



## Experience-Based Learning in the Geo-Information Sciences: 15 Years of Nuts Game

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### Abstract

One of the most successful modules offered at the International Institute for Geo-information Science and Earth Observation, ITC, The Netherlands, is the so-called NRM Module 1. The module is based on the Spiral Model of Learning, an experience-based learning methodology, and is particularly developed for adult education. The knowledge and the professional experiences of the students are seen as an important source of learning. The education process is organised in a six-stage cycle involving six adaptive learning modes – initial expectation and readiness, description of experiences, diagnosis and reflection, conceptualisation, experimentation and practice, and integration and action planning. Each of these stages requiring a series of carefully developed individual or group exercises.

Through its interactive and reflective nature the module is constantly changing and adapting to new realities and changing directions in the professional field. New learning tools, such as e-learning and the use of a virtual learning environment, appear to be developed for experiential learning. The Spiral Model of Learning methodology promotes lifelong learning and fits the concept of continuing professional development. It is recommended to further explore this approach and similar approaches in the search for new and sustainable curricula for future land professionals.

### 1. Introduction

The discussion on the changing nature of the surveying profession has been a key issue for more than a decade. Experts in the field expressed their concerns, analysed the issue and developed new insights on the nature of the surveying profession and practice (Enemark, 2002; Osskó, 2008).

The major key international trends in the surveying education are summarized as follows (Enemark, 2007):

- Management skills, versus specialist skills
- Project organized education, versus subject based education
- Virtual academy, versus classroom lecture courses
- Lifelong learning, versus vocational training

University and training institutions looked for new ways to respond to these trends and the challenges they represent (Enemark, 2002, 2004, 2007; Markus, 2008; Sternberg & Krebs, 2008; Lam & Chan, 2007; Coleman & Dare, 2007; Mansberger & Steinkellner 2007).

This paper highlights the experiences with one of the successful modules offered at the International Institute for Geo-information Science and Earth Observation, ITC, The Netherlands, the so-called Natural Resource Management Module.

The paper describes the educational approach and structure of the Natural Resource Management Module, illustrated with some of the typical exercises and one in particular, the so-called “Nuts Game”.

In the search for new educational approaches for training of future land professionals, it is worth while considering this example of an experience-based learning approach, where the experiences of students are the source of learning and development.

### 2. The need for a multi-disciplinary module

The Introduction to Natural Resource Management, or the so-called NRM Module 1, marks the start of the Master of Science Degree and Postgraduate Diploma Course in Geo-information Science and Earth Observation for Natural Resources Management at the International Institute for Geo-information Science and Earth Observation (ITC), Enschede, The Netherlands.

This introductory module has a history dating back to 1993. At that time ITC was offering several separate courses in the field of Natural Resource Management: Forest Survey, Soil Survey, Rural and Land Ecology Survey, Survey Integration for Resource Development and Forestry for Rural Development. The management of the institute recognised the importance of a multi-disciplinary

approach towards Natural Resource Management and how could this be better promoted than in a common introductory module for these courses?

Considering the aim and objectives of the module and the particular target group, the Spiral Model of Learning methodology (FMD Consultants, 1993) was selected for this module. This student-centred training methodology is based on the principles of experiential learning and is in particular applicable for adult education.

The Spiral Model of Learning methodology was earlier successfully applied at ITC in the post-graduate course Forestry for Rural Development (1990- 1997). In this course, with its particular focus on community involvement in forestry and forest surveying, participatory and action research approaches were very much promoted. The Spiral Model of Learning was the appropriate education approach for this course.

A multi-disciplinary team of lecturers was invited to develop a module to form the common start for all Professional Master's and MSc Degree Courses in the field of Natural Resource Management. To bring staff from different disciplines together was at that time a unique and challenging undertaking, and not at all an easy one. Next to their different professional backgrounds, most staff members were not familiar with experience-based learning principles.

The different disciplinary courses became "specialisations" of a NRM Programme in 2000, and from 2008 further integration resulted in one new MSc and Postgraduate Course in Geo-information Science and Earth Observation for Natural Resources Management.

The 15 years old NRM Module 1 survived all these curriculum changes, adapted to new insights and realities. It still brings together the experiences of the students based on which a common and solid framework is developed for their further MSc and PG study trajectory. The educational approach, management and basic structure of the module have remained unchanged during the years the module is being offered.

Through its interactive nature the module is constantly changing and adapting to new realities (Box 1). Each year the module is updated through the input of new contributing staff and the experiences of the students, mostly mid-career professionals. More than 50 different academic staff members contributed as module coordinators, facilitators or moderators, while more than

1000 students, from all over the world, participated.

#### Changing Aims of the NRM Module 1.

The NRM Module aims at eliciting from the students, and further developing, a common basis for the assessment of multi-actor and multi-disciplinary nature, and thus the complexity and conflicts involved in Natural Resource Management (Study Guide, 1999).

The module aims to support the MSc and PG degree students, in acquiring a critical attitude towards the role of geo-information science and earth observation for natural resources management while emphasising a system approach towards solving natural resource management problems. (Study Guide, 2008)

*Box. 1: hanging aims of the NRM Module 1.*

Not only the content is constantly adapting to new realities, also new educational tools and techniques, including e-learning, are easily taken up and integrated. In particular young students are responsible for the introduction of challenging digital tools such as Wiki, but also new forms of interactive presentation techniques.

### 3. Experience-based learning

#### 3.1 Basic assumptions

The knowledge and the professional experiences of the students are seen as an important source of learning. Much of the training in the NRM Module is based on exchange, analysis and systematization of these experiences. This means starting with the student and working with the experiences they gained in their organisation and actual working situation.

Experience-based learning also means students learn from systematic reflection on what they do individually and inside a training group, gaining essential skills for multi-disciplinary teamwork. But also other basic professional and academic skills such as critical thinking, independent learning, presentation and communication skills, reading and writing skills are part of the learning objectives.

#### 3.2 The Spiral Model of Learning

The Spiral Model of Learning is based on the principles of discovery learning and is in particular applicable for adult education. The Spiral Model of Learning is based on the theory of experiential

learning developed by Kolb (1984). Learning is defined as the process whereby knowledge is created through the transformation of experience. Kolb, in his structural model, describes the process of experiential learning as a four-stage cycle involving four adaptive learning modes – concrete experience, reflective observation, abstract conceptualisation, and active experimentation.

The Spiral Model of Learning distinguishes the following main steps in the education process:

1. Initial expectation and readiness
2. Description of students experiences
3. Diagnosis and reflection on experiences
4. Conceptualisation and analysis
5. Analysis, experimentation and practice
6. Integration and action planning

In the following paragraphs the different steps of the Spiral Model of Learning are explained and illustrated with practical examples of learning exercises from the Natural Resource Management Module.

### 3.2.1 Initial expectation and readiness

The learning process starts with the expectations of the students about the course. These are presented and compared with course objectives, and differences are discussed to reach a shared learning perspective. The training process is clarified for a clear and shared understanding of how learning is organised.

To stimulate favourable learning conditions, emphasis is on developing an open atmosphere of mutual respect, trust and commitment within the group. Students are stimulated to play an active role in the learning process.

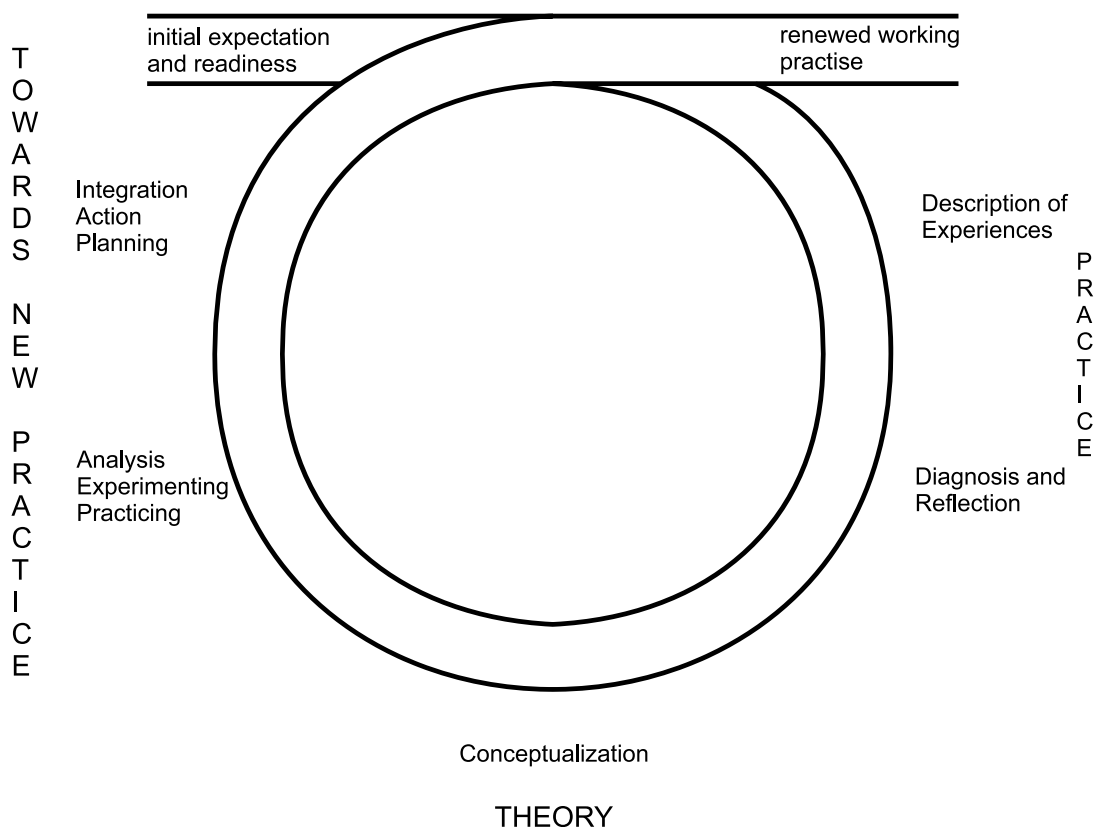


Fig. 1: The Spiral Model of Learning (FMD Consultants, 1993)

**Reporting and Animation Committee**

At the first day, participants are invited to take part in one of the following committees: reporting committee or animation committee. Through these committees they are made responsible for the course and their commitment for the learning process is increased.

*Reporting Committee*

The Reporting Committee is in charge of making a daily report of the activities and outcome of the module. In this way the outcome of the module is documented, and the information can be used by students who arrive later in the module, and serves as input in other exercises. Each morning the report of the day before will be presented by two reporters.

Participants in earlier courses (1993) used hand written reports, later followed by digital copies and PowerPoint presentations. The last years the digital learning environment Blackboard is used to publish and manage the daily reports. One of the recent groups organised the reports in a Wiki-environment, which allowed for more interaction and easier management of the reports.

*Animation Committee*

The Animation Committee takes care of a good working atmosphere in the group and promotes active participation. The committee proposes the use of animation games when appropriate in the module, e.g. at the start of the morning sessions or afternoon sessions. An active animation committee may even organise social activities during the evenings or weekend.

Participants make use of a guide for workshop facilitation (Groenendijk, 2006). But more often they use their own experiences and ideas about group animation. This can vary from the well known ice-breakers and energisers, to traditional dances, songs and music plays. The use of YouTube was a remarkable experience in the 2008 course: various students were very eager to show their home or aspects of their work or projects they are involved in.



Mr. Toru Nagayama, Japan, demonstrating the Koto, NRM Module 1, 2007



One of the Kenyan students explaining her traditional ornaments, NRM Module 1, 2007

*Box. 2: Example of a learning exercise in step 1. Initial expectation and readiness.*

**3.2.2 Description of students' experiences**

In this step the present knowledge and experiences of students within their working context is analysed and systematized. Students are stimu-

lated to describe their knowledge and experiences through a series of carefully developed individual or group exercises:

- To express their knowledge and ideas
- To reflect their working experience and practice

- To reflect on their regular working behaviour or attitude
- To describe their working or institutional context

A central part of learning is that individual experiences are being expressed, discussed and compiled for further brainstorming in the group.

Various exercises are developed to explore students' perceptions on Natural Resources and Natural Resources Management. Analysis of student's working experiences result in on an overview of success and failure factors in Natural Resource Management.

### Success and Failure in NRM

Various exercises are developed to explore participants' perceptions on Natural Resources and Natural Resources Management.

What are the key issues in Natural Resource Management? In this exercise students explore their working experiences to answer this question. The focus in this exercise is on success stories (what went good and why?) and the failures (what went wrong and why?) in NRM in their daily work. Further analysis and relating the findings to the outcome of earlier exercises will lead to a list of key issues or problems in Natural Resource Management.

Students are asked to answer the following questions and discuss these in teams:

- What do you see as a successful achievement in NRM in which you have been directly or indirectly involved?
- What do consider an 'unsuccessful' NRM activities in which you have been directly or indirectly involved in your work?

In plenary the results of the teams are presented, compiled and further analysed resulting in and overview of achievements and difficulties and a consolidated list of success and failure factors in NRM.

Participants NRM Module 1, 2006. Group 2.



Box. 3: Example of a learning exercise in step 2. Description of students' experiences.

### 3.2.3 Diagnosis and reflection on experiences

Students systematically compare their a priori ideas of their situations with the emerging picture of actual practices and conditions under which these practices develop.

Such a comparison leads to the identification of gaps between their actual (what they really do) and desired situations (what they think they do). It enables the students to evaluate their role in the past and motivates for further learning.

Based on the diagnosis of students' experiences, gained in the earlier steps, the key issues and

problems in Natural Resource Management are identified. These issues will be further studied in the next steps.

In 1993 the following key issues in Natural Resource Management were identified by the course students: Participation, Multi-disciplinarity, Sustainability and Spatial variability; in 2008 one of these issues has been considered still relevant, sustainability, but others have been replaced by more prominent aspects like Competition and Conflicts, and NRM in the International Context.

#### The village sketch map

Students are asked to draw a sketch map of a village they know very well (e.g. home village, or the village of their parents or grand parents, or a village they visit often for their work). They are asked to include aspects of build up area, different land uses, infrastructural features, water ways, elevation and other relevant aspects of the landscape. A legend is added to the map.

The sketch maps are used to discuss in teams, and later in plenary:

- The natural resource areas in the sketch map
  - Location
  - Trends (increasing/decreasing area)
- The actors involved in managing the natural resources.
  - The owners, the users, the managers, ...
  - Interests and objectives of these actors.
- Management systems involved in NRM
- Issues of resource tenure
- Importance of geo-spatial information for Natural Resource Management



Example of Village Sketch Map, by Rhoda Nyaribi, Participant NRM Module 1, 2005.

Box. 4: Example of a learning exercise in step 3. Diagnosis and reflection on experiences.



### The Nuts Game

A typical experience-based exercise and the exercise that has become the flagstone of the module. The Nuts Game marks the start of a learning block on the key issue of sustainability. Through this exercise participants reflect on stakeholder behaviour with respect to the use and management of scarce natural resources and recognise the role of institutional mechanisms to ensure sustainable use of natural resources.

The Nuts is a game played in teams of 5-7 participants. Each team gets a bowl and a number of nuts, and a scoring table (Harvest Recording Sheet). Each player's goal is to accumulate as many nuts as possible during a so-called life cycle. A life cycle consists of one or more seasons. After an explanation of the rules, the teams start the game.

Immediately after the game, the moderator will summarise the total scores of the different teams and the results, including the different strategies followed by the teams, are discussed in plenary. The discussion focuses on the analysis of players' (stakeholders') performance and underlying factors and the attitudinal changes and development of co-operative strategies. Being the basic question: "What did you learn from this exercise in relation to the management of scarce Natural Resources?"



Participants NRM Module 1, 2000, Group 1.

#### Conclusions

- People are "greedy"
- Powerful people profit most, others "hungry"
- Everybody for his own sake is not sustainable
- Rules needed for sustainable use of natural resources
- Control!
- Everybody supposed to follow the rules, if not it will not work
- Women are best resource managers: equal representation
- Democratic rule/decision maker

For a complete description of this game see: Edney (1975), ITC (2008)

*Box. 5: Example of a learning exercise in step 4. Conceptualisation and analysis.*

### 3.2.4 Conceptualisation and analysis

Only at this stage new theories and experiences from external sources are being offered to the students in the form of special lectures, reading assignments, reflective exercises, internet searches, or videos. The key issues identified in earlier stages are now further studied.

The main elements for a framework for a multi-disciplinary approach in NRM are developed, the emphasis of which on the role of geo-information in NRM. Central to the approach is the interconnection between the key issues identified. This will create a new understanding of the role of surveying and geo-information within NRM.

The continuation of the course fits into this initial conceptual framework of NRM developed based on the experiences and realities of the students.

### 3.2.5 Analysis, experimentation and practice

The students gain more insight experiment the concepts and developed approach during a fieldtrip. Under field conditions they validate their new insights and approach, which contributes to further learning and consolidation of concepts.

Students are responsible for the planning, organization and reporting of this one-day fieldtrip. Trained skills in earlier modules have to be applied and gained insights are being tested.

### 3.2.6 Integration and action planning

In the case of NRM Module, the Spiral Model of Learning methodology is applied in the introductory phase of the course. In this case, the concepts and approaches developed in the introductory module serve as a “framework” for the remaining part of the course. Regular moments of reflection on the learning progress throughout the course are organized in which the learning experiences of the students are integrated in this overall framework.

At the final stage of the course, students prepare themselves for the implementation of the developed framework in their own working situation: the training spiral is becoming a full cycle.

### 4. Potential for training of the new land professionals?

The learning approach applied in the NRM Module at ITC has been particularly developed for training of adult and mid-career professionals from mainly developing countries. It has proven to be an excellent educational approach to train surveying professionals with different working and cultural backgrounds.

The typical nature of the experiential learning approach makes each module or course a new adventure. Changing realities in the professional field are brought in by the students and become the basis for further learning and developing the module or course. If the only constant in the surveying profession is change (Enemark, 2007), this more than 15 years old module has proven to be an excellent and sustainable educational answer to that.

It is clear that experience-based learning, and as applied in this case, the Spiral Model of Learning, promotes lifelong learning and fits the concept of continuing professional development. Each new individual training effort can be considered a loop in the spiral model of lifelong learning.

E-learning and the virtual learning environment, in this case Blackboard, increased dramatically the available number of educational tools and training challenges. Discussion boards, Wikis, Blogs and Communities of Practice are typical examples of these, and it seems as if they were developed to support experiential learning.

Next to the content and technical skill training, experience-based approaches address profes-

sional and academic skills such as: critical thinking and independent learning, communication skills, group work, presentation skills and information skills.

It is recommended to further explore this approach and similar approaches in the search for new and sustainable curricula for future land professionals.

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