied for many years in World Bank projects until it was concluded that T&V did not solve farmer's problems because it was not context sensitive, and was too expensive (Anderson *et al.*, 2006). In his work

Fig. 14.2. Training and Visit (T&V) system of extension management. (Adapted from Benor and Harrison, 1977.)

on extension theory, Röling (1988) calls T&V 'Doing it *for* the farmer'. My own early farming systems research and extension (FSR/E) work (Auerbach, 1994), showed how improving maize production in southern KZN had more to do with easing constraints on production than on supplying technical knowledge. The contribution of this work to FSR/E theory was described in Auerbach (1995), and is summarized in Chapter 1 of this volume.

In the 1980s, the diffusion of technology conceptual framework became popular (see Fig. 14.3), where the work of progressive lead farmers or master farmers was assisted by research results, and the 'early adopters' would take up the work of these 'innovators' (Rogers, 1962). Through diffusion of technology, most nearby farmers would then adopt the new practices, forming the 'early majority', followed by the 'late majority' adopting the innovation. Eventually even the last group, 'the laggards', would cotton on. Röling (1988) calls this 'Doing it *to* the farmer'. In practice, although some new technologies do follow the diffusion pattern, it was found that there is considerable adaptation and local modification of new practices to suit different conditions. Very often, diffusion is impeded by lack of access to finance, timeous land preparation, agricultural inputs and knowledge (Auerbach, 1994).

Röling (1988) explains the shortcomings of these two theories, and later introduces a number of participatory approaches where there is a process of co-learning between communities, extension agents and researchers (Bawden, 1992; Röling and Wagemakers, 1998). He calls this 'Doing it *with* the farmer', as the emphasis is on helping farmers to innovate in their particular situation. In summary, Röling has explained three approaches to extension: (i) doing for; (ii) doing to; and (iii) doing with the farmers. So much for extension theory; does it explain how farmers learn? Is the process in fact similar to Kolb's experiential learning cycle, as shown in Fig. 14.1?

In his work at Hawkesbury College, Bawden brings together extension theory and adult learning (Bawden, 1992). Just as Röling argues for the empowerment of farmers through a process of co-learning (Röling, 1988), so Bawden argues that agricultural students will benefit from a process of practical learning based on the concept of praxis. Assuming that head office or

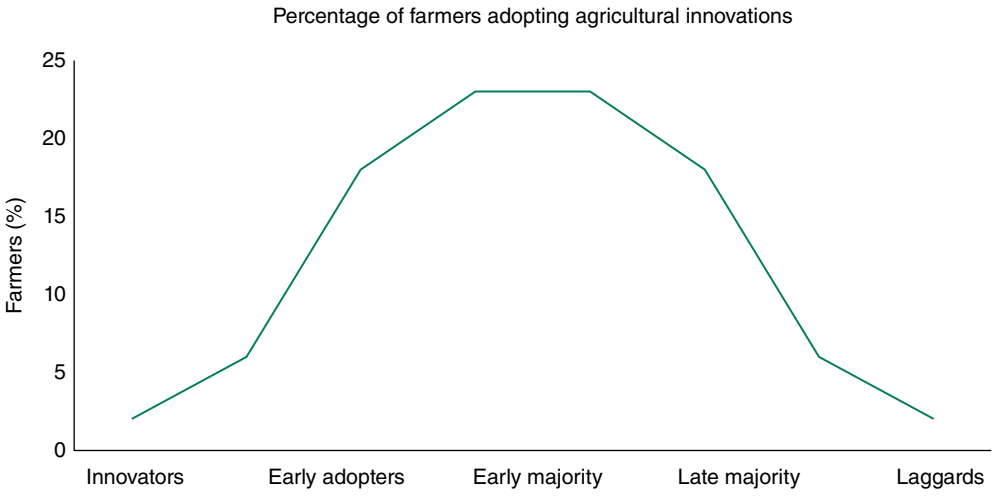

Fig. 14.3. Diffusion of technology extension theory. (Adapted from Rogers, 1962.)

the scientists hold the important knowledge disempowers farmers and inhibits innovation. The introduction of Green Revolution technology by the World Bank led to many problems in Asia and South America (Anderson *et al.*, 2006). It also led to massive waste of resources in Africa, where yields did not increase significantly and farmers could not access the whole range of inputs required (Auerbach *et al.*, 2013). Technology and innovation may thus have unintended side effects, and may even serve to disempower farmers, making them dependent on expensive technology or causing severe environmental and human health damage. Bawden (1992) addresses these unintended negative consequences by using farming experience in farmer training. He argues that praxis draws the theory out of experience.

I conclude from the above that workplace learning is essential in giving a practical balance to theoretical inputs. The actual challenges of a job are very different to the theoretical 'knowing of the issues involved'. Farming from a textbook is a hazardous activity. Both theory and practice are essential, as good theory allows one to generalize from a particular context to other (very different) contexts. Good practice is specific for a given time, place and context; without it the concepts remain concepts. A theoretical cow is very different from a real cow, which may kick you, show affection, demand attention, produce milk, calves (and copious amounts of dung and urine at just the wrong time), get sick, and even die. In addition, I will show through the case studies that experiential learning is more effective if it precedes theoretical instruction. This can stimulate innovation and promote a more profound and grounded understanding of conventional (theoretical) wisdom, and encourage a healthy and independent spirit of inquiry.

The approach outlined in Chapter 4 of this volume by Konrad Hauptfleisch emphasizes the 'Theory-Action-Reflection' triangle, which, he emphasizes, is neither sequential nor hierarchical, and also allows for adaptation to the local context. Both Kolb (1984) and Hauptfleisch emphasize that adult learning requires the teacher to combine subject matter knowledge with the ability to manage a process of exploration and reflection, and that learning involves exploring, preferably in practical situations, and changing what is experienced in one context, to make it more suitable for one's own context.

Methods

Case study research is widely used in organizational studies, as well as in the social sciences (Robson, 2002; Hartley, 2004). In this chapter three case studies using variations of experiential learning are applied, using the insights of Kolb (1984) to guide the process. His approach to praxis is adopted, also informed by Bawden

(1992), and by Röling and Wagemakers (1998), as outlined above. Each of the three case studies reflected in the three models that developed over time are described and discussed. Each time, the actual experience is outlined, followed by a reflection on that experience, and then some more general conceptualisations are presented; hopefully, this will lead the readers to experiment in their own context!

Results and Discussion

I now present the three case studies, using the experiential learning cycle (Fig. 14.1) as a framework for examining the experience, then looking at what was learned in reflecting on the experience, and at what concepts were extracted, leading to experimental design and a new experience. I describe how Model 2 changed in the light of the experience of Model 1, and how these two experiences of the Rainman Landcare Foundation informed subsequent work at Nelson Mandela University, taking the existing model which was found there, and giving rise to Model 3. The conclusion will look at the conceptual insights arising from all three experiences.

Model 1: Rainman training-farm-based learning

Experience

In the years from 2000 until 2005, we tested the training-farm-based model. Students were in class from 8 to 10 a.m., then after breakfast, they spent 2 h in their individual student garden. These were rainfed garden plots, in size only 3 m × 5 m, where three crops were planted, based on the market survey they had done while at their homes. Before attending the programme, they found out what they could sell to their neighbours and for what price, and this informed their choice of crops. In addition, the crops had to be selected as follows: (i) one heavy feeder crop; (ii) one light feeder crop; and (iii) one legume crop. (Heavy feeders need a lot of plant nutrients, light feeders require less, and legumes supply nitrogen to the soil.) This allowed for a good crop rotation, which would prevent most disease and pest problems from reaching epidemic proportions. In the afternoons, students worked on the Rainman organic farm, learning about compost making, irrigation, pest and disease control, weeding, harvesting and preparing crops for marketing through our local community supported agriculture (CSA) scheme, which was part of the Ntshongweni Participatory Guarantee System (PGS) (Katto-Andrighetto and Auerbach, 2009).

Reflection

Although Model 1 was found to be effective, it had two drawbacks. First, students had to find their way to the farm by 8 a.m. each morning as we had no dormitories. Second, little farming took place in the students' home environment during the training period. Although there was a market survey exercise at the start, and a business plan aiming to implement a real project at home at the end of training, many trainees drifted away from agriculture.

We found funds to follow up and establish six local organic farming cooperatives; each of these set up their own PGS to ensure that the produce was organically grown (Katto-Andrighetto and Auerbach, 2009). A secondary (Ntshongweni Organic) cooperative was established to handle marketing and distribution. Four of the six primary (producer) cooperatives functioned quite well and continue to produce organic vegetables. The secondary cooperative was not able to continue without support, and ceased to exist once support was withdrawn. Farmers kept farming organically, as the approach helped them to use soil moisture more efficiently.

Conceptualisation

Rainman Landcare Foundation decided that we had met the local need, and that we should take the training out to the farmers and gardeners in other areas. In partnership with a municipality in KZN, we developed a community-garden-based Model 2, where training was scaled up (100 gardeners in four groups, supported by 20 mentors working on-site north of Durban). Similar training was later also done at two locations in Zululand.

Model 2: Rainman training and on-farm based learning

Experience

The project was set up in partnership with a permaculture training centre (located near the community to be assisted). Rainman set up three processes. First, the new community garden was fenced (eventually) and rudimentary irrigation systems were developed. The garden was ploughed, and plots were allocated to a number of people who were already involved with gardening activities.

Second, the gardeners were offered a 7-month learnership, which included a small stipend, and which required them to attend 1 week of training per month at the Permaculture Centre. This was followed by 3 weeks of mentored activity in the garden, after which the process was repeated for each of the 7 months.

The third process was the selection and training of the gardening mentors, who would complete three 2-week modules, and would support the (mostly elderly) gardeners at the community garden site. This process was problematic, as we had no say in the selection of the mentors, and the project manager and local councillor were both involved in politics. All mentors selected were politically active, and were young (aged 20–30). None of the mentors had significant knowledge of gardening, and few had much interest in gardening. All were keen to receive the monthly payment as mentors. They came to the Rainman farm for 2 weeks of training before the commencement of gardener training. After the first week, I was despairing of the capacity of the group to assist the gardeners.

In the course of this module, I reflected on the activities relating to self-empowerment of the mentors, and ways of treating adult learners with respect and avoiding preaching and lecturing. The role-play activities had failed to elicit a response from the mentors that the old people who were gardening, while uneducated, had many skills which should be respected. Respect, in the view of the mentors, was only due to them because they were older people. I recognized that many of the mentors lacked listening skills, and also lacked empathy. It had also become clear that the informal settlement where our research group lived was a place where many victims of the struggle against apartheid, and also many older impoverished rural people, had fled in order to escape either political persecution or rural poverty. Members of the first group had little respect for members of the impoverished group.

I developed a talking and listening activity in order to allow the mentors to practise listening to each other. I asked them to pair off using a random pairing process, and instructed them to spend 5 min listening to the life story of the other person, and then to tell their own life story in the next 5 min. They would then be given 2 min each to report back to the group on the other person's life experience. I was not ready for the buzz which developed, where each pair of mentors was locked in intimate exchange. There was no way I could bring this to a close after 10 min. Something was obviously working, and so I allowed a little over an hour for the listening process, only reminding participants regularly that one person should be talking, and the other person should be listening. Eventually, we had our feedback session, and story after story emerged of murder of parents and family members, burning down of houses, flight from home, persecution by security police, divided communities where one faction betrayed the other faction, insidious payment for information by government to *impimpis* (paid informants).

The report-back lasted for over 2 h, after which we all sat back, totally shell shocked. There was silence for about 10 min, interspersed with sobbing. When I had some control of my own emotions, I sent the group home for the day, asking them to remember that all of the gardeners had their own difficult story to tell, and that all were worthy of respect, and had experiences which could teach the mentors a great deal. I asked participants to go home and reflect on what had happened. I promised that the next day would start with a group reflection, followed by an attempt to understand the significance of the day's experience.

The next day people behaved very differently. The reflection session was subdued but profound, with powerful insights emerging. We began to develop a vision for empowerment through food security. This was intensely political. Only after the feedback and our breakfast break, did I respond telling a story of an arrogant young American Peace Corps volunteer, who had tried to tell a black community what to

do, without himself having any relevant life experience or skills. I told them how this had led me to promise myself that I would not try to teach people skills that I had not practiced myself. This resulted in 20 years of farming before I started training farmers. Many of the mentors accepted that they needed to work on their horticultural skills.

Reflection

Although about half of the mentors were much better after this experience, many did not change the way they related to the gardeners, and the lack of gardening skills meant that they had little to offer the gardeners, who knew more about gardening than the mentors did. However, the experience certainly taught me about the importance of understanding the socio-political context of learners, and how important it is to draw good theory out of good practice, both with adult mentoring and with actual vegetable production. The project had many difficulties to deal with, related to the municipality's lack of responsiveness, but in the end the project did receive an award for the best learnership in the province. Gardeners were able to produce high quality vegetables organically with little additional water and few pest and disease problems.

Model 2 worked well for the gardeners, as they received training which they were able to put into practice in setting up their new plots at the new community garden. Although resources (especially toilets and the fence) were very slow in coming, there was some support, and the gardeners were initially very appreciative. Soon, however, the gardeners started to demand more and more from the municipality. As our role was simply that of trainers, and not project managers, we were no longer formally involved in the project at this point.

Conceptualisation

The two models developed by the Rainman Landcare Foundation were aimed at semi-literate farmers, and were based on the National Qualifications Framework (NQF)2 National Certificate in Mixed Farming Systems; NQF2 level qualifications are designed for mid-secondary school level learners, with only basic numeracy and functional literacy in their mother tongue. Instruction was in isiZulu, and only minimal written competence was required. The mentors completed NQF5 training as Organic/Landcare Facilitators at NQF level 5 (post-secondary school). Training was offered in English, and higher levels of reporting competence were required. Six business management modules were included. Various other mentorship training with trainees selected on the basis of appropriate skill criteria resulted in good skilling and motivation, and many of those Landcare Facilitators are still training farmers. In separate projects, some were trained for the Limpopo and Mpumalanga government extension services and others for smaller civic organizations. Mentorship appears to be very important to the success of trainee farmers.

Model 3: Nelson Mandela University at George (Diploma in Agricultural Management); classroom followed by experiential learning and then integration

Experience

The Nelson Mandela University at George offers an agroecology-oriented agricultural management training approach as part of the School for Natural Resource Management (SNRM), and has a 1-year on-farm practical workplace experience component offered in semesters four and five (middle of the second year to middle of the third year). This is followed by the final theoretical semester (end of the third year) which completes the diploma. Top students may then elect to complete an Advanced Diploma in their fourth year. The workplace learning starts in the South African winter (July), and thus includes this planning period and the spring planting period, as well as the whole summer growing season. By December, many South African farms are ready to harvest; this first semester has a technical focus. The three first-semester assignments are: (i) environmental scan of the farm; (ii) technical report (on any two enterprises, preferably one animal- and one plant-based production sector); and (iii) a personnel project (which looks at compliance with labour law, management of staff and a self-evaluation of the student's management strengths and weaknesses).

The second semester of the workplace learning (January–June) focuses on management, and the three assignments are marketing, profitability/cash flow, and finally an integrated business study, drawing together all five earlier assignments. This is followed by an oral presentation to the first-year students, evaluated by the fourth-year students and staff. By this stage, the second-year students are already off campus having started their workplace experience.

Reflection

The structure of Model 3 is thus based on presenting 18 months of theory followed by 12 months of practical on-farm work, with a final 6 months to integrate theory and practice. The work integrated learning has evolved into an effective period in which the learners are exposed to many experiences on commercial farms across the country (some even choose to go overseas). The six assignments give the opportunity for learners to reflect on technical, social and economic aspects of commercial agriculture, culminating in an oral presentation of their integrated business plan based on all six assignments completed during the year. Students are instructed to look at environmental sustainability issues, but many only pay lip service to this requirement. Many farmers also claim to embrace sustainability, but this is difficult to measure.

Although the Mandela University programme is progressive and has evolved from years of experience on the George Campus, the underlying assumption is that good practice comes out of good theory. The first 18 months in my subjects (Soil Science and Plant Production) had been totally theoretical. My colleague in animal production had already introduced a number of practical activities as she felt that the theory alone was inadequate. I was convinced, and started establishing practical facilities.

In the first year, we set up a weather station, and made compost. In the second year, we planned a permaculture garden. In the third year we found the funds and set the garden up, where students now make compost, design a crop rotation, prepare seedbeds, and plant a vegetable garden which they look after and harvest at the end of the semester. They do a small garden project as part of Plant Production I (with the emphasis on learning how plants grow), and a major project in Soil Science II in the second semester. They are thrown into the first project with very little theory, and are encouraged to experiment. They are helped to reflect on this experience and to use the learning to inform the second project.

They are also exposed to the long-term comparative farming systems research trials, especially in their fourth (BTech/Advanced Diploma) year, where each student completes a crops project. We have observed that students ask more questions and are also prepared to innovate more readily now in their projects. Understanding of basic concepts such as soil acidity, cation exchange capacity and available plant nutrients has improved. They learn in Plant Production classes how to supply nutrients organically, how to set up crop rotations and how to monitor and control pests and diseases. In Soil Science classes, they learn how to improve soil water holding capacity through managing SOM, and how to address soil acidity, making essential plant nutrients available to crops.

Conceptualisation

It was found that a block of theory followed by a block of practice was not an efficient teaching system. Since the establishment of practical facilities, students have been experimenting with soil fertility and plant growth from the start of their diploma. Their attitude to soil science and plant production has improved. They recognize the importance of soil analysis and of integrated pest management, having experienced the problems of plant production first hand. It has been possible to start with some theory reinforced with experimental practice for 18 months. Next, they spend 12 months practising farming in the real world, reinforced with theory through their six assignments. Finally, they have 6 months in which to integrate theory and practice. If they stay for the fourth year, they have the opportunity to design their own experiential learning process.

Conclusion

Climate change will see increases in temperature, decreases in rainfall in many areas, and erratic climate events; organic farming systems show promise in improving water use efficiency

(WUE), and in assisting farmers to use and make available to crops the nutrients which are locally available.

Given the experiences with on-farm training from Model 1, and with the mentors from Model 2, and the other experiences leading to Model 3, the following principles for effective work integrated learning in agroecology are proposed:

- Good practice should *precede* good theory, and should ideally be extracted from learner experiences where possible.
- As quoted earlier from Erasmus and Albertyn (2014), learning only happens if the experience is grasped, examined and transformed; this requires an experiential learning challenge followed by a process of guided reflection.
- Kolb's learning theory (Fig. 14.1) is thus enriched by Röling's 'Platform building for resource use negotiation' and Bawden's combination of adult learning approaches which build on good extension practice. Practical experiences for learner farmers should initially introduce the nature of practical challenges in food production. Once the learners have become familiar with the difficulties of practical soil and plant management, they are more receptive to theories of soil fertility and plant nutrition, as well as integrated pest management. Only then are they in a position to be exposed to the real world of commercial farming.
- Good mentorship, provided by well-trained mentors with experience in agroecological food production, should be available to help learners reflect on their experience, draw out the conceptual implications and integrate theory and practice through this process of praxis.
- Such a structure can help learners to understand what is needed for African food security and food sovereignty in these times of climate change.

Authentic learning and authentic assessment can build in experiences which encourage joint reflection and re-conceptualisation. In this way, learning about farming through guided experience can construct new knowledge, rather than simply reinforcing old habits. This only happens with proactive experienced mentorship, and many training institutions are reluctant to provide adequate resources for this process.

While the Mandela University George Experiential Learning process has adapted to circumstances and resource constraints, it is recommended that this programme should now be evaluated, to determine its effectiveness and the optimal balance between resource use and learner competence. If financial constraints at the university are used to argue for fewer experiential learning resources, the quality of the experience offered to students will decline significantly.

Experiential learning can show farmers how to experiment with local resources. Using organic farming systems can help them to deal with climate change by introducing crop rotations and improving SOM levels. This increases WUE, promotes biodiversity and reduces pest and disease problems. Drawing good theory out of good practice allows learners to adapt to a challenging environment, while giving them the confidence born from the practical achievement of growing nourishing food.

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