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Innovative Teaching in Systems Analysis and Design - an Action Research Project

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***Abstract*—**Systems Analysis and Design is a key subject in Information Technology courses, but students do not find it easy to cope with, since it is not "precise" like programming and not exact like Mathematics. It is a subject working with many concepts, modeling ideas into visual representations and then translating the pictures into a real life system. To complicate matters users who are not necessarily familiar with computers need to give their inputs to ensure that they get the system the need. Systems Analysis and Design also covers two fields, namely Analysis, focusing on the analysis of the existing system and Design, focusing on the design of the new system. To be able to test the analysis and design of a system, it is necessary to develop a system or at least a prototype of the system to test the validity of the analysis and design. The skills necessary in each aspect differs vastly. Project Management Skills, Database Knowledge and Object Oriented Principles are all necessary. In the context of a developing country where students enter tertiary education underprepared and the digital divide is alive and well, students need to be motivated to learn the necessary skills, get an opportunity to test it in a "live" but protected environment – within the framework of a university. The purpose of this article is to improve the learning experience in Systems Analysis and Design through reviewing the underlying teaching principles used, the teaching tools implemented, the observations made and the reflections that will influence future developments in Systems Analysis and Design. Action research principles allows the focus to be on a few problematic aspects during a particular semester.

***Keywords*—**Action Research, Project Development, Systems Analysis and Design, Technology in Teaching.

I. Introduction

THIS paper focuses on a second year subject, Systems Analysis and Design (SAD), offered as two modules in the course: Information Technology at a South African university. The subject matter differs from other subjects in the course in the sense that it is not relying on logic alone like programming subjects and it is not exact like mathematical subject – subjects the stronger students excel in. Success in the subject rely on combining various skills like analysis of an existing system, design of a new system and by implication, the development of the designed system, possibly through making use of a prototype. The prescribed text book is similar to other material covering the subject matter: a rich text describing "the" SAD life cycle, methods, techniques, processes, procedures and definitions. Lots of examples based on case studies are included – creating an information overload which makes it difficult for the average student to cope with. A project done in groups and following the explained life-cycle based on a real-life example is completed over the two six month semesters. A structured time-table of two 90 minute contact sessions per week is followed and the available learning and collaboration environment, eFundi (a Sakai product) is relied on to allow continuous communication between students, student assistants, supplemental instructors and the facilitator/teacher; also to enhance the learning experience.

Action Research is used both to ensure "action" and to ensure "research" is taking place. Improving the learning experience by addressing only a few critical aspects per year (offered in semesters) is the main aim and formally reflecting on the progress is the purpose of publication.

The article will address the underlying philosophy to teaching and learning, the South African context, action research as research approach, the recent history of the subject, what happened during the last year in the subject and what is planned for the subject in 2012. The paper is lastly concluded.

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II. The Underlying Philosophy

From the point of view of an academic teaching a group of students, the students are approached according to a personal belief system, influenced by the way the teacher believes learning to take place most effectively and efficiently. Class room practice is grounded in a methodology that is grounded in some philosophy as explained in fig. 1 below:

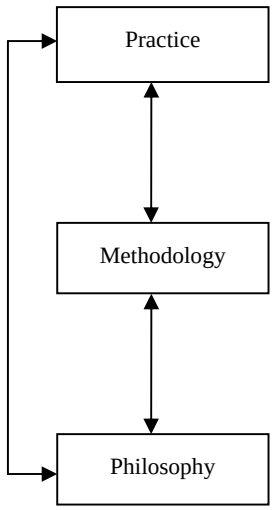


Fig. 1 The relationship between philosophy, methodology, and practice, adopted from Goede [8].

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Class room practice should also take the nature of the subject into consideration. With this in mind, the following is important:

- students should learn actively by performing certain actions – action learning,
- students should learn from one another and also teach one another – collaborative learning,
- students should be allowed, within boundaries, to direct their learning – self-directed learning, and
- students should have various opportunities to learn the same thing, taking their learning preferences into consideration – flexible learning.

The above-mentioned principles involve the teacher in the following way:

- Action Learning – through the implementation of the action research cycle, "action" is more important anything else; Dick [7] addresses this by warning against the four traps of procrastination; postponing data collection until the literature study is complete, postponing analysis until the all the data is collected, postponing action until all the data is interpreted and postponing writing it up until the research is done. Therefore Dick [7] proposes early action and interpreting data as it is collected, interpretations to be turned into action plans that are implemented as early as possible, results of actions to be reviewed immediately, and capturing of conclusions as they develop. Dick's phases can be transferred to the Systems Development Life Cycle's phases where the teacher is valuable in facilitating action.
- Collaborative Learning – although the teacher guides the learning process, she also becomes part of the learning process, and learns from students as well. Learning includes both the material coved and how to best (better) teach the subject.
- Self-directed Leaning – here the function of the teacher is to allow for particular preferences, but at the same time ensure the learning of the basic SAD theory, principles and practices.

Flexible Learning – the teacher's role is to allow for various ways of learning using different senses like hearing, seeing and doing. Unfortunately it is time intensive to develop teaching material, but the material can be developed over a period of time. It is also of great help to make use of material already developed and available on the Internet.

III. THE SOUTH AFRICAN CONTEXT

South Africa has a number of challenges in the educational system, which includes a multi-cultural environment, the digital divide, language barriers and financial constraints as the most important ones. The class reflects the multi-cultural campus composition as listed in table I.

The university has a number of computer laboratories with 200 computers available 24 hours per day, every day of the week. It should be noted that these facilities are shared by most of the 6000 students on the campus. Although assignments can be done using the facilities, it becomes very difficult for groups of students doing a complex project to use these facilities. During the first semester more than half (ten) of the seventeen groups had access to at least one laptop among them, this changed to twelve of the eventual fifteen groups that remained during the second semester. Obviously better access to fast computers with the necessary software will assist groups to perform well.

TABLE I

SYSTEMS ANALYSIS & DESIGN CLASS COMPOSITION

Groups	Number		Gender	First Language		
	Sem 1	Sem 2		E	A	O
Black	9	8	**F**			all
	24	20	**M**			all
White	3	4	**F**		all	
	10	8	**M**		9 7	1 1
Indian	1	1	**F**	all		
	2	2	**M**			all
Coloured	1	0	**F**	all		
	0	0	**M**			
TOTAL	50	43				

Sem-Semester
F-Female, M-Male
E-English, A-Afrikaans, O-Other languages

The North-West University (NWU) has three campuses, each with different teaching languages. At the Vaal Triangle campuses two teaching languages, namely English and Afrikaans are used. A revolutionary translation service is used on all campuses where a lecture can be done in the one teaching language and is translated by a translator through a system where each student wishing to hear the lecture in the other language can use earphones. In SAD it was jointly (the teacher, all students and the translator) decided that English will be the teaching language, while questions will be allowed in Afrikaans. Most students' second language is English, but the fact that they were in their second year of study, contributed to the group experiencing little language problems.

IV. ACTION RESEARCH

According to Altrichter, et al. [1] action research has been recognized as a field of research practice, but it does not have one, widely accepted definition.

Kemmis and McTaggart [9] define it as:

> "… a form of collective, self-reflective inquiry that participants in social situations undertake to improve: (1) the rationality and justice of their own social or educational practices; (2) the participants' understanding of these practices and the situations in which they carry out these practices. Groups of participants can be teachers, students, parents, workplace colleagues, social activists or any other community members – that is, any group with a shared concern and the motivation and will to address their shared concern. The approach is action research only when it is

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collaborative and achieved through the critically examined action of individual group members."

In our situation, we were a teacher and group(s) of students (a different group each semester) – *participants*, who want to improve understanding of the subject matter, as well as how the learning of the subject matter can be improved – *shared concern*.

According to Dick [6], action research is a family of research methodologies in pursuit of action or change that enables understanding at the same time. This is achieved through action and critical reflection and as the cycles evolve methods are continuously refined.

In our situation, we were in pursuit of the improvement of the learning experience – *change*, which is achieved through *action* and *critical reflection* and implemented in yearly *cycles*.

Another source [13] identifies some distinctive features of action research:

"Critical collaborative enquiry by reflective practitioners who are accountable in making the results of their enquiry public, self-evaluative in their practice, and engaged in participative problem-solving and continual professional development (i.e. the CRASP model)."

Through publishing our experience and the evolution of the subject is made *public*, the process allows for *(self)-evaluation* and *professional development*.

The action research cycle, evolving as a spiral, is depicted in fig. 2:

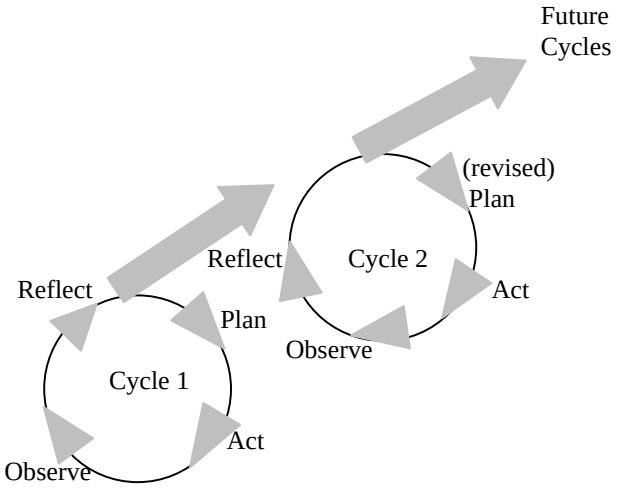


Fig. 2 The spiral of Action Research cycle, adopted from Zuber-Skerritt [14]

This article describes the first cycle over a period of a year with refinements implemented between the semester one and two.

V. SYSTEMS ANALYSIS AND DESIGN AT NWU

As stated earlier, the NWU has three campuses; the Potchefstroom (PC), Mafekeng (MC) and Vaal Triangle (VTC) campuses. The Information Technology (IT) course is owned by the PC, but offered by all three campuses. SAD is one of the subjects offered in the Information Technology (IT) course. The PC is responsible for selecting a textbook and compiling a study guide to direct the teaching. Other lecturers offering the subject have a choice: to use the prescribed text book and study guide, or to select another textbook and compile one's own study guide.

The selected textbook [4] describes the Systems Development Life Cycle (SDLC) in full:

- Scope definition
- Problem analysis
- Requirements analysis
- Logical design
- Decision analysis
- Physical design & integration
- Construction & testing
- Installation & delivery

It also refers to alternative routes and strategies like the waterfall development approach, the iterative development approach, model-driven development and the rapid development strategy. The SDLC is based on structured design principles, but two chapters are dedicated to the object-oriented design approach – which links to the object-oriented programming languages offered by the NWU, namely Java and C#. Project management is also covered.

It could be argued that a textbook integrating different approaches and its underlying philosophies like that of Avison and Fitzgerald [3] would be a better choice. That may be true, but the selected textbook focuses on what needs to be done during the development of a typical information system – what is expected from groups of students during their chosen project's development. In addition to this, the predecessor lecturer made use of the existing material. For these reasons, as well as the fact that an existing study guide supplying basic guidance amended with a custom made semester schedule and assessment plan makes valuable time available to spend on the development of course material, the first option was selected.

VI. SYSTEMS ANALYSIS AND DESIGN – NOW

In essence the assessment approaches differ between the campuses. For example: in IT subjects only one semester test is written per semester on the PC, where up to five smaller semester tests can written on the VTC. On the PC regular class tests are written, while on the VTC they are rarely used. A combination of the two approaches was selected for the subject as seen in table II.

The underlying philosophy was used as guidance:

- Assignments were designed to allow students to actively participate in the learning process.
- The group project and some of the assignments (towards the latter part of the semester) allowed students to learn collaboratively.
- Class tests were conducted on new work to motivate students to take ownership of their learning.

- Although a strict time-table is followed, some allowance was made to allow students a choice in writing a test or handing in an assignment.
- A layered approach was followed to ensure various encounters with the same material – in different formats; class tests on basic definitions/explanations, assignments guiding semester tests and project work progress, semester tests and the culmination of the work covered in the integrated practical project – staggering work and allowing some scaffolding of concepts. The different tools used and explained below, was also helpful.
- Bonus marks were implemented to motivate students to do "more than their share".

TABLE II
ASSESSMENT PLAN – SEMESTER 1

Type of Assessment	Detail
Class Tests <best 7 of 9> Weight 10	On work to be covered. 10 marks clicker test. Closed book.
Assignments <best 9 of 11> Weight 10	Hand in assignment on designated date (AFTER theory is covered). All assignments available from week 1.
Semester Tests <best 3 of 4> Weight 50	Only on work covered.
Project Weight 30	Consultation, Final Demo & Hand-in compulsory. Individual members in a group may obtain different marks. Poster, Presentation, Documentation, Prototype
Bonus Weight 5	Three options: • Class Test weight 15 • Assignment weight 15 • Semester Test weight 55 + 1 mark if you have "no gaps".

The NWU with its three campuses is mainly a residential institution, where students have classes on a strict time-table. The VTC has a history of part-time classes that was offered after-hours in IT until recently. That contributed to a limited time-table where students have to work on their own extensively. To assist this limited time-table situation, the university makes a Learning and Collaboration Environment (LCE) available to lecturing staff and students. The LCE used is called eFundi, a Sakai product. It allows continuous communication between lecturers and students and saves class time by allowing students to hand in assignments and teachers to supply feedback outside class time. The LCE also makes it easy to refer students to additional reading, video clips and explanations by peers. eFundi was used extensively to augment formal classes explaining concepts like entity modeling and data flow diagrams. In addition to lecturing staff, the NWU makes use of Supplemental Instructors (SI) and Student Assistants (SA), senior students to assist classes with specific problems during additional class times. During the first semester a SA was used to help with technical problems and various SI's to assist with specific problems and to supply guidance to project groups.

Already during the first semester some changes on the design was implemented in collaboration with students:

- Class tests was limited to 5 marks (instead of 10) and open books were allowed.
- Bloom's revised taxonomy [2] was used as a guideline to determine higher order (Analyse, Evaluate and Create) and lower order (Knowledge, Understanding and Application) mark allocations in semester tests.
- Bonus marks were introduced to motivate students to do "more than their share".

A depiction of Bloom's revised taxonomy is shown in fig. 3.

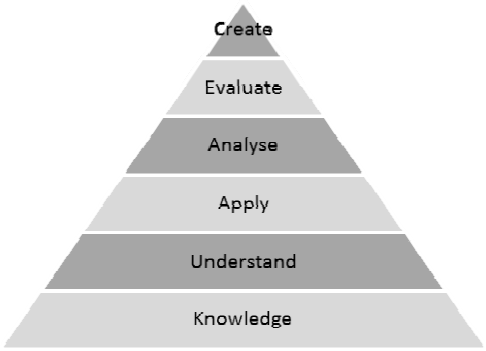


Fig. 3: Bloom's Revised Taxonomy[2]

In consultation with a colleague, the second semester assignments was changed to allow for hand-in before a class was offered and a second hand-in after the class was offered, with each counting 50% towards the assignment mark.

Upon reflection one semester test was eliminated to allow students more time to work at their own pace. Strict guidelines were established regarding the allocation of questions according to Bloom's taxonomy.

In consultation with students, the weighting of semester tests and the project was changed to allow for the additional project work load in the second semester.

The semester 2 assessment plan is shown in table III.

The format of classes was changed to allow for class work, instead of formal teaching during classes. This can be seen in the light of the fact that the basic concepts were already understood by students due to the fact that it was explained to students during semester 1 in the analysis context and applied in the design context during semester 2. Since students also came to classes prepared to write a class test and already completed version 1 of the assignment, class time was used to complete a prepared list of questions in groups of two to four students. These questions were designed to ensure the understanding of the work covered. Time was also allowed for questions. Answers to questions were handed in per group and a group answer was selected to be uploaded on eFundi as a model answer.

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TABLE III
ASSESSMENT PLAN – SEMESTER 2

Type of Assessment	Detail
Class Tests <best 8 of 10> Weight 10	On work to be covered. 5 marks clicker test. Open book (own book only).
Assignments <best 8 of 10> Weight 10	Hand in assignment on designated date (before theory is covered). If not 100% correct, second opportunity on theory class day (Thu) midnight. Two assignments have equal weight towards mark.
Semester Tests <best 2 of 3> Weight 40 (20 each)	Only on work covered. Test 1: 40p:60t Test 2: 50p:50t Test 3: 60p:40t
Project Weight 40 (35+5)	Consultation, Weekly Demo, Final Demo & Hand-in compulsory. Individual members in a group may obtain different marks. Poster, Presentation, Documentation, System & Guides (User Manual, Installation, Help, etc.)
Bonus: Weight 5	Four options: • Class Test weight 15 • Assignment weight 15 • Semester Test weight 45 • Project weight 45 + 1 mark if you have "no gaps".

Each week project groups were elected to explain their application of the concept covered during the preceding week.

The NWU Assessment Policy makes provision for two examination opportunities during each semester and students may choose to write any examination or both should they fail their first opportunity or require a better mark. Participation marks (compiled from weights determined by work done during a semester) and examination marks contribute equally towards a final mark. Seen in the light of the above-mentioned assessment plans (table II & III), where students needed to participate in class activities on a weekly basis, the examination is seen as a formality where students are required to understand work covered in the assessment plan.

When studying the final results as shown in table IV, it can be seen that the pass rate was good and both the examiner and moderator is convinced that the students who passed will be able to make a contribution in the field of SAD in industry.

It should be noted that although only 42 students passed the first semester, 43 was enrolled for the second semester. This is due to the fact that one student who failed the module during the previous year repeated it. It should also be noted that the first semester is a prerequisite to the second semester.

TABLE IV
SYSTEMS ANALYSIS & DESIGN EXAMINATION RESULTS

Categories	Sem 1 (50)	Sem 2 (43)
No participation mark	1	0
Pass first examination	40	36
Fail first examination	9	6
Pass second examination	2	5
Fail second examination	5	1
Pass rate (%)	84	95

Sem-Semester

NOTE: Two examination opportunities on all work covered, any one or both can be taken, results of the first is published before the second is written, final mark is compiled from the participation mark (50) and the examination mark (50)

VII. SYSTEMS ANALYSIS AND DESIGN – THE FUTURE

One of the students' biggest complaints throughout the past year was that the subject addresses many facts, some work repeats itself in a different context and these two aspects confuse students. It was also difficult to decide which information was important for their project. For tests the problem was magnified and students felt that they studied lots of material with many question opportunities, but can get only so many questions in an examination paper. One of the student reflections (an older student, working in a prominent close-by company) is presented in table V (own emphasis added).

TABLE V
QUESTION:
"WHAT WAS YOUR BIGGEST CHALLENGE(S) WHILE DOING THE PROJECT?"

GETTING THROUGH THE MATERIAL AND APPLYING IT IN PRACTICAL EXAMPLES. CLASS ATTENDANCE WAS FOR ME A BIT CHALLENGING ONLY BECAUSE I WORK. I FEEL I WAS COMPENSATED ENOUGH AND NOT PENALIZED FOR MISSING SOME CLASSES DUE TO WORK RESPONSIBILITIES. I WISH EVERY LECTURER COULD UNDERSTAND THAT POINT. **IT WAS A LOT OF WORK AND SOMETIMES I WAS UNABLE TO DISTINGUISH FROM THE MATERIAL WHAT WAS NECESSARY AND WHAT WAS NOT WHEN IT COMES TO PRACTICAL APPLICATION IN THE PROJECT**.

Students' feedback –informally and formally reflect a love of technology. The students love to work with eFundi and they visit it regularly, they experience little problems in using eFundi to upload their assignments, they work with the slides supplied and enjoy using clickers for class tests. This is understandable since they are studying technology and are part of Generation Y, also referred to as the Millennials or Nexters [5].

According to Monaco & Martin [10], Millennials and their parents want to see cutting edge technology integrated into their courses. Timmermann [12] agrees with this; he calls the Millennials "true techies", and emphasises that "high speed" and "instant response" are what they are used to.

Keeping the above-mentioned two facts in mind, a plan is for the students to work in groups of two (other than project groups which is groups of three) from the start of a year, with each group getting a number of weekly concepts to research and upload on the eFundi wiki depicted in fig. 4:

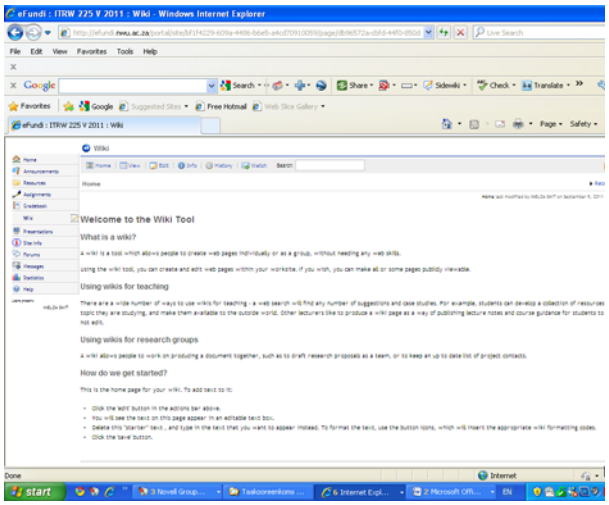


Fig. 4 The eFundi wiki function

The information will be available to everybody in the class to see and update. The idea is that a fair number of concepts will be explained throughout the semester/year. In future each year's new group will be allowed to build on the material already created by predecessors allowing the material to become richer. As a year progresses, the information that is available will be shared with students using a free online mobile instant messenger system called MXit (pronounced mix it) which is using 3G and GPRS to send and receive messages, each message costing less than 2 South African cent or a mobile messaging application that operates across platforms, which allows a person to exchange messages without having to pay for it, called WhatsApp messenger. This is opposed to an sms currently costing 70 South African cent. It is also possible to send and receive MXit or WhatsApp messages on your computer – without using a cell phone and to link the system to our eLearning environment. These messages will enable students to receive, read and learn SAD concepts using their cell phones wherever they are. Although an instant messaging system will not allow all the information on the wiki to be sent to students, it will assist a basic understanding and lure them towards the full explanation and example(s) available on the wiki. On this point, hopefully students will also use the messaging facility to discuss the concepts with one another and form chat groups to discuss difficult concepts. In addition, the involvement of student assistants and facilitators will also be encouraged. In addition, hopefully MXit and WhatsApp will be used for more than this, that it will be utilized in their project and group assignments. Eventually, the idea is that the wiki and messaging system will form the students approach to learning, making them life-long learners!

Short videos explaining difficult concepts will be made available on eFundi; in addition to the wiki-messaging system, to explain concepts like Use-Case Diagrams, Data Flow Diagrams and Entity Relationship Diagrams. It will allow students to work through written material along with the video clips. They will also be able to watch a video more than once and it will hopefully be easier to ask questions in class from this vantage point.

The chapters covering the SAD overview, including all the necessary SDLC phases are "boring" with many confusing facts. Therefore these chapters will be addressed as a class project where groups of students focus on the phases and come together in a huge open space to put the full SDLC together as it should be flowing. The foyer of one of our on campus buildings will be ideal, because it will allow the group to take photographs of the process and the finished product from the top floor. These photographs will be uploaded on eFundi as future study material.

To sensitise students to the fact that there is more to SAD than the SDLC, an assignment will be given to allow research on other approaches.

When presenting projects, more effort will be made to allow peers to see one another's projects. Students tend to keep their projects "a secret", but after the first two months projects are settled and it became more difficult to "steal" ideas. By forcing students to show their work to others from an early point on, they work hard to uphold appearances and their peers have a good idea of the standards of the competition.

Class discussions will be integrated even more into the whole approach to teaching. Here the advice of Roehling, et al. [11] will be followed by the teacher being enthusiastic about the subject matter, open to allow differences in opinion, guiding discussions to allow unemotional conversations and creating an informal atmosphere; in addition the scene will be set to encourage students to learn about one another and they will be motivated to come to class prepared to ensure improved confidence.

Database implementation is another huge problem, because students have little background in databases. This problem will be addressed through a practical assignment – facilitated by a SA – on normalisation during the first semester and one on database implementation during the second semester.

VIII. Conclusion

After some initial uncertainties the students enjoy SAD. Feedback on their examination scripts by two students from the winning project are listed in table VI below:

TABLE VI
FEEDBACK DURING THE EXAMINATIONS

Thank you for this year! I have learnt so much with this subject! Let's hope I get a good score!
Dear Mrs Smit Thanks for everything!!! …Take care

In future, as in the past the emphasis will be on creating a friendly environment conducive to teaching and learning; Allowing students to develop towards reaching their potential in their chosen occupation.

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REFERENCES

[1] Altrichter, H., Kemmis, S., McTaggart, R. and Zuber-Skerritt, O., (2002), "The concept of action research", *The Learning Organization*, 9(3), 125-131.

[2] Anderson, L.W., & Krathwohl, D.R. (eds.) (2001, A Taxonomy of Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.

[3] Avison, D. and Fitzgerald, G., (2006), *Information Systems Development methodologies, techniques & tools*, 4th ed. McGraw-Hill Education, Berkshire.

[4] Bentley, L. and Whitten, J., (2007), *Systems Analysis and Design for the Global Enterprise*, 7th ed. McGraw-Hill/Irvin, New York.

[5] Coornes, M., DeBard, R. (2004). *Serving the Millennium Generation*. San Francisco: Josey-Bass.

[6] Dick, B., (1991), *Action Research and Evaluation*, Interchange, Brisbane.

[7] Dick, B., (2002), "Postgraduate programs using action research", *The Learning Organization*, 9(4), 159-170.

[8] Goede, R, (2010), Combining research methods from different paradigms: a study in IS research practices. (In Goede, R, Grobler, L & Haftor, D. Interdisciplinary research for practices of social change: Proceedings of the 16 Annual Working Conference of CPTS, ISBN-978-90-807718-8-8) pp. 85-106, CPTS: Maarssen.

[9] Kemmis, S. and McTaggart, R. (Eds) (1988), *The Action Research Planner*, 3rd ed., Deakin University Press, Geelong, Victoria.

[10] Monaco, M., & Martin, M. (2009), The Flight of the Millennials in Higher Education, *Athletic Therapy Today*, 14(1), 21-26.

[11] Roehling, P., Kooi, T., Dykema, S., Quisenberry, B., & Vandlen, C. (2001), Engaging the Millenium Generation in Class Discussions. *College Teaching*, 59(1), 1-6.

[12] Timmermann, S. (2007), What a Difference a Generation Makes: How Our Life Experiences Shape Our Viewpoints and Behaviours, *Journal of Financial Service Professionals*, 61(3), 25-28.

[13] Zuber-Skerritt, O. (1992), *Professional Development in Higher Education: A Theoretical Framework for Action Research*, Kogan Page, London.

[14] Zuber-Skerritt, O. (2001), "Action learning and action research: paradigm, praxis and programs", in Sakaran, S., Dick, B., Passfield, R. and Swepson, P. (Eds), *Effective Change Management Using Action Research and Action Learning: Concepts, Frameworks, Processes and Applications*, Southern Cross University Press, Lismore, Australia, 1-20.

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