CASE STUDY 3 – COMPARING "CHALK-AND-TALK" WITH TEAMWORK IN 1997.

[Blignaut & Venter, 1998b]

Introduction

The concept of "lifelong learning" can be interpreted in many ways. We would like to consider lifelong learning as the ability to adapt to and be prepared for an ever-changing world. This would necessarily include the basic skills of using technology effectively to access large repositories of information.

The philosophy of lifelong learning must impact on the way classes are conducted in educational institutions. The effectiveness of the "chalk-and-talk" method is thus becoming questionable. In this study a different teaching style, incorporating teamwork and cooperative learning, was adopted to promote lifelong learning skills: empowering the student to have an active role in his/her education.

The use of computers is an integral part of statistics and therefore students need to be computer literate. The majority of our students come from disadvantaged backgrounds. In a South African context this *inter alia* means that:

- Many schools (38%) have no access to a telephone;

- 43% of all schools do not have electricity; and

- Only 41% have water on the premises.

(Quoted from a survey published in 1997 [Bot, 1997]).

For many of our second-year Statistics students, this course would have been their first encounter with computers. Due to the diversity of students'

backgrounds it was felt that this teaching strategy could be beneficial to educate our students.

Design and method

Students doing a second-year course in Statistics (in the second semester 1997, STA225) were placed in groups (or teams) at the onset of the course using Belbin's team-role test. (The Belbin test [Belbin, 1993] is used by industrial psychologists internationally to constitute teams.) In order to discuss their understanding of a particular section of the work in a group situation, students had to prepare prior to the lecture. A formal lecture was presented on the first double period of each week. All other periods (six) and tutorials were used for teamwork activities. Each group had to hand in a weekly assignment and a computer practical was handed in fortnightly. Teams needed to construct mind maps [Buzan, 1995] of each chapter. Finally both sides of an A4-sized paper (or one side of an A3-sized paper) could be used to construct a team mind map, summarizing all the work done during the semester. All participating team members could use this team mind map in the examination.

Both qualitative and quantitative research methods were used to collect data. The quantitative method used, entailed the use of a self-administered questionnaire. Unstructured interviews using Schön's reflective converstation protocol [Schön, 1983], lecturer's notes and students' e-mail messages were used to collect the qualitative data. (Photographs of students were used to allow the lecturer to become familiar with the students in a shorter period of time.)

The results of some of the more general questions

The 52 students attending this course came from varied cultural and socioeconomic backgrounds. The home languages of these students were as follows: 26.7% spoke Xhosa, 36.5% spoke English, 9.6% spoke Afrikaans and 26.9% spoke other African languages, such as Zulu, Sotho, Siswati, etc.

Forty-seven percent was enrolled for a B.Sc. degree. The females were slightly more than the males (57.7%). Twenty-three percent of the students were older than 23 years of age. Most of the students had attended public schools (81%), and 8% had obtained tertiary qualifications prior to university enrolment.

Sixty-eight percent of the students said that working in a group improved their self-esteem. Only 14% said they preferred conventional lectures above this method of lecturing. Twenty-three percent of the students did not enjoy doing weekly assignments. Computer practical assignments were difficult for 23% of the students. The majority of students felt that not enough assistance was given whilst doing computer practical assignments.

Fifteen percent found it difficult to express themselves in English and to understand concepts due to language difficulties. The textbook was always easy to read for 72% of the students. Nineteen percent used their own computers at home. Fifty percent said they used e-mail. The Internet was accessed regularly by 27% of the students.

The course was enjoyed by 73% of the class, whilst 27% said they were not so sure. Seventy-eight percent said they liked the way that the class was conducted. Eighty-two percent said they almost always attended lectures. Ten percent said they read the relevant sections before attending class whilst 57% said they only prepared occasionally.

Ninety-eight percent said the lecturer's attitude was positive when approached. Eighty-eight percent said they were always well informed of what was expected of them. Ninety percent felt that enough opportunity was given to discuss problem areas with the lecturer.

Eighty-six percent of students indicated that they enjoyed this more mature approach to learning. Eighty-two percent said that they almost always

attended lectures - we found this quite remarkable. Team functioning requires students to be prepared and especially to be present.

It was found that matriculation results could not be used to predict success rate in Statistics courses at our university.

Language group comparisons

English is the medium of instruction but is the second, or even third, language for 64.5% of the students. It is thus not surprising that most significant differences were found when the different language groups were compared.

Due to the small numbers per language group, the language groups with similar profiles were combined to form groups large enough for statistical comparison purposes. The Afrikaans and English students' data (24) were compared with all the African language students' (27).

When comparing the African home language students with the other students, it was found that they obtained significantly lower marks in the second semester Statistics module, matric mathematics and matric average. During interviews it was mentioned that the African language students received most tuition in school in their home languages and thus at university found it difficult to express themselves in English.

The African language students kept their thoughts, feelings and reactions to themselves during group discussions (Fisher's exact test p=0.002), they also tended to summarize or paraphrase what other members had said before responding or commenting (Fisher's exact test p=0.011). More of the students with English or Afrikaans as home language felt that their comments were interrupted during group discussions (Fisher's exact test p=0.0048). Significantly more of the African language speakers felt they

had learnt more in a group than they would have done individually (Fisher's exact test p=0.038).

Although the entire group felt positive about mind maps, more of the African language students felt that mind maps increased their understanding of the subject (Fisher's exact test p=0.045); the creation of these mind maps were also more enjoyed by the African language students (Fisher's exact test p=0.021). The non-African language students access the Internet on a more regular basis (Fisher's exact test p=0.0058).

No difference was found in the matric English marks between the two groups. The Afrikaans and English-speaking students obtained higher marks for matric mathematics and matric average compared to the African language students (Mann-Whitney test, p =0.0001; p=0.0017). English and Afrikaans speakers did significantly better in the first semester (STA215) computer test. Even though all the students generally do better in the second semester of this course, the English and Afrikaans speakers did significantly better in the (STA225) test, computer, group work, semester, exam and final marks compared to the African language speakers.

Comparisons between B.Sc. and B.Com. students

The B.Com. students kept their thoughts, feelings and reactions to themselves during group discussions (Fisher's exact test p=0.005). More of the B.Sc. students found the group's mind map interesting (Fisher's exact test p=0.0072) and they found it interesting to see how others rated them (Fisher's exact test p=0.034). More of the African language students are enrolled for a B.Com. degree, whereas more B.Sc. students are English or Afrikaans-speaking (Fisher's exact test p=0.0005).

The B.Sc. students did significantly better in the matric average mark. They obtained significantly higher marks in the computer, semester, exam and final marks of the STA225 course.

Gender comparisons

Even though significantly more females felt that their comments were interrupted during group work discussions (Fisher's exact test p=0.031), they felt that group work helped them to understand the work better (Fisher's exact test p=0.0078). More females felt that mind maps gave them a broader perspective of the work (Fisher's exact test p=0.0057). The females were more inclined to prepare before attending class (Fisher's exact test p=0.036) and it is thus not surprising that they enjoyed the weekly discussions more than their male counterparts (Fisher's exact test p=0.012).

During both semesters the male students outperformed the female students in the computer test; this difference was only statistically significant during the first semester (Mann-Whitney test=7.1592, p=0.0075).

Age group comparisons (≤ 23; > 23)

It is interesting to note that the majority of students are older than 21 years of age. Less than 20% of the students who are academically in their second year have spent only two years at university.

More than 70% had been at university for a longer period. The younger students felt that group work helped them with the understanding of their work (Fisher's exact test p=0.0044) and they enjoyed discussing the study material (Fisher's exact test p=0.011), but they were forced to become more dependable (Fisher's exact test p=0.019). The lecturing format was enjoyed more by the younger students (Fisher's exact test p=0.0013). The older students found that they often did not have the extra time needed for the discussion groups as they had families and other responsibilities to tend to.
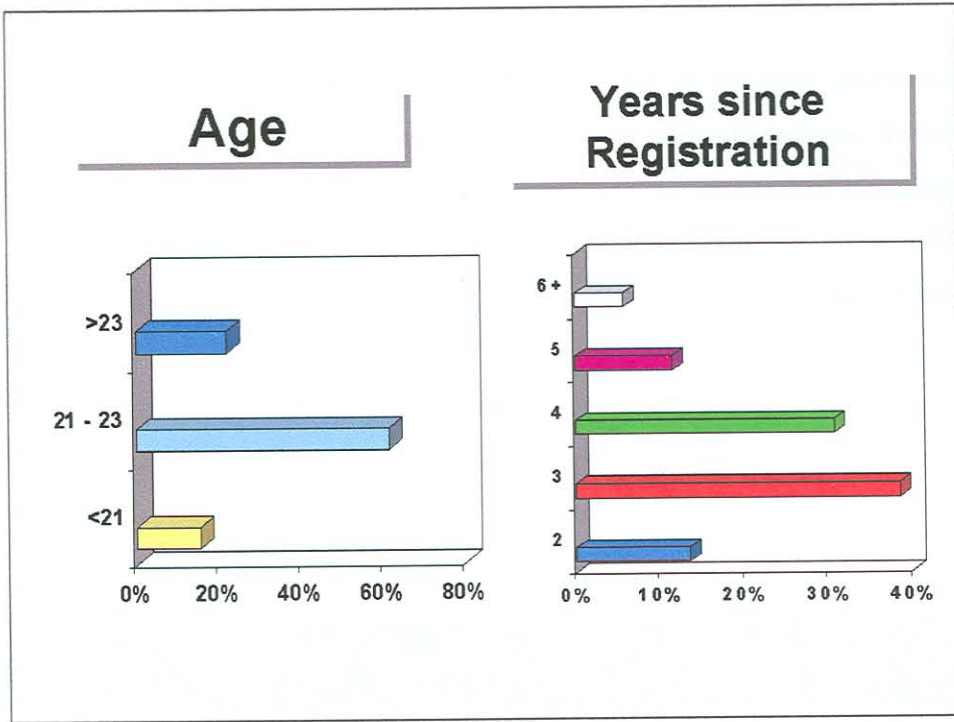
FIGURE 21:   Age and throughput of second-year students

None of the older students obtained a percentage greater than 59% for their matriculation average (Mann-Whitney = 7.499, p=0.0062). More of the older students had a tertiary qualification before entering university (Fisher's exact test p=0.022).

Even though the correlation of the various marks was calculated, no significant correlation could be found between the Statistics and matric marks. Thus the matriculation results could not be used to predict success rate in statistics courses in this group of students. The first semester final mark and computer mark (STA215) could be used to predict the second semester final mark (STA225) with reasonable accuracy.

Paired comparisons of final (STA215 and STA225) marks

In this section course comparisons were done only in the cases where the same lecturer presented the first semester and the second semester. It was felt that the only variable to be investigated was the method of lecturing. Students who enrolled for both the first and second semester courses were included for comparison of the final results of the two semesters. (Only the marks of 1994, 1995 and 1997 were used for comparison purposes, as the variable "the lecturer" was the same in both semesters of those years. The data of 1996 could not be used, as the same lecturer did not teach both courses.)
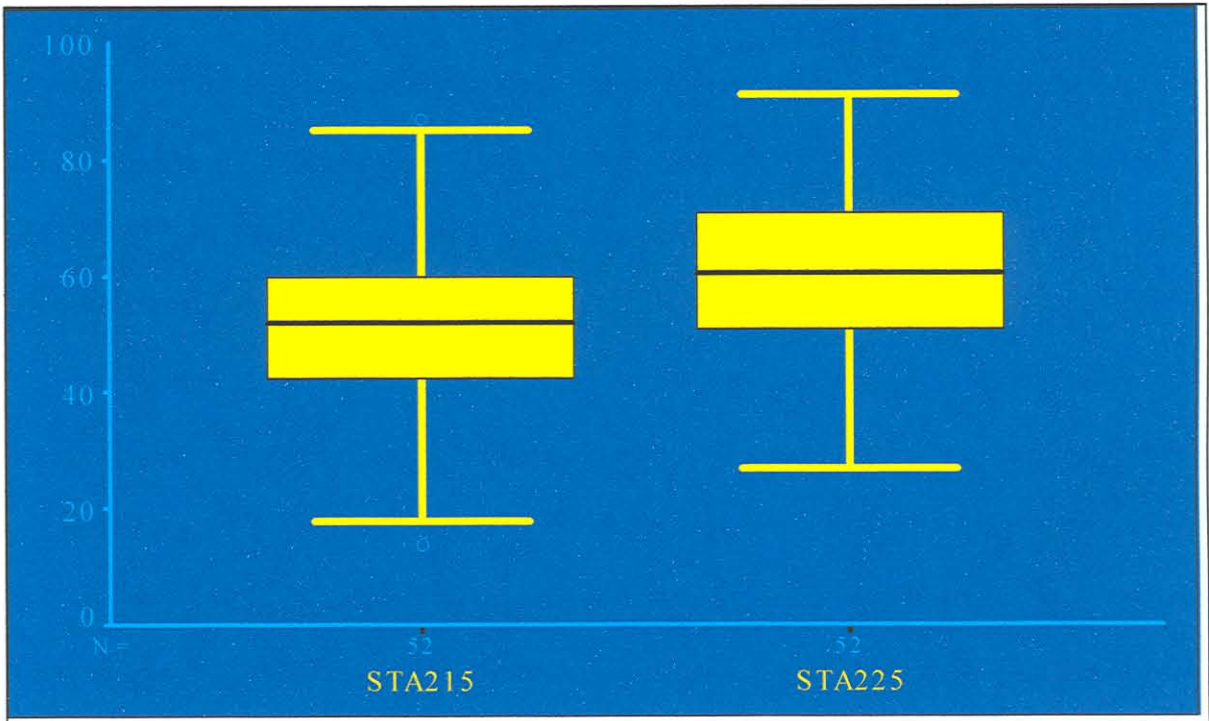
Paired T-test = 5.647, p = 0.0001

FIGURE 22:   Significant difference found between the teamwork, cooperative learning method and the "chalk-and-talk" method

A statistically significant difference was found between the final mark of STA215 ("chalk-and-talk" method) and STA225 (team, cooperative learning method) in 1997 (Paired T-test = 5.647, p = 0.0001). The Statistics marks obtained in 1994, 1995 and 1997 showed that in general (in all years) students, compared to the first semester, achieved higher final marks during the second semester.

We would like to believe that the significant increase in achievement in 1997 could be ascribed to teamwork and cooperative learning.

YEAR	VARIABLE	N	MEAN	STD.DEV	MIN	MAX
1994	STA215	19	50.05	16.01	14	85
	STA225	19	59.68	20.76	6	81
1995	STA215	34	52.15	10.50	29	75
	STA225	34	64.65	16.14	8	85
1997	STA215	52	51.98	17.12	12	87
	STA225	52	60.75	14.24	27	91

TABLE 4:   Descriptive Statistics 1994, 1995 & 1997

Summary of paired test results

VARIABLE	YEAR	NORMALITY	TEST	TEST STATISTIC	PROB-ABILITY	SIGNIFICANT DIFFERENCE
STA225-STA215	1994	NO	Wilcoxon signed rank	0	1.0	NO
STA225-STA215	1995	NO	Wilcoxon signed rank	0	1.0	NO
STA225-STA215	1997	YES	Paired T-Test	5.647	**0.0001**	YES

TABLE 5:   Summary of Paired Test results

The decrease in the computer mark between the two semesters could be due to many factors:

- The first semester computer work entailed using a Spreadsheet package (Quattro Pro) with no complicated statistical interpretation of data, whereas in the second semester the students were expected to interpret results, using theoretical principles covered in the course. The package used in the second semester was SPSS - a statistical package.

- During the first semester students were expected to complete all assignments individually. In the second semester each group completed a fortnightly assignment. The output and interpretation of the results were then e-mailed to the lecturer.

- From interviews it transpired that during the second semester some group members did not participate in the computer assignments.

- No time was appropriated on the official timetable for computer assignments. Students were expected to complete computer work in their own time. Some groups had difficulty finding suitable time slots to work together in order to complete the assignments.

The descriptive statistics (*Table 4*) show that in general (in all years) students achieved higher final marks during the second semester compared to the first semester. In *Table 5* a significant difference was found between the final mark of STA215 and STA225 in 1997. We would like to believe that the significant increase in achievement in 1997 could be ascribed to teamwork and cooperative learning.

Qualitative research findings

Interviews

To obtain additional information, interviews (using the "Reflective Conversation" protocol) were conducted with two members of each team [Blignaut & Venter, 1998b: Appendix I, 1 - 23].

It transpired that **language** was definitely a hurdle:

I had a problem when it comes to submitting it in English

We think it is better if we explain the work in Nguni. I am not Nguni, I'm Sotho. (another student says that he/she is Xhosa) *which is Nguni related. – I however, managed to adjust to Nguni. So whenever we work together as a group we speak Nguni. That would accommodate all the students, but I can't ignore the fact that we've come from different backgrounds.*

Students indicated that they now **reflected more** on their learning:

...you develop your own understanding.

Group work as a re-enforcement for understanding the study material was a good idea. [Blignaut & Venter, 1998b: Appendix H(i), 1]

They preferred **active learning** and creating **mind maps** [Blignaut & Venter, 1998b: Appendix I, 1 - 23]:

> *...group work, compared to last semester, it is easier doing it this way;*

> *...when you see it on the mind map - you actually see that the work is not so much and that it is linked together.*

Students felt **empowered:**

> *Group work, yes compared to last semester - it is easier doing it this way;*

> *I did the course last year but it is much better this year;*

> *...my mark - shot up by like 40% - so I can go to the exams with a 70% DP (semester average) - because I was working in a group it went up.*

They acquired **lifelong skills** such as **social, conflict resolution, management and leadership skills:**

> *The class became more close;*

> *It is actually better, a bit more personal;*

> *...there is problems but I learnt to work with them - and understand them;*

> *...we became friends - we socialised;*

> *I personally prefer to work individually but it was a good exercise - it was scary - but of course we had good times;*

> *...we learnt more about other people;*

> *...we have some mixed feelings, of course, but on the whole it was a group effort from all the individuals.*

Some had their reservations about the **Belbin team roles** but the majority indicated that they had gained new insights into themselves and it had made them realise their strengths and weaknesses.

Field notes

In order to monitor the various relevant systems implemented, the researchers kept field notes (daily observational reports). If it was deemed necessary, controlled action was taken. In general the groups reported positively on their team functioning. Initial problems arose from the different interpretation of team members' commitment. However, this was easily resolved by a discussion session between the lecturer and the team. Minutes of meetings, e-mailed once a week to the lecturer, were also an indication of how well the team was functioning.

Discussion and conclusion

UWC is committed to the concept of lifelong learning. It implies a fresh approach to knowledge, a holistic view of education, the integration of formal and informal types of learning and an appreciation for learning, which should be a lifelong endeavour. As resources are not likely to increase, innovative learning and teaching strategies will have to be developed to meet increasing needs.

English is a second or third language for most of our students and therefore they find it difficult to verbalise their understanding of the prescribed text. It is not surprising then that they resort to the memorisation of the text. With the introduction of cooperative learning students were expected to converse with peers, allowing them to learn to express themselves in English. It is a more desirable teaching method for these students who typically come from different academic and socioeconomic backgrounds.

RESEARCH QUESTION	INTERVENTION	RESULTS OF CASE STUDY 3
TEAM CONSTITUTION How should teams be constituted?	In the first semester of 1997 the "chalk-and-talk" method of teaching was used and in the second semester small group learning. Belbin team-role theory was used to constitute balanced teams in the second semester.	Students felt in general positive about their teams: *...I learnt to work with them, and understand them* *...we became friends and socialised*
FORMAL/INFORMAL LECTURE RATIO How often should small group learning be alternated with plenary sessions and formal lectures?	Formal lectures were given once a week plus *ad hoc* lectures – when students found material difficult. Photos of students allowed lecturer to get to know students in a shorter period of time.	Only 14% indicated that they would have preferred formal teaching. And in comparison to previous semesters a surprising 82% said they almost always attended class.
SUCCESSFUL LEARNING What could be considered a successful learning experience?	Cooperative learning with mind mapping was used for the first time with this group in the second semester.	Students were satisfied: *...my mark... shot up like 40%...*
MEASURING SUCCESS How is success measured?	■ Academic achievement ■ Conceptual learning ■ Equity ■ Prosocial behaviour	Students achieved SIGNIFICANTLY better with this method. Mind maps improved conceptual learning: *When you see it on the mind map – you actually see ... that it is linked together...* - -
ASSESSMENT How should students be assessed?	Some peer evaluations introduced but mostly formal examinations	Largest proportion of mark still individual examination mark. (The group mark forms a small proportion of the final mark)

TABLE 6:   Summary of the results of CASE STUDY 3 in terms of the research questions

The majority of students indicated that working in teams contributed to their understanding of the subject. They gained on personal and social levels and learnt more in the group than they would have by learning individually, confirming that whilst most people find it easy to learn, many find it difficult to be taught [Ross, 1997]. Most felt that the Belbin team profile provided them with insight into the contribution that they could make in a team situation. The more informal format of the lectures, and the preparation and presentation of mind maps were positively experienced by most students; they learnt new ways of ordering facts and information which enhanced their understanding of the work. Students with a language disadvantage seemed to enjoy the creation of mind maps more and felt that it increased their understanding of the subject.

The successful implementation of cooperative learning requires students to prepare prior to attending class. Although an unusually (for UWC) high attendance rate was monitored, students came unprepared to class. Students achieved significantly higher marks in the second semester, proving that this teaching strategy has merit.

Only a small proportion of our students have access to a computer at home. The Internet was accessed on a regular basis by a small percentage of our students. One would expect that students would be interested and excited to become acquainted with modern technology such as the Internet and the use of e-mail. During both semesters the male students outperformed the female students in the computer test. To address this gender imbalance, new methods need to be explored to empower females in the use of technology.

The incredible growth of access to the Worldwide Web necessitates the creative use of computers. Communication, through electronic media, is becoming an important lifelong skill needed to function in a modern society. Cooperative learning within a team can therefore be considered a

bridging methodology for students from a disadvantaged background. The development of life skills such as positive intergroup relations and the ability to work productively in teams could help to bridge the gap between tertiary education and the job market. With this approach students seem to enjoy learning more, making it a worthy pursuit.

Teamwork, the use of mind maps and Belbin's group constitution were all implemented in the second semester of 1997 (Computer Science group) and data collection was continued. This period will now be discussed as Case Study 4.

CASE STUDY 4 – A CHANGING WORLD NECESSITATES NEW
TEACHING METHODOLOGIES. THE SECOND SEMESTER OF
1997.

[Venter & Blignaut, 1998]

Introduction

This report focuses on new methods used in tertiary teaching and learning.
Although this study deals with students majoring in Computer Science, it is
felt that this method of teaching is generic and could be used in any
educational environment. The fundamental objective of tertiary education
is to develop each learner's talents, to build on their individuality and to give
them a way of coping with a world that is overflowing with information
[Ross, 1997]. Above all, learners must learn that learning is not only
practised in education but that learning is fast becoming the new form of
labour [Zuboff, 1988]. In group learning situations students will not only
study the contents of the subject but will also learn lifelong skills needed to
function in a modern society. Many of our students are from educationally
disadvantaged backgrounds and are inclined to memorize their work
verbatim. It was felt that a new learning methodology should be explored
to remedy this situation.

Learning takes place in informal, as well as formal situations, including both
education and training, which interpenetrate one another [Watts & McNair,
1995]. Not only does knowledge of the individual's team-role profile lead
to more appropriate contributions in team learning situations, but also to
better appreciation of the contribution of other team members. When
members of a team are familiar with the team-role strengths and
weaknesses of other team members, this leads to more realistic expectations
of their potential contributions and better utilisation of time and energy.
Our experience indicates that less time is wasted on the lengthy and often
disruptive process of role clarification and dealing with unproductive

competitive behaviour. The insight and knowledge gained through individual team-role profiles in team learning situations seem to lead to mature understanding of the self, which enhances any future team, as well as individual, learning situation.

Both qualitative and quantitative instruments of measurement were used to collect the data.

Design and method

In this course the method of teamwork and co-operative learning was used. Students were placed into teams using Belbin's team-role concept [Belbin, 1993]. A formal lecture was presented whenever students experienced a problem with a section of the work or was used to summarise work that was learnt the week before. Most periods and tutorials were used for teamwork activities. Each group had to do research on a topic for a presentation. Teams needed to construct mind maps [Buzan, 1995] of each chapter and finally a mind map was constructed summarizing all the work of the semester. Students were expected to prepare for class to enable them to participate in team activities. A weekly report on their progress (via e-mail) was expected from each group.

Data was collected using self-administered questionnaires and interviews were conducted with groups to obtain feedback on this teaching method.

Results

The 63 students attending this course came from varied cultural and socioeconomic backgrounds. The home languages spoken by these students were as follows: 17.5% spoke Xhosa, 40.4% spoke English, 15.8% spoke Afrikaans and 26.4% spoke other African languages, such as Zulu, Sotho, Venda, Tswana, etc.
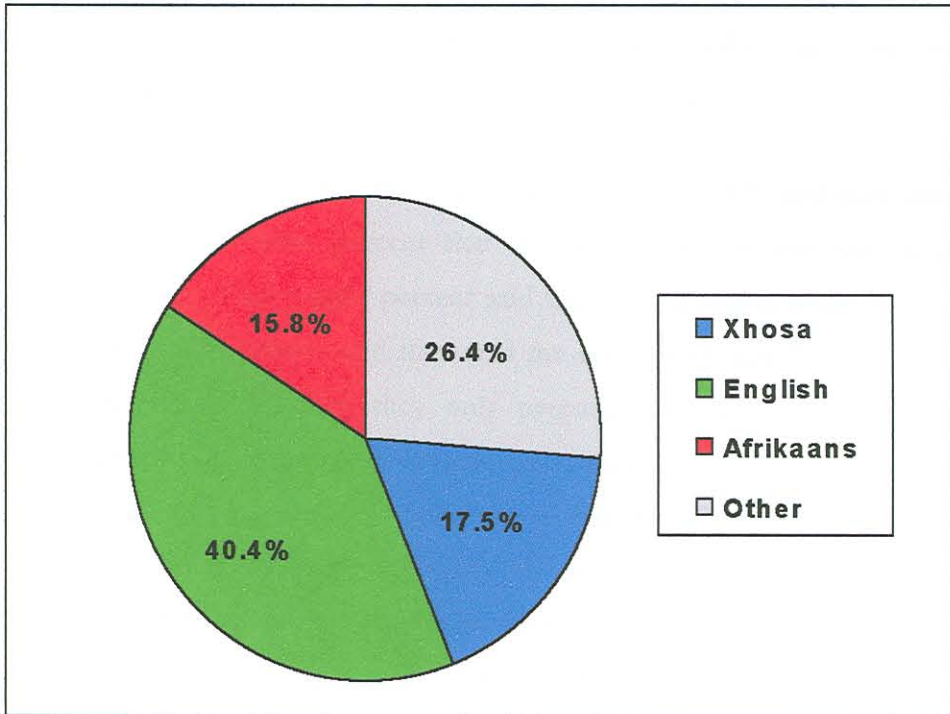
FIGURE 23:   Language distribution of the 1997 Computer Science study group

Sixty-one percent were enrolled for a B.Sc. degree. The class comprised mostly males (63.3%). Twenty-one percent of the students were older than 23 years of age. Most of the students had attended public schools (87%) and 10.2% had obtained tertiary qualifications prior to university enrolment.

Only 37% of the students said that working in a group improved their self-esteem. Only 11% said they preferred conventional lectures above this method of lecturing. Sixty percent of the students enjoyed doing the computer project. The computer practical was found to be difficult by 16% of the students. The majority of students felt that not enough assistance was given whilst doing the computer practical.

Nine percent found it difficult to express themselves in English and to understand concepts due to language difficulties. The textbook was always easy to read for 47% of the students. Forty-nine percent used their own

computers at home. Seventy percent said they used e-mail. The Internet was accessed regularly by only 54% of the students.

The course was enjoyed by 64% of the class, whilst 29% said they were not so sure. Fifty-nine percent said they liked the way that the class was conducted. Eighty-eight percent said they almost always attended lectures. Twenty-eight percent said they read the relevant sections before attending class, whilst 43% said they only prepared occasionally. Ninety-seven percent said the lecturer's attitude was positive when approached. Sixty-three percent said they were always well informed of what was expected of them. Seventy-four percent felt that enough opportunity was given to discuss problem areas with the lecturer. Fifty-one percent of the students indicated that they preferred blocked courses – that is, that one module is completed before the next is started. Sixty-four percent felt that the progress reports helped with their time management.

Language group comparisons

Due to the small numbers in some language groups, the language groups with similar profiles were combined to form groups large enough for statistical comparison purposes. For some questions the Afrikaans and English-speaking students (32) were combined and compared with the African language students (25), and in other cases, English-speaking students (23) were compared to all students with a home language other than English (34).

The English and Afrikaans-speaking students had not obtained any tertiary qualification before entering university, whereas 24% of the African language group were qualified in another direction prior to entering university (Fisher's exact test p=0.0049).

Significantly more of the African and Afrikaans-speaking students felt that they were influenced by group members (Fisher's exact test p=0.014) and

experienced insight into the role they could play within a team positively (Fisher's exact test p=0.037). These students preferred teams constituted using Belbin's team-role concept compared to a random selection (χ^2 = 4.482, p = 0.034).

It was felt by the African and Afrikaans home language group that mind maps gave a broader perspective of the work (Fisher's exact test p=0.0024); they felt that it was important to present the mind maps (Fisher's exact test p=0.014) and enjoyed this experience. Significantly more of these students enjoyed the lecturing style that incorporates teamwork and cooperative learning (Fisher's exact test p=0.026).

African home language students prepared before attending class more than their counterparts (Fisher's exact test p=0.0049). Although the χ^2-test is not valid (due to too small numbers in the cells in the table) the data indicates that none of the English-speaking students felt that they were prejudiced towards people of other cultures before getting to know them in a group situation. Many of the Afrikaans and some of the African home language students felt some prejudice towards other cultures before getting to know them in a team situation.

No difference was found in the matric English marks between the groups. The Afrikaans and English-speaking students did significantly better in the Computer Science modules, matric mathematics and matric average, compared to the African language students.

Comparisons between B.Sc. and B.Com. students
The B.Com. students felt that they had learnt to cooperate with other students (Fisher's exact test p=0.0036). More of the B. Com. students were inclined to change their course registration since their original registration (Fisher's exact test p=0.037). Significantly more of the B.Sc. students prepared before attending class (χ^2 = 8.386, p = 0.015). This correlates well

with the fact that these students also preferred the more informal format of lectures (Fisher's exact test p=0.015).

The B.Sc. students did significantly better in the Computer Science Network module examination.

Gender comparisons

Significantly more females felt that team members understood what they tried to communicate (Fisher's exact test p=0.033); they felt that they knew the students in the class on a more personal level compared to other classes they attended (Fisher's exact test p=0.011). More males felt that group work gave them the opportunity to talk and discuss the study material ($\chi^2 = 4.339$, p = 0.037). More females obtained an A, B or C for their matric mathematics compared to the male students ($\chi^2 = 4.189$, p = 0.041).

Age group comparisons ($\leq 23; > 23$)

Thoughts, feelings and reactions are kept private by older students during group discussions (Fisher's exact test p=0.0082). More of the older students had a tertiary qualification before entering university (Fisher's exact test p=0.013). Younger students did significantly better in CS323 (Mann-Whitney = 4.3688, p = 0.0366).

Even though correlation was calculated using all marks, no significant correlation could be found between the Computer Science and matric marks. Thus the matriculation results could not be used to predict success rate in Computer Science courses in this group of students. Regression analyses, with CS324 (the Network module) marks as the dependent variable, proved to be inconclusive.

Qualitative research findings

Questionnaire comments and e-mailed reports

Teams were expected to e-mail the minutes of their weekly meetings to the lecturer. This was done to keep the lecturer informed of their progress and to allow intervention if the need arose. Conflict resolution as well as the ability to function productively within a team are important lifelong skills. Therefore students were expected to resolve their problems but could call on the lecturer for advice and intervention if necessary. In general, the groups reported positively on their progress and team functioning. In a few cases it was necessary to intervene; problems were resolved by consultation with the individual members of the team and the team as a whole.

As part of the questionnaire students could write a comment. Only sixteen students commented on the course. Of these comments eight were positive, three indifferent and five negative.

Interviews

To obtain additional information, interviews (using the "Reflective Conversation" protocol [Schön, 1983]) were conducted with two members of each team.

It transpired that students enjoyed the more **informal method of lecturing** [Venter & Blignaut, 1998: Appendix H(ii), 14 and Appendix I, 1 – 35]:

The teaching method was fresh and different...

I don't think there's a problem with working like, in class like that. Sometimes you get bored when the person stands there and speak a long time and all these long things. What I like is participating and asking questions, it is much better, that way. We did enjoy the course.

The way in which the classes were conducted I like this way. You rely on yourself and learn by yourself. You don't just guess things, no spoon-feeding! As a final-year student, the following year you will be doing honours then you go to masters, so if the lecturer does everything it is not good, there is no growth.

Students also enjoyed **working in a group**:

Yes, working in groups you meet different people and you learn from them. I tutor maths 114 so they also have this group work so – I actually like it. At first year we done this workshop - once you've done that – it is better than just normal lectures.

Yes, it was quite nice, I mean, okay, we had our problems, but it was quite nice. The fact that besides having the lecturer behind you and hand in over, instead you've done it for your group. It was a totally different feeling and I enjoyed it.

Yes, I did enjoy working in a group. It breaks down the task into like smaller parts so that you don't actually have to do everything yourself. You can give it to different people to do. Certain parts - you can make a big job smaller.

But where I did get the sense of camaraderie was in the practical. You really get to know each other – the character came through -- under stress, true to type and those who are committed and those who are not committed. You can get a sense of their character and their strengths and weaknesses.

…group work has been quite helpful in encouraging a person to appreciate what you are studying and I think most of us enjoyed it.

I think that it was fantastic. Well, I knew a lot of people, but I couldn't say I related to them openly, fairly. And I think this year has been the best year to be able to talk to people.

Students indicated that they now **reflected more** on their learning:

Ja. Because now you actually have to go out yourself and find out, whereas when the lecturer stands in front and just gives you that – OK fine, you just take that and learn that. Now we have to like try and understand it by ourselves, try and work it out by yourself.

So, in the beginning it was a bit difficult, but when I started out, it was maybe, probably because of my attitude, maybe of – like I am used to work alone. But later on -- I see the benefits of it and I also see the negative side. You learn from each other, we discuss and you get different ideas and different views or -- and the other part also. But because working in a group it is less work on the individual itself so you can become a little lax on the other side as well.

Yes definitely! During the first semester I used to memorise everything – I did not try to understand it. Now I find that if you try to understand it, it makes it less work. And easier.

Students felt **empowered**:

I didn't actually think that for networking that we actually would have to set up a network. I didn't actually expect it, but it is actually fun.

The project is quite a learning experience. Because we actually had to get up and meet with people that work in the field. So, it's not actually off closed in the varsity. You actually go out and meet all these people. You can learn things from – that experience –

The things that were said there, I mean that amazed me. I never thought I could be a leader, but – in that assessment it says something like that.

They acquired **lifelong skills** such as **social, conflict resolution, management and leadership skills**:

Yes, definitely, because you learn to work with people.

Before this year I didn't know anybody. I just knew their faces in the class. Since we formed the group, in the first semester I named people, and now, it is different group. Now I've learnt to know many people.

Ja, it has. It is nice, I think that is the nice part about it that when you go home it is not like first semester where you just set myself to do that, whenever I want to. Now I cannot and I think it is preparing us for life. That is a good aspect of that.

Actually I want to talk about the relationships. -- I haven't actually met Winston before, I met him in this group. He is a nice guy and - most of the groups are nice - I mean it brought the whole class like together. I think that is nice about group work where formal lectures is just you sit down and you listen to the lecturer and finished your work up and you only busy with your own curriculum.

Because I find my style to be very individual, and you always cause conflict within the group if you don't watch yourself.

Getting a pace and getting a sense of where you all coming from because we had all different ideas about things and how to do things. Ja and that was the biggest struggle, but being together as a group, that was fine.

Mind maps summarised the study material effectively:

There is a structured approach to it. So the mind map shows you exactly this comes from this section ...

Yes, they help a lot. Sometimes when you see a diagram you remember most of the things.

I think it has its advantages and disadvantages, like we just said now. One of the advantages is that it let the student work more.

Now, the mind maps was a good idea, in fact, and I try to learn according to them and I could focus say for instance on certain things that's on the mind maps, and I just know here and there and I just can expand what it is. Oh, the mind maps was a very good idea!

Yes, when like, after we've done - each one our own mind map - we brought it together. While we were compiling the big one, we discuss certain things.

Some had their reservations about the **Belbin team roles** but the majority indicated that they had **gained new insights into themselves** and it had made them realise their strengths and weaknesses. As one student said:

The first role that everybody gave me on my list was a Shaper and I thought of myself as an Implementer because I know like eventually I have to get this thing done and so then I will do it. So I don't know —

Okay, you read through it and then, like, think 'who is this?'

Yes, as compared to last semester where we were chosen in alphabetical order. It wasn't nice. We clashed a lot -- everybody wanted to be a leader, even though we chose one —

Discussion and conclusion

Our university is committed to the concept of lifelong learning as underpinned by this extract from its new mission statement –

The university will - encourage and provide opportunities for lifelong learning through programmes and courses ...

Lifelong learning is about providing the skills to develop learning abilities needed throughout each person's life. The information age and globalization require special communication skills and it is therefore rather surprising that only 70% of the students regularly use e-mail and even fewer

(54%) use the Internet. It would be expected that at third-year level ALL students would use e-mail and the Internet regularly. Perhaps it is because only 49% of students have access to a computer at home.

It is interesting to note that in 1997 the majority (63%) of third-year students studying Computer Science at our university was male. Significantly more of the females felt that group work gave them the opportunity to talk and discuss the study material. Could this be ascribed to the fact that the majority of the class was male or that the field is traditionally male dominated? Females therefore may have felt intimidated when participating in large class discussions.

In modern society great emphasis is placed on the ability to function constructively within a team as the complexity of problems necessitates more than an individual insight. Most of the students felt that working in teams did not only contribute to their understanding of the subject but gave them the opportunity to develop their personal and social skills. Most students experienced the innovative method of lecturing positively. Students with a language disadvantage felt that the creation of mind maps gave them a broader perspective of the work and felt that it increased their understanding of the subject.

Research in teaching and learning methods is a cyclical process with continuous adaptation and refinement as problem areas are identified and rectified. The quantitative and qualitative methods of measurement are complementary and allow a holistic perspective of the situation [Lincoln & Guba, 1985].

RESEARCH QUESTION	INTERVENTION	RESULTS OF CASE STUDY 4
TEAM CONSTITUTION How should teams be constituted?	Belbin team-role theory was used to constitute balanced teams in 1997.	Some commitment problems - could be resolved.
FORMAL/INFORMAL LECTURE RATIO How often should small group learning be alternated with plenary sessions and formal lectures?	Most periods used for informal teaching, small group learning and *ad hoc* lectures.	Only 11% said they would have preferred conventional lectures.
SUCCESSFUL LEARNING What could be considered a successful learning experience?	The use of cooperative learning with mind mapping was continued.	*You don't just guess – no spoon-feeding.*
MEASURING SUCCESS How is success measured?	Academic achievement Conceptual learning Equity Prosocial behaviour	Could not be proved conclusively. *I used to memorise everything* *…we all had different ideas about things…* -
ASSESSMENT How should students be assessed?	Group work mark increased, still formal examinations	In new curriculum continuous evaluation will be allowed to a greater extent.

TABLE 7:   Summary of the results of CASE STUDY 4 in terms of the research questions

The study was continued in 1998 in order to collect more data. To do significant analyses on the nine Belbin team roles and the various groupings of roles, more data was needed. The next period, the first semester of 1998, will now be discussed as Case Study 5.