The Computer-Ndaba experience:

Introducing IT in a rural community in South Africa

Helana Scheepers
helana@cs.auc.dk
Department of Informatics,
University of Pretoria,
Pretoria,
South Africa

Abstract

The paper describes an action research effort aimed at IT diffusion in an educational setting in a rural community in South Africa. The case was performed at the SEIDET community centre at Siyabuswa, a rural community close to Pretoria. The purpose of the paper is to report on two aspects of the research. Firstly, the practice at SEIDET where principles for IT development and implementation, developed in previous research, has been implemented. Secondly, the lessons learned from the experience for research in this area will be described.

Keywords: Diffusion of Innovation, Computer Literacy

BRT Keywords: DD0502, IA02

Introduction

The use of information technology (IT) in a socio-economic development environment and in the educational setting has received a lot of attention in the past. The promised benefits of IT for socio-economic development have influenced aid and donor agencies (Bell & Wood-Harper, 1993) to invest heavily in this area. However, numerous examples of failures can be found, usually the failures are due to organisational, political and social issues (Avgerou & Madon, 1995). At the same time huge amounts of money is invested by various countries on IT and education projects (Newman, 1993; Schank, 1993; Wilkinson, 1983). A number of issues arise when the computer moves into the classroom, such as what type of hardware is necessary, what should the pupils and teachers be taught, how should the computer be included in the syllabus etc. (Wilkinson, 1983).

The paper describes an action research effort aimed at IT diffusion in an educational setting in a rural community in South Africa. The case was performed at the SEIDET (Siyabuswa Education Improvement and DEvelopment Trust) community centre at Siyabuswa, a rural community close to Pretoria. One of the objectives of SEIDET is to provide supplementary tuition programs to grade 10, 11 and 12 pupils (Conradie *et. al.*, 1998). The Siyabuswa community is an example of a disadvantaged or underdeveloped community. In the community unemployment is very common. The community has a 100 primary and secondary schools, but classes are an average of 80 to 90 pupils per teacher. Telephones and electricity has become available in the last few years but most people cannot afford such commodities.

The diffusion process was called the Computer-Ndaba. The word '*ndaba*' is a Zulu (a local South African Language) word and is defined as *'a topic of conversation, affair'* (English-Zulu, Zulu-English dictionary, 1953). This word was chosen because it called the teachers together to discuss, plan and formulate ideas for the use of the computers to the advantage of the community.

The purpose of the paper is to report on two aspects of the research. Firstly, the practice at SEIDET where principles for IT development and implementation, developed by Scheepers & Mathiassen (1999) has been implemented via the Computer-Ndaba. The principles are based on the trade union tradition of systems development in Scandinavia. Secondly, the lessons learned from the Computer-Ndaba experience for research in this area will be described. The research questions that we seek to answer are: *How should IT introduction be done in a rural community centre in South Africa where there is no previous experience of using IT? What are the social and technical risks in such an introduction process and how can these be addressed? How did the principles for IT development and implementation apply in the introduction process and what lessons were learned about them?*

The paper consists of the following sections. A background for the research is given in section 2. Section 3 produces an outline of the Computer-Ndaba experience. This is followed by a section in which the lessons learned in terms of principles for IT diffusion with disadvantaged groups are outlined. In this section the principles as identified for the South African environment based on the Scandinavian trade union tradition will be outlined. The way in which the principles and aspects of the principles have been implemented will be discussed and changes to the principles will be outlined. Lastly the implications of this research are outlined in section 5.

Background

A brief background to IT diffusion is given as the case study described in the next section is an example of a diffusion process. The biggest problem in implementing IT in a developing environment is that local knowledge about IT is not developed and IT is seen as technological and not as a social system (Braa, 1997). The diffusion is thus used as background for discussing the environment within which the Computer-Ndaba took place. Action research is further discussed to describe the research method used by the researchers.

IT diffusion

Research in the diffusion of innovation can focus on individual adoption, the adoption by organisations and macro-diffusion (Attewell, 1992). On the level of individual and organisation adoption two metaphors for adoption is used (*op. cit.*): diffusion as a process of communication and influence; and diffusion in terms of cost and benefit. Two types of communication in diffusion are identified, signalling and technical knowledge. Signalling refers to the communication of the advantages of the new technology and the technical knowledge refers to the knowledge required to use the new technology. However, the process that took place in the Computer-Ndaba could rather be described as IT intervention focusing on knowledge building within SEIDET an example of a socio-economic development environment.

IT diffusion in organisations can be divided into five stages (Rogers, 1995), see

Figure 1. The stages are (*op. cit*.):
Agenda-setting*: General organisational problems that may create a perceived need for innovation.*
Matching*: Fitting a problem from the organisation's agenda with an innovation.*
Redefining/Restructuring: *The innovation is modified and re-invented to fit the organisation, and organisational structures are altered.*
Clarifying*: The relationship between the organisation and the innovation is defined more clearly*
Routinising*: The innovation becomes an ongoing element in the organisation's activities, and loses its identity.*

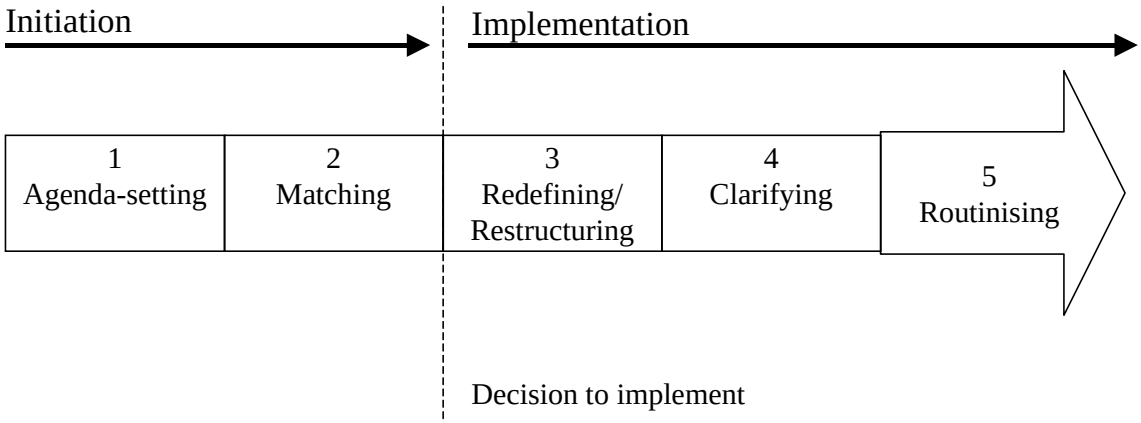

Figure 1: The innovation process in an organisation (Rogers, 1995)

A number of role players can be identified who has an influence on the diffusion process (*op. cit*.): Opinion leader: is a person that forms part of the social system that can influence the rest of the group to accept or reject the innovation. Change agent: is a person who is contracted to influence the process so that the social group adopts the new innovation and are usually heterophilous from the group. Aides: is a person who is employed by the change agent to help with the adoption decision and is usually homophilous with the average member of the group and thus bridges the gap between the change agent and the member of the group. Huff and Munro (1985) identify further roles in the adoption process that will not be discussed further in this paper, as the case study as it unfolds is the main focus.

Four criticisms are identified against diffusion research (*op. cit.*). (1) pro-innovation bias - the implication that the new technology should be accepted by all as it is (2) individual blame bias - the tendency to hold the individual responsible for his or her problems rather than the system they belong to, (3) recall problem - inaccuracies because respondents are asked to remember a time in the past when the diffusion took place, (4) issue of equality - socio-economic gaps are widened when new technologies are used.

The research done in this study addresses three of these criticisms - pro-innovation bias, individual blame bias and the issue of equality. The process used in the research take as basis that the innovation should be tailored to the needs of the adopter and furthermore tries to uplift and emancipate the adopter from their present position. These principles thus address the criticisms directly by taking the issue of the adopter as foundation. The problem with recall is not relevant in this situation because of the research method used by the researcher.

Action Research

Action research was used in the Computer-Ndaba to redefine the use of IT by the teachers at SEIDET. The use of the research method was identified as one of the principles for such projects in Scheepers & Mathiassen (1999).

Rapoport (1970) describes action research as *'[It] aims to contribute to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework.'*

A number of characteristics of action research, that are important for this research, can be identified (Checkland, 1981; Checkland, 1991): the researcher forms part of the change process, it is a collaborative process between the researcher and the people involved in the problematic situation, there is a practical outcome, the focus is on social practice and the researcher is a change agent.

The definition of change agent in diffusion places the emphasis on the change agent as an outsider, manipulating the clients to accept the innovation. However, the role that the change agent plays in action research is different. The one important difference is that there is collaboration between the researcher and the client. The client-researcher relationship is characterised by Bennis as quoted by Foster (1972) as a:

- joint effort that involves mutual determination of goals
- relationship growing out of mutual interaction of the client and the change agent
- relationship where each party has equal opportunities to influence the other

Establishing this collaborative relationship is not easy. The way in which this relationship with the help of the role-players (discussed in section 2.1) has been established in the Computer-Ndaba is discussed in section 3.

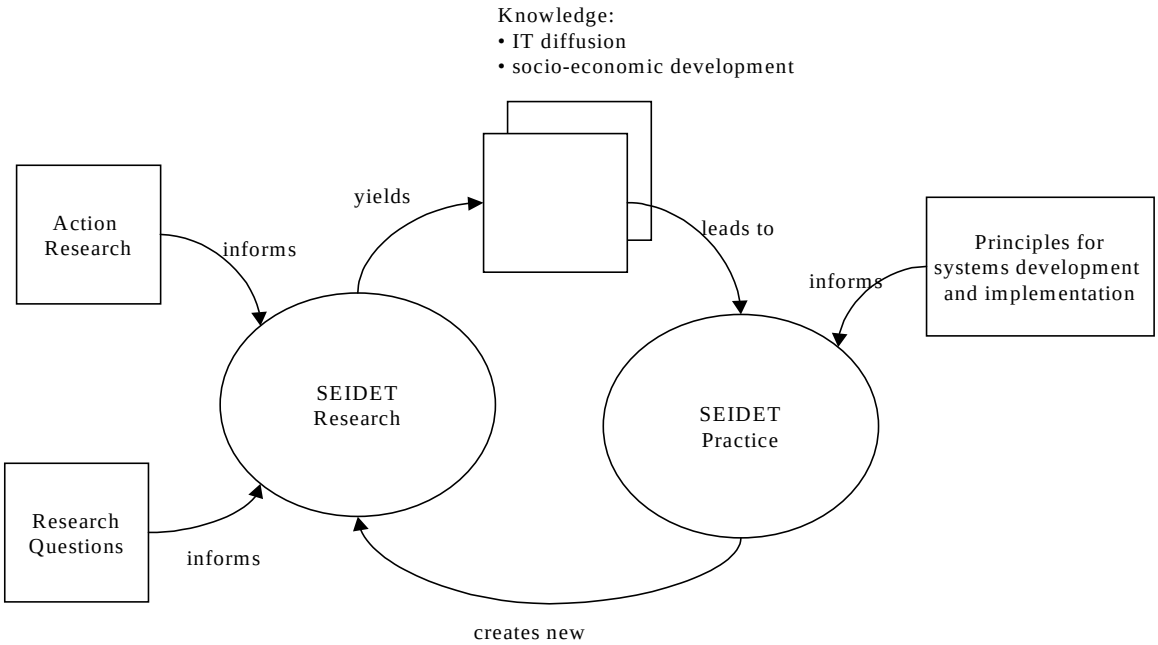

Figure 2:Action research in SEIDET

Figure 2 identifies the environment within which the action research took place as well as defines the framework, methodology and application area based on the research done by Checkland (1991). Two areas can be identified for action research, one in which the practice is taking place and one in which the research about the specific aspect is taking place. Mathiassen (1998) distinguishes between research and practice for action research in terms of the purpose, the intellectual framework that underlies practice and

research, the applied processes and the shared arena within which practice and research takes place. Table **1** gives an outline for the discussion in the paper in terms of these concepts. In the practice the purpose of the Computer-Ndaba is to change and improve SEIDET within the framework of SSM and by getting input from the Scandinavian trade union experiences. The process that took place was the implementation of principles for systems development and implementation to combat typical problems that occur in developing environments in the arena of SEIDET. The purpose of the research was to learn about the principles for IT development and implementation as well as about IT diffusion in rural communities. The framework for the research was SSM as well as IT diffusion. The process that was used in the SEIDET case (the arena within which it took place) is action research.

	Research	Practice
Purpose	To learn about principles for IT development an implementation; IT diffusion in rural communities	Change and improve SEIDET
Framework	SSM, IT diffusion	SSM, Scandinavian Trade Union experiences
Process	Action Research	Principles for systems development and implementation
Arena	SEIDET case	SEIDET case

Table 1: Relation between practice and research for the SEIDET case

A number of different data collection methods (see Table 2) were used to ensure that the reflection stage of the action research process could be performed. Questionnaires were used to determine the needs and feelings of the teachers about the course. Interviews with individual teachers were held to determine on an individual level the needs and feelings of three randomly chosen teachers. Diaries created a record of each session with the teachers and were written within 5 days after each session. The topics for the diary were identified before the first session.

Soft systems methodology (SSM) (Checkland & Scholes, 1992) was used as methodology. The concepts within SSM were used for the research to ensure reflection and learning took place.

Data source	Explanation
Diaries	A diary was kept by the researcher and was written after each session.
Interviews	Three interviews were held in the middle of the Computer-Ndaba. The interviewees were chosen at random by the researcher. The interviews were 20 minutes. The interviews were tape-recorded and transcribed.
Questionnaires	Three questionnaires were handed to the attendants of the course during the Computer-Ndaba. The first one was handed to the attendants early during the course and determined why they wanted to attend the course, some background information about the attendants and what they felt about the course thus far. The second questionnaire was about co-operative learning and traditional learning the two ways of teaching that was used during the computer literacy (see Scheepers & de Villiers, 1999). The last questionnaire was to reflect on what the attendants thought about the course and was completed at the end of the course.

Table 2: List of data sources

Computer-Ndaba experience

Context

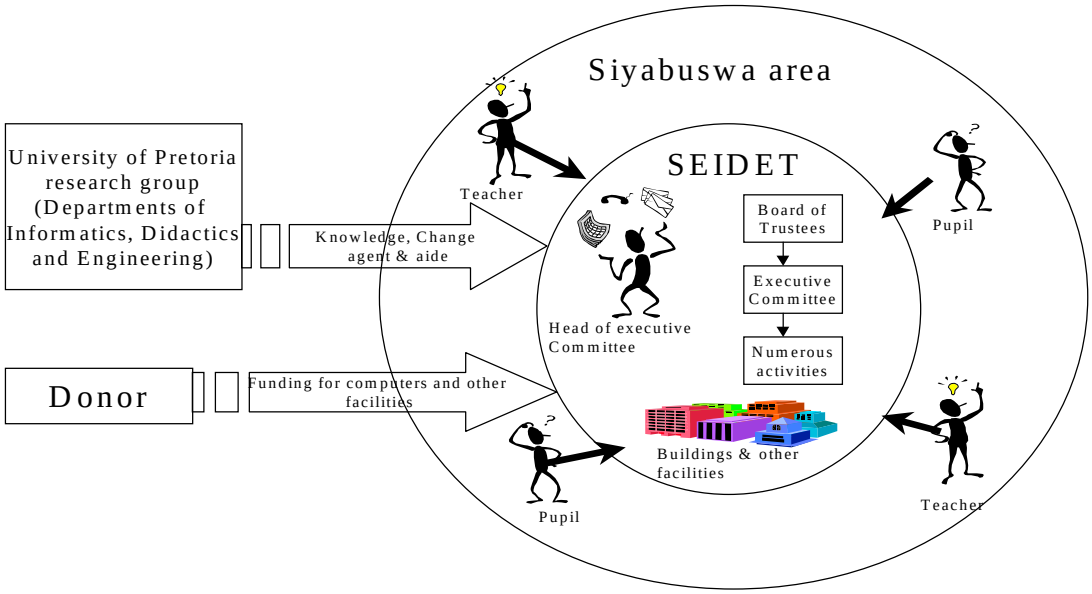

Figure 3: SEIDET context

Figure 3 is a rich picture of the situation at SEIDET as well as the process that has taken place. SEIDET is a non-governmental organisation that has as its purpose the education improvement and development of the community. The organisation consists of a board of trustees and an executive committee. The head of the executive committee is a strong opinion leader for the community and has played an important role in the conception of the centre. Teachers of the community perform the supplementary tuition activities for pupils. These teachers are chosen on merit to form part of the centre.

The need for computers was identified by the executive committee and was further enhanced by the creation of a research group from the University of Pretoria in partnership with the SEIDET centre. The aim of the research group is to do research about computer supported co-operative learning at community learning centres, funded by the Foundation for Research and Development (Co-operative learning project, 1997). The need for the Computer-Ndaba was identified after SEIDET received a donation for creating a computer laboratory in 1998. The funds were used to build the classroom for the computers as well as buying 27 Pentium PCs.

The diffusion of IT in SEIDET can be described in the following way. The founder of SEIDET and his board members identified the need for IT in the centre. With the creation of the partnership between the research group at the University of Pretoria and SEIDET the matching of the IT with the centre was performed. The researcher was then asked to help mainly with the *redefining* of IT for the purposes of SEIDET. The Computer-Ndaba was thus a process for *redefining/ restructuring* of IT but there were also activities that can be classified as *clarifying* and *routinising* of the IT for the purposes of the community centre. The group of people that formed part of the redefining process was the head of the executive committee and the teachers who are involved with the supplementary tuition activities. The foundation was thus laid for further introduction of IT in the centre as can be seen in the new developments that are taking place at SEIDET.

The important opinion leader in the diffusion process is the head of the executive committee. The author can be seen as the change agent as explained in section 2.2. The change agent did not try and influence the adoption process as an outsider, but created a mutual learning process between the teachers and the change agent. The first letter that went out to the teachers conveyed the fact that the researcher was not going to make changes, but that the teachers with the help of the researcher will plan and implement the necessary changes. The letter used language such as '*The only way in which we can ensure that the lab is used to its full potential and to our* [the teachers] *advantage is to plan and talk together about it*'. The aide that was employed played an important role because she was a teacher herself that received personal training from the change agent. In most other characteristics the teachers at SEIDET could relate to her. During the Computer-Ndaba it was evident that they preferred to ask her questions if they needed help.

The Computer-Ndaba was initiated in February 1998 and came to conclusion at the end of July 1998. Further activities are planned for the future to address certain issues that were identified during the initial period. The importance of the course for SEIDET and the teachers was emphasised by the attendance of the head of the executive committee and two executive committee members. The course was opened by an introduction of the researcher and the course by the head of the executive committee and a further welcome by one of the executive committee members. He said that the teachers at SEIDET should use the knowledge that they gain from the collaboration between SEIDET and the University of Pretoria to the advantage of the whole Siyabuswa community. In that way they show appreciation for the hard work that the researchers from the University of Pretoria was doing at the centre.

Background of the Computer-Ndaba

From the discussion in the previous section it can be concluded that the main aim of the Computer-Ndaba was the introduction of IT. The three issues discussed during the Computer-Ndaba were: How will the lab be managed?; How are we as teachers going to use the lab in the work of the centre?; How are we as teachers going to learn about PC's and other aspects relevant to PC's?

The Computer-Ndaba sessions were held on Saturday afternoons from 15h15 - 17h45, as this was the only time available to the teachers. The dedication and commitment of the teachers to learning about computers can be seen in that Saturday afternoons are usually reserved for sport, family time and that some of the teachers had to travel quite far to come to the sessions. Previous experience has shown that a major soccer event kept most teachers away from such courses and that these courses usually ended with about 40 - 50% of the teachers who started. In the case of the Computer-Ndaba only 4 teachers out of 42 was lost and the Saturdays during the Africa Soccer Cup was well attended.

It was planned that each Saturday session of the Computer-Ndaba will consist of two parts, ¾ hour discussion and work sessions on the management and use of the lab and the rest of the time would be spent on the following subjects: What is learning? What is curriculum 2005? (2 weeks); Co-operative learning (2 weeks); Computer literacy (1 week); MS Word (3 weeks); MS Excel (3 weeks); Basic concepts of E-mail as well as a field trip (2 Weeks); Other types of IT for example CD-ROMs. (1 week)

The Curriculum 2005 and co-operative learning are very important issues for the teachers, because a mayor revamp of the educational system in South Africa will take effect in 2005 (Department of Education, 1997). These subjects were thus important

issues for teaching and the use of IT.
A number of problems were encountered during the course of the Computer-Ndaba:

- Another venue for the start of the Computer-Ndaba had to be found, because the additional room that was built for the computers was not finished by the time the course started. Furthermore, the computers were not available until about the fourth or fifth week of the course, which was a source of frustration for the teachers.
- The teachers did not realise that they needed to practice after they had a lecture. It was necessary to make changes to the times the computer laboratory was available for use, because the computer laboratory was only open on Saturdays during the Computer-Ndaba.
- The teachers did not have the necessary expertise to do maintenance on the computers. They also did not realise that computers might break down. Who should identify computers that needed maintenance, who was going to pay for the maintenance and who was going to do the maintenance?

A number of outcomes of the Computer-Ndaba can be identified. Firstly, 38 teachers were made aware of the possibilities of IT and became computer literate. Secondly, the teachers wrote a procedure for the availability of the computer laboratory. Thirdly, a request for funding of a computer laboratory manager was realised and two teachers were identified for this role. These two teachers would receive training in maintenance of computers. Fourthly, the procedure that should be followed to identify a computer for maintenance was formalised. Lastly, the Computer-Ndaba started a process at SEIDET in which other courses was identified and initialised as well as the creation of more computer laboratories at other branches of SEIDET.

Experience

In the previous section the planning for each session as well as for the whole Computer-Ndaba was outlined. The reality differed from this planning (see Table 3 for an outline of the different session). Each individual session was devoted to one subject instead of dividing a session into different parts. This was done because the researcher found that the teachers could not spend time on more than one subject, especially if the first part of a session was spent on practical hands-on work on the computers. Four sessions was spent on the management and use issues and the rest of the time was spent on training and field trips. Each of these sessions can be described as an incremental introduction of new ideas. Each of these sessions was a move or a stretch forward.

Session number	Activity	Date
Session 1	What should the computer laboratory be used for?	21 February
Session 2	The use of IT for administrative needs of the teachers	4 April
Session 3	Administration of the computer laboratory	25 April
Session 4	The use of IT for teaching needs of the teachers	30 May

Table 3: Management and use sessions

The theme for the first session was ‘What should the computer laboratory do for us?’ During this session the teachers and the researcher established a general goal for the Computer-Ndaba. The teachers identified why they wanted to do the course and what their goals and reasons for attending the course were. This session was also used as a fact-finding session for the researcher to determine the extent of the teachers’ knowledge about IT. A further result of this session was that a number of important issues for the

teachers were identified:

a) The Computer-Ndaba was seen as the training of the trainers and that they are the people who will take the knowledge about computers to the rest of the community.
b) Specific areas for use of IT for the teachers were identified: teacher administration and teaching purposes.
c) The laboratory is for the whole community.
d) A need for Internet access and other hardware facilities such as printers.
e) A belief that computers are going to solve a lot of problems. In general they were too optimistic and did not realise that funds for maintenance and personnel such as a laboratory administrator will be necessary. They used statements such as *'computers will save time and money for themselves as well as for SEIDET'*.

In this session the role of the media could be seen. The teachers had heard about a number of computer terms and believed a lot of media hype about computers. The terms they heard about are Internet, homepage, LAN and e-mail. They believed that computers would be able to solve their problems as can be seen in point (e) above. In this iteration the teachers were confronted by the subjects they would learn about and trying to identify what they thought they would use computers for.

A second session was used to identify the administrative needs that the teachers had in terms of IT. The five concepts of SSM were discussed in small groups. The teachers identified a number of threats and ideals for the use of IT. This session created a framework from which the practical sessions on the computer use could be linked.

A third session was used to identify the changes necessary in the administration of the laboratory. Up until this time the lab was only open on Saturdays during the Computer-Ndaba but it became clear that they needed to practice during the week. Here they were confronted with the idea that a laboratory manager is necessary for keeping the laboratory open and that that person will need funding for maintaining the hardware. The result of this session was a procedure for the lab. This procedure was reviewed at a follow-up session and the necessary changes were made. The discussion of the procedure created a request for funding and the creation of a permanent post for laboratory manager. The teachers thought that the biggest hurdle was overcome when they received the donation. They also realised that the laboratory will have an effect on the way in which the available funding at SEIDET will be distributed.

A fourth session was held for discussing the IT needs for teaching purposes. This was unfortunately not such a successful exercise. The idea of using the computer for teaching purposes is very far removed from the teachers' world, even though they received a number of articles about the use of computers in secondary education environment as well as a field trip to a school that used IT in innovative ways. There was one group of teachers (the Mathematics teachers) that did develop something useful during this session. The mathematics teachers were able to do this because it was their second computer course. More time and experience with computers will be needed to create worthwhile ideas for using computers for teaching purposes in the SEIDET environment.

Lessons: Principles for IT diffusion with disadvantaged groups

This section will discuss the lessons learned during the implementation of the principles. The principle as it was proposed before the Computer-Ndaba (Scheepers & Mathiassen, 1999) will be given in Italics. In the case of the first three principles a new improved principle will appear in bold directly beneath the old principle. A discussion of how the

principle has been realised in the research will follow. Furthermore the risks will be identified and used to modify the principles.

Problem owner

There is a need for a variety of research projects to promote the interests of disadvantaged groups as part of IT development and use.

There is a need for a variety of research projects to promote the interests of disadvantaged groups as part of IT development and use, based on local support from the community and with the use of local structures.

The principle identifies who the organisation or group is for which the projects should be undertaken. It thus links the beliefs and values of the problem owner to the project and identifies the motivation of the problem owner to participate in the project (Scheepers & Mathiassen, 1999).

The Computer-Ndaba is an example of the research projects identified in this principle. The important goal for the Computer-Ndaba was to achieve democratisation and upliftment of the rural community into which the IT intervention took place. Furthermore, to achieve knowledge transfer to the community with delinking from the donators of the IT. SEIDET is a community centre in a rural area for a disadvantaged community and is thus an excellent venue for this research to fulfil the principle above. The centre has been running for the past six years and is very successful and well organised.

A number of stakeholders could be identified in SEIDET: executive committee of SEIDET, administration department of SEIDET, teachers, students, teaching activity, business and the community. All of these stakeholders were not represented at the Computer-Ndaba, because the main attendants were the teachers. Thus it can be concluded that the problem owner for the Computer-Ndaba was the teachers. These teachers saw themselves as the educators for the rest of the community in terms of IT as can be seen from the comments made in the first session of the Computer-Ndaba.

The reason the teachers specified for attending the course, as identified in a teacher questionnaire, were to become computer literate (84% of the respondents). The reason why the teachers wanted to be computer literate were articulated in the questionnaire as follows: computers benefit the individual in terms of work, administration and other subjects (36%), to be able to teach others about computers (21%), to use computers for retrieving, typing and printing of information (21%) and to be effective and / or efficient (18%). Further comment during the second session as to why they would like to use computers was '*computers will save time and money, computers are economical and efficient, computers are accurate and neat and information is retrievable*'.

One factor that will create successful intervention is the context and environment within which the intervention takes place. The risk for such a project will become very high if there is no support from the community and when there is not a well-organised structure within which these projects could take place. A further risk factor is the commitment of the participants. They must have the will and the need to learn and then teach others in the community. This realised in SEIDET, because five teachers created a computer literacy course for pupils, during the holiday, after the Computer-Ndaba.

Weltanschauung

The research projects should - based on the interest of disadvantaged groups - develop 1) relevant knowledge and skills 2) IT systems that support democratisation of work and

society 3) IT-development approaches that support participation of heterogeneous groups of users.

The research projects should-based on the interest of disadvantaged groups-develop 1) relevant knowledge and skills 2) IT systems that support democratisation of work and society 3) the change agent should have the support of homphilius aids and of high level opinion leaders.

This principle identifies what should be done in the project and what the goals for the project should be (Scheepers & Mathiassen, 1999). The problem owner thus plays an important role in identifying the objectives and the content of projects. The context within which a project takes place is an important aspect of the problem owner and should thus be taken into consideration.

Two formal opportunities were given to the teachers to identify the goals for the course as well as to give them an opportunity to change the subjects that formed part of the course. Quite a number of the teachers remarked that they did not expect subjects such as Curriculum 2005 and co-operative learning to form part of a computer literacy course. This is underlined by the comment made in one of the interviews: *'I looked forward to only learning about the computer, but I was fascinated when I found out that we are actually doing outcome-based education* (an important building block of Curriculum 2005)*'.*

During the first opportunity five goals was identified for the Computer-Ndaba: *Instil a love for computers in the community; empower our community with computer literacy; teachers should become trainers in the community for computer literacy; the laboratory should improve the standard of teaching; and use the lab to save money and time as well as streamline the administration of SEIDET.*

The second formal opportunity was the teacher questionnaire. The questionnaire identified on a more practical note what the teacher would like to achieve. The responses were: to be able to computerise administrative work and personal information (67%), to teach others about computers (28%), to use computers in teaching (8%), improve working conditions (8%) and be computer literate (8%).

In the interviews with the individual teachers, one teacher expressed the importance of computer literacy in the following terms: *'I know that in my school I will be the first one to be able to use a computer. ..... I will be a key staff member as the government is retrenching and re-deploying. They will not consider me for redeployment.'* Thus this course is also seen as a means of job security in a changing educational environment and is thus a goal for the teachers.

The three aspects that form part of the principle were realised in the Computer-Ndaba. The first part of the principle identifies relevant knowledge and skills based on the interest of the disadvantaged group. The discussion above identifies the process used to identify the subjects based on the interest of the teachers. The ideal was that teachers should be computer literate as well as make decisions about how to manage the lab. Comments in the final questionnaire that emphasises that this was achieved: *'Not only were we taught how to use the computer, but also the application of outcome based education was made clear'*, and *'We were always asked how everything was going and what we thought was right for us. So everything was tailor made for our needs'.*

The second aspect emphasises democracy of work and society. The five goals showed the importance of the community to the teachers and they saw themselves as the people who will take computer literacy to the rest of the community. It also showed that the teachers thought that they would be able to use the computers in their work. The knowledge that was given to them would give them the ability to make choices that affect

their lives.

The last aspect of heterogeneous users was realised in the fact that the change agent was heterophilous from the group. It was necessary to get the help of a homophilous aid and the support of the opinion leaders. There is a high risk that a trusting relationship will not be formed between the change agent and the participants of such a project.

One of the risks inherent to this principle is aiming too high. A number of visits to other institutions with computers were organised for the teachers to form ideas about how computers can be used in their environment. The visits should be to institutions that are very innovative with the limited resources they have. This will give the teachers a realistic goal to attain. This was achieved by visiting a disadvantaged school, where a number of XT computers were used for teaching purposes. In summary this can be explained, as small increments with stretch - like milestones in a project. A subject that links to this risk is when the teachers try to attain a goal, such as student-teacher interaction with the use of computers, but they cannot visualise it. This was one subject the teachers identified they would like to do, but even though considerable time was spent on this subject, they could not come up with plans that will be feasible. The reasons for this failure might be that the jump from computer illiterate to computer literate and using computers for teaching was to great for the time spent on the subjects. The implication here is that there should be stretch towards a better situation, but too much stretch can be counter productive.

Another risk for this principle are inherent to the participants. The participants might not be able to use the knowledge they have gained during the course. A procedure was passed, in the case of the Computer-Ndaba whereby all documentation handed in by the teachers at SEIDET should be done on computer.

Methodology

An action research approach should be taken based on the active participation of one or more disadvantaged groups of IT users.

An action research approach should be taken based on the active participation of one or more disadvantaged groups of users. The relationship between the researcher and the participants should be supported by local structures. Incremental changes should be made each change should be an improvement from the present situation to a new situation.

This principle identifies how the project should be executed by taking the previous two principles into consideration (Scheepers & Mathiassen, 1999). The important concepts for this principle is action research, relationship between the researcher and the problem owner (or participants) and the actual sessions that form part of the project, such as visits to similar sights and the study of relevant literature. Another aspect is the dissemination of the information to others.

The principle itself gave the researcher the idea for the name of the course – Computer-Ndaba. The word '*ndaba*' places the importance of participation by all to the course. The teachers thus expected to form part of the course and to influence decisions that would have been made during the course of the course.

The Computer-Ndaba took place within an action research project and SSM (Checkland & Scholes, 1990) was used as methodology in this project. One important aspect of the action research project is the relationship between the researcher and the participants. In the previous principles (problem owner and Weltanschauung) an outline

of the role-players was given and the importance of the building of a relationship between the change agent and the participants was given. In the course of the trade union projects (these projects was used to identify the principles in Scheepers & Mathiassen, 1999) the role of the researcher was defined as a resource. The researcher in the case of a socio-economic development project cannot play this type of role. The knowledge of the participants is such that the researcher has to play a more leading role, but not a primary role. The researcher should determine the way in which the project enfolds. This implies that the researcher should walk a fine line between identifying what should happen and being lead by the participants of the course.

The five different concepts of SSM was used on different levels by the teachers and correlate with the sessions 1, 2 and 4 identified in Table 3 Management and use sessions. In each of these sessions the teachers were asked to identify the five concepts and discuss each of these.

All of the activities that contributed to the SSM as well as teaching were done in small groups. The examples used for Word and Excel was based on teaching exercises to allow the teachers to see where they can use the applicable software. This was done to adhere to the principle of the problem owner and the context within which they worked.

In the sessions of the Computer-Ndaba two visits was planned. The one visit was to the CSIR a South African industrial research institution. The second visit was to a school in a disadvantaged community who has used computer literacy in an innovative way with limited resources.

Literature about co-operative learning, Curriculum 2005, computer literacy and use of computers in a teaching environment were given to the teachers. The use of this literature was not effective. This could be ascribed to the fact that the teachers had very little time to go through the literature and that the literature about using computers in teaching was not understood by the teachers because it was too far removed from their environment and too technical.

The teachers liked the way in which the course has been presented as can be seen in the final questionnaire answered by the teachers. On the question whether they liked the approach used in the course all of them answered yes. Further positive feedback could be found in the individual interviews with the following comment*: 'It is actually what I think we should be doing in the classroom. It is not just information, you have given us a problem. The computer is a problem to us and you were saying here is a problem how do you solve it and we came up with ideas'*.

The biggest risk in this principle is if the relationship between the change agent and the participants is not built on trust and mutual respect. The change agent has to make sure that the relationship is based on equality with mutual goals and that the interaction between the change agent and the participants are open and honest. Another risk linked to the relationship is understanding between the participants and the change agent. It is necessary to place checkpoints in the course to make sure what and how the participants understand. The reason for this is a language barrier. The project will typically be conducted in English which is a second or even third language for the participants and possibly for the change agent and aide as well. This causes possible misunderstanding or metaphor clashes.

IT-use ideas

The IT-use ideas are that of human oriented design of computer artefacts to support and develop the democratisation of society, the quality of work, the knowledge and skills of individual users to increase self-esteem and a freedom from servitude.

This principle identifies what is good, acceptable and unacceptable use of IT (Scheepers & Mathiassen, 1999). In the case for the Computer-Ndaba the teachers identified job security and certain aspects of their jobs as important for them to learn about computers.

During the course of the Computer-Ndaba the teachers for the use of IT identified two subjects: teacher administration and teaching. To enhance this idea the examples used in the computer literacy classes were based on teaching activities such as tests and class lists.

In the first questionnaire the question about 'Why they wanted to learn about computers?' was answered as follows: 36% said it would benefit the individual in his work, administration and other aspects. In answer to the question 'What they would like to do after the Computer-Ndaba?': 67% answered that they would like to computerise administrative work and their personal information and 8% would like to use it for teaching. All of these remarks refer to the quality of work aspect of the principle as well as the knowledge and skills of the individual users. It would hopefully give them more choices and would increase their self-esteem.

The increase of self-esteem could be seen through observation. The teachers were more comfortable in talking about computers and suggesting new tasks to perform. The fact that a number of teachers started a computer literacy course for pupils on their own initiative, identify that the course has added to their self-esteem.

The aspect of democratisation of the society will hopefully be answered in the future. It is the intention of the teachers to take their new knowledge to the rest of the community as can be seen in their goals. This is further underlined in the first questionnaire to the question 'What would you like to do with the computer?' 28% answered that they would like to teach others about computers. Answering the question why they decided to attend the course 11% answered to use computer literacy to teach others. Answering the question: 'Why do you want to learn about computers?' 21% again identified teaching others about computers.

The risk in this principle can be summarised from previous principles: Lack of resources, lack of commitment by the participants, bad management of the computer laboratory, a dependence on other institutions to make things happen - thus no knowledge transfer.

Knowledge transfer can be described by the use of an analogy of transplanting an organ into a human body. IT is the new organ that is transplanted into the SEIDET community. After the transplant, it is important for SEIDET to see the innovation as part of themselves. They thus need 'medicine' in the form of redefining the IT to their needs. The redefining process was done through the Computer-Ndaba and the help of the change agent. The redefining should ensure that they see IT as part of their work and environment, else the IT will be rejected. The redefining should take the context within which the IT should function into consideration and should be changed accordingly. After the redefining, 'exercises' is needed to ensure that they do not forget what was done. It is also necessary for them to identify realistic goals to strive for.

The ideas for IT-use is that of human oriented design of computer artefacts to support and develop the democratisation of society, the quality of work, the knowledge and skills of individual users to increase self-esteem and a freedom from servitude and that this knowledge is transferred to the users.

IT-development ideas

The IT-development ideas are participation and negotiation between heterogeneous

groups of users, systems developers, and managers with the understanding that systems development is a mutual learning process.

No comments on this principle can be given, because no systems development was done. A number of systems for SEIDET has been identified and will be developed in the future.

Discussion

Through the Computer-Ndaba a number of lessons were learned. There is a need for a well-organised environment and local support from the community for the redefining process to take place. The use of IT should take the participants into consideration. There should be incremental change with stretch that is within reach of the participants. Goals that are too high should not be set otherwise the participants will not even try to attain these goals.

The way in which the role players should communicate is very important. The participants should be able to set the goals for the redefining process and should have the ability to change any aspect of such a course. This implies that the relationship between the change agent and the participants should be open and honest. Usually the change agent is heterophilous and this can create problems in the establishment of such a collaborative relationship. Other role players thus play an important role in the establishment of this relationship.

In conducting the Computer-Ndaba at the SEIDET centre a number of changes could be made to the principles for IT development and implementation. These are very valuable insights into such a situation. In general the Computer-Ndaba started a process of IT diffusion in the Siyabuswa community and can thus be seen as a huge success, although a number of problems were encountered. A further important result of the course was the identification of the risks in this type of project.

The research that took place in this environment addressed on important criticism of diffusion for developing countries: the issue of equality. It is usually found that the diffusion process widens the socioeconomic gap between the 'haves' and the 'have nots' (for example Rogers, 1995; Roche & Blaine, 1996). The diffusion process as described in this paper is about people that can be seen as losers in a diffusion process. The participants of the Computer-Ndaba were given a chance to develop and implement IT to their own advantage and to create the necessary knowledge to be able to operate the technology effectively.

Conclusion

The research questions will now be discussed. How should IT introduction be done in a rural community centre in South Africa where there is no previous experience of using IT? The discussion above gives a detail description of how the Computer-Ndaba was used to introduce IT into the Siyabuswa community. The course consisted of both hands-on practical sessions as well as discussions about the use and management of the technology. The importance of the needs of the problem owner, in this case the teachers, was emphasised.

What are the social and technical risks in such an introduction process and how can these be addressed? A number of risks have been identified with each of the

principles. In general the risks can be linked to the three subjects that were considered at the Computer-Ndaba. The risks associated with the management of the labs are: lack of finances, unavailability of facilities, bad management of the lab and external factors (theft, vandalism). The risks associated with the use of the lab are in many ways linked to the management of the laboratory. The risks associated with presenting a course in computer literacy to such an environment are: skills that have been attained are not practised, a collaborative relationship between the participants and the change agent is not established.

How did the principles for IT development and implementation apply in the introduction process and what lessons were learned about them? A discussion was given about the principles and how they applied in the case of the Computer-Ndaba. Based on the experiences in this case changes were made to the principles.

How should IT diffusion be done in a development environment? The important aspect of IT diffusion in a development environment is the delinking of the knowledge from the donor and change agent to the participants themselves. The participants should be able to go on with the process and day-to-day activities without the help of other institutions. An important factor is also that the redefining process should be done in such a way that it takes the context within which the IT will function into consideration.

References

Attewell, P. (1992). Technology diffusion and organizational learning: The case of business computing. *Organization Science* **3**(1): 1-19. February.

Avgerou, C. & Madon, M. (1995). Development, self-determination and information. *SACJ* (15): 4 - 12.

Bell, S. & Wood-Harper, T. (1993). Systems Analysis and Systems Design in Developing Countries: Real Needs, Analytical Honesty, and a Multi-Perspective Methodology. In Cotterman, W.W., Malik, M.B. (eds) *Information Technology in support of Economic Development, Research Monograph No 106*, Georgia State University Business Press, Atlanta, Georgia, 31-54.

Braa, J. (1997). Use and design of information technology in third world contexts with a focus on the health sector: Case studies from Mongolia and South Africa. Thesis submitted for the degree of Doctor Philosophiae.

Checkland, P. (1981). *Systems thinking, Systems Practice.* Wiley, Chichester.

Checkland, P. (1991). From Framework through experience to learning: the essential nature of action research. In Nissen, H.E., Klein, H.K., Hirschheim, R. (eds) *Information Systems Research: Contemporary Approaches and Emergent Traditions*, 397-403.

Checkland, P. & Scholes, J. (1990). *Soft systems methodology in action.* John Wiley & Sons, Inc.

Conradie, P., Phahlamohlaka, JP, Greyling, M (1998). An evaluation of the functioning of the Siyabuswa Educational Improvement and Development Trust (SEIDET). Human Science Research Council, March 1998.

Co-operative learning project, (1997). Project proposal for the development and deployment of computer supported co-operative learning at community learning centres. University of Pretoria, May, 1997.

Department of Education, 1997. *CURRICULUM 2005: Lifelong Learning for the 21st Century*, Department of Education, 1997. URL:

http://www.polity.org.za/govdocs/misc/curr2005.html
English-Zulu, Zulu-English dictionary (1953). *English-Zulu, Zulu-English dictionary*, Witwatersrand University Press, Johannesburg. Second edition.
Foster, M. (1972). An introduction to the theory and practice of action research in work organizations. *Human Relations* **25**(6): 529-556.
Huff, S.L., & Munro, M.C., (1985). Information technology assessment and adoption: A field study. *MIS Quarterly*, December, 1985.
Mathiassen, L. (1998). *Reflective systems development*. Doctor Scientarium thesis, Aalborg University, Aalborg, Denmark
Newman, D. (1993). School networks: Delivery or access. *Communications of the ACM* **36**(4): 49 - 51.
Rapoport, R.N. (1970). Three dilemmas in action research. *Human Relations* **23**(6): 499-513.
Rogers, E.M. (1995). *Diffusion of Innovations*. The Free Press, New York. Fourth Edition.
Roche, E.M., Blaine, M.J. (eds.) (1996). *Information Technology, Development and Policy.* Ashgate Publishing Ltd, England.
Schank, R.C. (1993). Learning via multimedia computers. *Communications of the ACM* **36**(5): 54 - 56.
Scheepers, H., de Villiers, C. (1999). Teaching of a computer literacy course: A case study using traditional and co-operative learning. Forthcoming ECIS '99, Copenhagen, Denmark.
Scheepers, H., Mathiassen, L. (1999) Out of Scandinavia – Facing social risks in IT development in South Africa. Forthcoming in the Journal for Global Information Management.
Wilkinson, A.C. (1983). *Classroom Computers and Cognitive Science*. Academic Press, Inc, New York.