A Critical Social Research Perspective on Self-Directed Learning and Information Technology Practitioners

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Abstract—Information systems practitioners are frequently required to master new technology, often without the aid of formal training. They require the skill to manage their own learning and, when this skill is developed in their formal training, their adaptability to new technology may be improved. Self- directed learning is the ability of the learner to manage his or her own learning experience with some guidance from a facilitator. Self-directed learning skills are best improved when practiced. This paper reflects on a critical social research project to improve the self-directed learning skills of fourth year Information Systems students. Critical social research differs from other research paradigms in that the researcher is viewed as the agent of change to achieve the desired outcome in the problem situation.

Keywords—Action Research, Critical Social Research, Information Systems Education, Self-directed Learning.

I. INTRODUCTION

DURING discussions with alumni it became apparent that some information, communication technology (ICT) practitioners experience problems adapting in the ever changing world of technology they work in. They are required to keep themselves up to date with the latest technological developments in their field with little formal guidance.

It was decided to change the method of instruction of one of the modules of the 4th year Information Technology (IT) students at the Vaal Triangle Campus of the North-West University (NWU) in South Africa to self-directed learning (SDL) in order to develop the SDL skills of the students. The module concerned is in Data Mining (DM). This paper reports on an action research project under taken to improve the SDL skills of these students. The aim of the paper is to demonstrate how critical social research (CSR) is used to achieve participative change in an environment. The aspects of CSR identified by Harvey [1] are used to evaluate the research project. The paper begins with a discussion of critical social research focusing on the work of Harvey. This is followed by a brief introduction of SDL in section III. Section IV serves as the empirical report of the project dealing with the details of the research methods used. The aspects of CSR identified by Harvey are then used to evaluate the project in Section V. Concluding remarks are provided in section VI.

II. CRITICAL SOCIAL RESEARCH

In Information Systems research, research methods are mostly described ontologically and epistemologically from the perspective of three research paradigms: positivism, interpretivism, and critical social research [2], [3].

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This paper focuses on the third paradigm namely critical social research. Since these paradigms developed chronologically, critical social research is better understood when discussed after a short introduction to the other paradigms. Therefore a short discussion is given here on positivism and interpretivism before a discussion of critical social research is provided.

A. Positivism

Positivism is known as the "natural scientists' model" of research [4]. In positivistic research, the scientist is objective and knowledge is gained using a method that is repeatable and focuses on facts rather than values.

Data collection methods include standardized questionnaires and experiments. Data analysis is done with statistical methods such as factor analysis and regression. Positivistic methods are especially suitable when the influence of a specific measurable factor needs to be determined.

Positivistic research projects are evaluated in terms of statistical criteria. These include the validity of the questionnaires and the suitability and accuracy of statistical methods applied for analysis.

B. Interpretivism

Interpretive research focuses on meaning. Dilthey [5] argued that one could only understand behavior through the comprehension of their inner meaning; the meaning that led to their production. Subjective understanding is central to interpretive research. Knowledge is gained from rigorous hermeneutic analysis of behavior in the context(s) of the participants.

Data collection methods include ethnography, interpretive case studies, and interviews. Data analysis is often done using coding methods such as content analysis and grounded theory.

Interpretive research projects are evaluated in terms of holistic understanding. It should be clear that biases are stated and care is taken to understand the phenomenon under investigation from all the participants' point of view. Myers and Klein [6] developed criteria for the evaluation of interpretive case studies in information systems.

C. Critical Social Research

Critical social research is under-pinned by a critical-dialectical perspective, which attempts to dig beneath the surface of historically oppressive social structures [1].

Critical social theorists see knowledge as being structured by existing sets of social relations that are oppressive. This can be class, gender or race oppression. "Knowledge is critique It is a dynamic process not a static entity…It is the process of

moving towards the understanding of the world and of the knowledge which structures our perceptions of the world" [1].

Critical social research methodology describes methods based on the changing of oppressive structures. It regards positivistic scientific method as unsatisfactory because it deals with surface appearances only, while critical social theory aims to cut through these surface appearances [1]. In this section, the general elements of critical social theory are discussed.

Action research is often used as research method for critical social research. Action research is a participative and iterative method used to solve problems. It has five stages in the cyclic process: (1) diagnoses, (2) action planning, (3) action implementation, (4) evaluating success, and (5) advice on improvement. The planning and action implementation phases are often guided by existing theoretical work. Data collection and analysis is a means to an end and suitable positivistic and interpretive methods are used from a critical perspective.

When critical social research projects are evaluated, the key question to be answered is whether the oppressing situation that led to the initiation of the research project is relieved without causing new oppressive structures.

Although critical social research is verified in different methods, shared elements can be identified. Harvey [1] identified the following aspects: abstraction, totality, essence, praxis, ideology, structure, history, and deconstruction and reconstruction. These aspects should not be viewed as discrete units but rather as parts of a process that relies on all the aspects. These aspects are central to this paper and are briefly discussed.

1. Abstraction

Critical social theory accepts that facts cannot exist independently from reality and works from abstract to concrete. It starts with abstract generalizations and then investigates them in reality. It involves an understanding of the general use of a concept, as well as a study into the underpinning structures which specify the nature of the abstract concepts. It aims to reveal underlying structures that are otherwise taken for granted. These structures specify the nature of the abstract concepts which have themselves been assimilated uncritically onto the prevailing conceptualization.

2. Totality

Totality refers to the view that social phenomena are interrelated to form a total whole. Social phenomena should not be investigated in isolation but always as part of a larger context. In a research environment, the researcher aims to relate the empirical detail to a structural and historical whole.

3. Essence

Essence refers to the fundamental element of the analytical process. Critical social researchers view essence as a fundamental concept that can be used as the key to unlocking the deconstructive process.

4. Praxis

According to Harvey [1], praxis means practical reflective activity. It is activity that changes the world. Knowledge

changes not simply as a result of reflection but as a result of action. Knowledge is not static, since we transform our knowledge through what we do; it exists in our everyday lives.

5. Ideology

The nature of the ideology needs to be revealed by the researcher through the identification of the essence of social relations and the separation of this essence from structural forms through a process of dialectical deconstruction and reconstruction.

6. Structure

Structure is seen by the critical social researcher as more than the sum of the elements. It is viewed holistically as a complex set of interrelated elements which are interdependent and which can be conceived adequately only in terms of the complete structure. This implies that parts conform to intrinsic laws which determine the nature of the structure and the parts. The structure is thus capable of transformational procedures.

7. History

According to Harvey [1], history refers to both the reconstructed account of past events and the process by which this reconstruction is made. Following the discussion on abstraction, critical social research involves the grounding of a generalized theory in history, as well as the exposure of the essential nature of structural relations which manifests them historically. Critical research history is not so much interested in the historical facts as in the circumstances within which it occurred. It investigates the social and political contexts, addresses the economic constraints and engages the taken-for-granted ideological factors. It also takes the situation of the researcher into account.

8. Deconstruction and reconstruction

The critical researcher aims to deconstruct the situation into abstract concepts in order to study the interrelations between the concepts with the purpose of discovering the key to the structure of the situation. It is a constant process of moving backwards and forwards between abstract concept and concrete data; between social totalities and particular phenomena; between current structures and historical development; between surface appearance and essence; between reflection and practice [1]. The researcher is constantly aiming beyond surface appearances. The core concept is identified through the deconstruction of the problem situation into concepts through investigation of the different elements of the situation. The core concept is used to reconstruct the situation. If this reconstruction does not fit reality, further analysis of the core concept is needed. A study of the essence and history of the structures in the situation leads to the identification of the core concept. This is an ongoing process to expose the ideology underpinning the situation in order to identify the oppressive mechanism, which requires change.

D. Information Systems Research

Most information systems research projects can be classified according to the above research paradigms. Such a

classification aids the evaluation of the research quality. Klein and Myers [6] provide guidelines for the classification of research methods.

They argue that IS research is positivistic when there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from a representative sample to a stated population.

Information systems research can be classified as interpretive if it is assumed that our knowledge of reality is gained only through social constructions, such as language, consciousness, shared meanings, documents, tools, and other artifacts. Interpretive research does not predefine dependent and independent variables but focuses on the complexity of human sense making as the situation emerges [6].

One can classify IS research as critical if the main task is seen as one of social critique, whereby the restrictive and alienating conditions of the *status quo* are brought to light. Critical research seeks to be emancipatory in that it aims to help eliminate the causes of unwarranted alienation and domination and thereby enhances the opportunities for realizing human potential [6].

The aim of this paper is to reflect on a research project that aims to improve the self-directed learning skills of IS students. A brief literature review on self-directed learning follows.

III. Self–directed learning

Self directed learning (SDL) is a concept introduced by Malcolm Knowles in 1975 [7]. Key to this concept is moving the responsibility of learning away from the teacher to the learner. The experiences of the learner provide rich information that should be combined with the formal material to add to the richness of learning of the group. Learning moves away from traditional subject-oriented learning to task-oriented learning. Learning is focused on tasks to complete rather than a large amount of factual knowledge.

The learner should take control of the learning experience and the teacher should only facilitate this process. In teacher oriented learning the learner is externally motivated in terms of rewards and punishment, whereas in SDL the learner is internally motivated, by aspects such as accomplishment or curiosity to learn [7].

Various authors provide models describing the components or aspects of SDL. Long [8] discusses SDL in terms of sociological (independent task management) and pedagogical (educational) aspects. Garrison [9] extends the work of Long [8] by describing SDL in terms of interaction between self-management (contextual control), self-monitoring (cognitive responsibility), and motivational (entering and task) dimensions. Intrinsic motivation to acquire new knowledge is central to the success of SDL. Personal responsibility of the learner as described by Brockett & Hiemstra, [10], is central to the success of SDL in terms of life-long learning as intended by Knowles in 1975.

However, self-directedness in a learner develops in stages. Grow [11] describes different phases of self-directed learning

skills of learners as dependent, interested, involved and self-directed. Learners need to be guided to become more self-directed over time. Individual students have different levels of SDL skills and one should provide guidance to different students according to their SDL skill. This aspect is also referred to as SDL-readiness.

Guglielmino [12] provides an SDL readiness test, which is developed from a positivistic research paradigm consisting of Likert-scale type questions. Students' responses to questions are analyzed and a score is computed indicating the readiness of a specific student for SDL. A high score implicates that a student requires less guidance in learning than a student with a lower score. Some authors [13], [14], [15] have criticized the readiness test of Guglielmino [12], identifying validity issues. Students who dislike learning in general will have lower scores, which is not necessarily indicative of their self-directedness. The tool however remains widely used by positivistic researchers.

Fisher, King and Tague [16] developed a SDL readiness tools focused on nursing education. Their test contains 40 items that include personality traits and skills such as time management. Motivational and control aspects are also included in the test.

The research project that is partly reported on in this paper is aimed at improving the SDL skills of 4th year IS students in order to develop these students into lifelong learners capable of adapting in the ever changing world of technology. An action research project was initiated to achieve this.

IV. Empirical work: Improving SDL skills of IS students

Action research (AR) is a cyclic participative CSR method to facilitate change in a problem situation. As stated in the introduction, it became apparent that IT graduates struggle to adapt in a changing technological world. It was decided to change the Data Mining (DM) module of the 4th year students to an SDL delivered module in order to improve SDL skills of these students. This empirical part of the paper is organized according to the phases of AR namely: initial diagnosis, action planning, implementation, evaluation of success, and advising improvement.

A. Initial Diagnosis

Action research is a participatory method where all stakeholders need to be involved in the improvement of a problem situation. Currents students, past students and the lecturer were identified as the key stakeholders in this situation. From discussions with 5 former students the following problems were identified:

- When confronted with a new topic to investigate, the former students all had problems finding a starting point for their investigation.
- Former students did not set themselves simple tasks to complete using the new technology; they attempt to understand enough detail to complete a full-size project.

- Although they view themselves as life-long learners they reported that learning new technology is a skill mostly acquired after they have left the university.

The concerned 4th year module in Data Mining is presented after hours in a part-time mode of instruction. Most of the students are also working full-time in the ICT industry. The findings of the discussions of the past students were tested in discussions with three current students working in industry. Their stories supported the findings from analysis of the interviews with past students.

The SDL skills of individual learners must be understood in order to develop study material suitable to develop the SDL skills of individual learners. Blended learning (combining e-learning and contact sessions) provides the opportunity to provide different learning experiences for learners on different levels of self-directedness. If the SDL levels of students are understood, different guidance can be provided by means of e-learning material to accommodate the different levels of SDL readiness of the group.

It was decided to test the SDL-readiness of the students. Since the readiness test of Guglielmino is widely used it was decided to use this test. The results of the 17 students completing the questionnaire had a normal distribution and the average SDL readiness score of the group was slightly higher than the population. No students had low SDL readiness score and 3 students had a high score. It was concluded that the test results indicated the module change to SDL could be successful and that the students were able to study using SDL mode of instruction.

However very little were understood about individual students regarding their expectations and fears caused by the change towards SDL. The same group of students completed interpretive questionnaires on SDL readiness. Twenty-four students returned the questionnaire compared to the 17 in the previous section. The questions were compiled from SDL literature incorporating questions on aspects found in positivistic questionnaires.

The results of only 5 of the questions are discussed here to illustrate the understanding achieved from interpretive analysis. Content analysis was used and codes were identified to describe the answers of the students.

The first question presented in this paper was:

"What was your first reaction to the change of the module? Positive / Negative and why?"

As described earlier the first part of the module was presented using a lecturer centred model and it was changed to a SDL model. Codes were developed for (number of responses):

- Anxious mixed (2);
- Mixed (gave positive and negative reasons) (3);
- Negative (enjoyed previous methods) (2)
- Negative (against teamwork) (2)
- Negative (time management) (2)
- Positive (13).

From these one may group codes together. All the negatives add up to students, mixed 5 and positives 13. To illustrate the riches of information gathered a few of the answers and their codes are given here:

Anxious: "Never have I done this before! Scared and excited. Scared because of this huge change. Excited because of this huge change. This is a good opportunity to see if I can learn independent of any course material and study guide. I can choose these myself."

Negative (time management): "Negative, because it seemed like a lot of work to be done in a short period of time. And also the confusion of where to start, how to start, and to look for"

Negative (enjoyed previous methods): "Negative. Is easy to just settle at one's comfort zone, lecture coming prepared, lecturing and I just sit there and do what she told me"

Positive: "Positive because we are now applying the concepts more practical to the field in a real world than having assignments from the textbook only which are pre – prepared questions from a certain environment and difficult to imagine"

From this it is clear that special guidance on time management and teamwork should be provided to students. In a blended learning environment students can choose how much guidance they use in terms of how many optional resources on non content related topics they study.

Another question was: "Do you view yourself as a curious person?" All the students except one answered positively. Only one student answered a question on their ability to evaluate their own examination performance negatively. Only one student indicated that he thinks that he will not pass the module stating the following:

"No, to be honest the time I spend on my studies is too minimal. My responsibilities at home where not permitting me to concentrate on my school work. As a father I had to give full support at home. This worked against me at all costs."

The final question reported on in this section was: "Do you do a lot of research on your hobbies? Explain." After coding, 9 students indicated that they often don't do research on hobbies while 13 indicated that they do. Two explained that they would rather form interest groups to investigate their interests.

B. Action Planning and Implementation

After the analysis of the interpretive questionnaire it became clear that there are students with lower levels of SDL readiness in the groups and special care needs to be taken to accommodate these students.

The course of module is as follows: Data mining is presented as a year module. For the first five months students had to do assignments as preparation for lecturers. This was done to ensure that students have a solid foundation in basic data mining skills. After five months the students had to propose three topics in data mining they wanted to study using SDL techniques in groups. It was at this time that the students completed two SDL readiness questionnaires, one positivistic and one interpretive questionnaire.

Clear outcomes for the student projects were set. A project must be in the format of an extended journal paper. It should cover at least the following:

- A description of the technique
- Motivation of choice of technique
- Literature review on other people applying the technique
- Data should be found to apply the technique on
- A program to apply the technique must be found
- A report on the practical use of the technique
- Conclusions on the suitability of the technique for specific problem situations

An internet-based learning management system (LMS) site was used to communicate with students and to allow students to communicate with one another.

In terms of assessment, the students had to give presentations of their work in the monthly contact session. The entire group and the lecturer completed evaluation sheets. The lecturer provided the feedback very quickly after the session adding additional comments to help students improve. Very often the students engaged with the lecturer in the LMS chat room. The marks allocated by the students combined with that of the lecturer were awarded for the presentations. Students had to submit a full report in journal paper format for each project which was evaluated and scored by the lecturer.

By allocating marks for other groups students became critical thinkers and they better understood the mark allocation. There was a definite improvement from the first to the second and again to the third presentation in quality. They had all the evaluation sheets before submission dates and they could use it for self-evaluation.

The standard of the work done by the students was above expectation. Some of the papers written by the students are on conference standard.

C. Analysis of the Success of the Intervention

The goal of the project is to improve the SDL skills of the students in order for them to better adapt to change in the ICT industry. This is a longer term goal and impossible to measure after the completion of this SDL module in Data Mining. However it is possible to investigate whether the SDL skills or aspects thereof improved. It was decided to distribute another interpretive questionnaire after the completion of the module to the students. All the students expressed enjoyment of the SDL part of the module. Most of the student referred to the opportunity to choose their own topics and material as beneficial, some answers are quoted here:

"Yes indeed because the second part was more empowering in the fact that I able to take control on my studies and learn more on the subject matter as well develop other important skills that I can apply in the real world."

"Choosing the topic and the angle of focus suited me the most. It gave me the freedom to explore data mining the way I wanted. The fun part was finding and making a link between topics and exploring their collaboration through data mining."

All the student perceive improvement in their own SDL skills. One student made the connection to the ICT workplace:

"Definitely. Because now I am aware of the SDL and I am able to do research on a certain topic, my presentation and communication skills have improved. These skills can assist me in the work place."

From analysis it became clear that more students were anxious about the change in the mode of teaching. A number of students who did not refer to negative feelings in the first questionnaire referred to frustrations and fear in reflection:

"Basically I think I have performed better than I thought as I was at first frustrated about the change that one has to undergo."

Communication within the group and time management were the biggest challenge. Many students reported improvement in these aspects.

Some of the aspects discussed by Knowles in the development of SDL were evident; one student wrote:

"I like working or doing practical things, instead of just studying a long theory and answering with long sentences."

It was concluded that the intervention was successful in improving the SDL learning skills of the students. The students were able to take more control of their learning and enjoyed the mode of instruction. This mode of instruction will continue in future.

D. Advise Improvements

Although the SDL skills of the students improved, the original aim of the project (improved adaptability) has not been reached yet. The students who participated in this project need to be contacted in a year's time and only then will it be possible to investigate whether these students perceived themselves better equipped to handle change than the former students interviewed in the diagnosis phase of the project.

The third project completed by the students involved the use of prescribed software tools. None of the students were familiar with the specific tools. A large number of the students reflected positively on this project and the group scored higher marks in this project than the other two projects. One can further investigate why the students performed better when the software tool is prescribed. One should perhaps prescribe the tool for the first project and allow the students to select tools for the latter projects. This would be more in line with the work of Grow [11] indicating improvement in SDL learning skills of students.

V. CRITICAL SOCIAL RESEARCH EVALUATION OF RESULTS

Although the work of Harvey was not used during the planning of this research project, it is used to reflect on the project from a critical social research perspective. The discussion will be done according to the aspects identified by Harvey [1] discussed in Section II and also serves as a summary of the process followed.

A. Abstraction

This project started with the abstraction that SDL skills should be improved in order to improve the adaptability of

ITC practitioners. A module in Data Mining was changed to SDL instruction. A study into the concepts of SDL led to the development of an interpretive questionnaire to test the SDL readiness of the students. Underlying concepts that were identified as troublesome included time management, group work, self esteem and resistance to change.

B. Totality

As the students involved in this study are part-time students it is important to understand the circumstances of each student. Care was taken to allow each student to voice his / her expectations of the module and flexibility was granted in terms of the assessment time schedule where appropriate. The interpretive questionnaire developed included questions on personality traits such as curiosity outside the scope of academic training.

C. Essence

It was difficult to identify the essence of the lack of self-directed learning skills of students. Although the essence of SDL is control, lack of SDL skills of students may be contributed to other factors than the inability to take control of one's own learning environment. The academic models discussed in section III gave clues as to what the real stumbling blocks for students are. Aspects such as self-belief and poor time management and resistance to group work were identified. Control as the essence of SDL in general must be shifted from the lecturer towards the student.

D. Praxis

When shifting control towards the students it must be done in a careful manner. Students need to know what is expected of them. Even though extreme care was taken to manage this process, some students reported that they did not know at the beginning of the module what was expected of them. It was only after the students did complete three SDL projects when they reflected on their SDL skills that many of them were able to articulate their fears and frustrations experience at the start of the project.

E. Ideology

Many students had low self-esteem issues at the start of the project which prevented them from taking control of their own learning environment. Individual students did demonstrate curiosity and creative problem solving techniques required for SDL but lack of confidence in presentation of their work to other people prevented them from realizing their potential. During the first round of class presentations, many students were anxious and could not communicate their work appropriately. They received additional information on presentation skills and were supported in the development of their second presentations.

F. Structure

Structure in this project can be seen as the framework created by the lecturer for the students to function within. It includes the guidelines for the projects, the assessment criteria and actual assessment of the project. Communication strategies and individual guidance was made part of the structure by using the LMS. Students knew when and how to receive more guidance. It is important to describe the complete project formally in order to achieve similar positive results in future. Some structural aspect may be lost if not described. Lecturer availability can be viewed as an example of this: the lecturer was available each Monday night for consultation in the chat room of the LMS; many students reviewed the chats without taking part in them. Without this interaction lots of communication would not have taken place.

G. History

The remark of a specific student that he found SDL as a total new experience was a shock to the research team. These are 4th year students and one would expect that they would have experienced SDL in the past. Their above average scores for the Guglielmino – test indicated that they were better prepared for SDL the average person taking the test. The social context of the students was taken into account. Even the political history of South Africa has an influence on some of the dimensions of SDL ability such as confidence. Students were asked to provide motivation for their expectations of the module.

H. Deconstruction and reconstruction

The inability of ICT practitioners to adapt to change was deconstructed in a low level o SDL skill of the past students. SDL skills were deconstructed in terms of specific dimensions such as creativity, taking control, self-confidence and poor team work. A module in Data Mining was developed to improve these aspects. Control of the learning situation was shifted towards the students away from the lecturer. After completion of the reconstructed module students perceived an improvement of their SDL skill. At least two students related their new skills to work experience, which is the ultimate goal of the project.

VI. CONCLUSION

The work of Harvey allowed the researcher to reflect on a research project from a critical social research perspective. This work should also be used in the planning of future projects. It allows the researcher to gain a more holistic understanding of the problem environment.

Improving the SDL of IT students during their formal training might have benefits in terms of their life-long learning and ability to adapt to new technology in their work place. Future research will be done using this group of students to verify this. The paper aims to make a contribution to adaptability of ICT practitioners by changing IT education strategies.

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