

## TEACHING OF STATISTICS TO HISTORICALLY DISADVANTAGED STUDENTS: THE SOUTH AFRICAN EXPERIENCE

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### INTRODUCTION

Statistical education has developed during the last decade into a field where much research is being done. Statisticians increasingly realise the importance of using modern methods to teach statistics. Changes in society almost demand from us to move away from the traditional ways of teaching statistics.

We all know that the important fundamental concepts of statistics are quintessentially abstract. The traditional approach not always took this into account with the result that students were scared away from the subject.

The new approach uses technology to teach especially the introductory courses. Computer software, video cassettes, graphical calculators and multimedia are used to a large extent to teach introductory courses.

We can almost describe it as a revolution that is beginning to take place in the field of statistical education.

The question arises whether this approach is applicable in the case of students that can be described as historically disadvantaged?

### WHAT IS A HISTORICALLY DISADVANTAGED STUDENT? (HDS)

A hds can be described as a student who has been deprived of normal quality education during the whole of his/her school career.

The student was never taught how to study. There was a lack of evaluation and very little discipline existed in schools. Most of the teachers were not qualified or had inferior qualifications. A shortage of books and study material existed. Many schooldays were lost due to strikes by teachers and pupils due to political unrest. Basically no culture of learning and study existed. Classes were too big and the physical facilities very poor and virtually non-existent. Think of a classroom with broken or no desks, broken windows, if any, and sometimes no roof.

Think of a teacher with no diploma or degree and sometimes not even a senior

certificate. Many of the teachers were unmotivated, and have no sense of responsibility or work ethics.

The student comes from a home where poverty exists and the parents themselves illiterate.

It is clear that a hds generally represents very poor university material. The question arises: How did the student qualify for admission? I do not want to speculate about this but the fact of the matter is the student qualified for admission and find himself in the statistics class. We have to assume that the student has the potential of majoring in statistics. We have the obligation to exploit and develop any potential the student may possess.

The problem we face at a historically disadvantaged university is that the majority of the “better” students enrol at the so called historically privileged universities. Our students generally fall in the lower category of the hds’s.

#### PROBLEMS PECULIAR TO THE TEACHING OF STATISTICS TO HDS’S

##### *Language problems.*

A significant number of the students have difficulties in understanding standard English.

It is not their mother tongue and when one combines this problem with the difficulty of explaining abstract statistical concepts, it is clear that the lecturer is faced with a very difficult task.

Another problem that is linked to the language problem are the examples used in foreign textbooks. The students are not used to the first world nature of the examples.

For example: A nutrition study of London bus drivers included measurements of daily food intake in calories; in a medical experiment, 60 guinea pigs are injected with tubercle bacilli to study their resistance to infection. The survival time after infection is measured.

##### *Mathematical background*

The majority of the first year students have a poor or insufficient mathematical foundation.

This is typically a problem that originated at school level. The entrance requirements of most of the disadvantaged institutions are such that for statistical

methods, mathematics at senior certificate level is not necessary, whilst only a D symbol (50-59%) for standard grade mathematics and an E symbol (40-49%) for higher grade mathematics at senior certificate level is generally required for statistics

This is significantly lower than the minimum requirements for statistics students at the historically privileged universities.

#### COMPUTER LITERACY

Very few of the students had any experience with computers. Any reference to computers in the statistics courses is of very little use. To use computers for the purpose of teaching statistical applications, the lecturer must virtually start from scratch.

This is very time consuming and together with the normal time constraints on lecturing time it limits the amount of time that can be spend on the statistical part. Even the use of pocket calculators, which is essential in any statistics course, is almost a burden for the simple fact that the students must be taught how to use it.

#### *Socio-economic background*

Many students live in circumstances at home or other places which is not conducive to study. In many cases no study facilities exist, such as electrical lights, a room to study in as well as the general atmosphere of study. Examples are noise, overcrowding and general poverty.

#### POSSIBLE SOLUTIONS

From the foregoing it is clear that the statistics students' performance, apart from their own abilities, is restricted by quite a number of factors. Some of the problems lie beyond our powers of solving. Here we think of the socio-economic background, and to a lesser extend the language problem.

For the rest of the problems, actions are already in progress to minimise them.

#### *Bridging Programs: Mathematics*

One of the plans of action to enhance the mathematical abilities of the first year statistics students is to conduct mathematical bridging programs. The students are given a

course, at the beginning of the year, in basic mathematical principles needed in statistics. This type of course do not form part of the statistics curriculum and is also not compulsory. Students are however encouraged to attend it.

Mathematics topics forms part of the first and second year courses. The advantage is that students are refreshed on those mathematics topics that are important for statistics.

The disadvantage is that less time is available for the pure statistics part of the courses.

The bridging courses place a relative heavy burden on the lecturers and are in this regard definitely not the ideal solution.

The introduction of modules in the statistics courses might be a possible way out. This means that a specific designed mathematics module, teaching students basic mathematical skills, can be made part of the statistics curriculum.

#### *Local Textbooks*

The use of local textbooks in stead of foreign textbooks can to a certain extend bridge the problem of examples the students are not familiar with. Unfortunately the few local textbooks that are available, are written mainly for introductory courses. For the more advanced courses the lecturers still have to use foreign material.

It is realistic to assume that local textbooks will always be limited. On the other hand the problem hopefully is only temporary of nature. As the country develops with reference to its education, it is reasonable to assume that the problem will be phased out.

#### STUDY MANUALS

The use of study manuals, written by lecturers of the department, proved to be a valuable solution of the problems with foreign textbooks.

The manuals can be written in a style (language) the students understand, without violating the statistical content. It has also a big cost advantage in that the cost to the student to buy a study manual is much less than to buy a handbook.

Another advantage is that a study manual can be written in such a way that only relevant topics, with reference to the purpose of the course, be included in the study manual.

## RESTRUCTURING OF SYLLABI

The change from the “traditional approach” of semester (or year) courses to a modular system may be a possible solution.

A statistics curriculum can be modularised . The modules can be designed in such a way that each module deals with a specific topic.

Modules of other subjects, like mathematics, can now be included in a statistics course.

It can be made compulsory for students without senior certificate mathematics to include a basic mathematics module in their statistics course.

The modular approach has many advantages. One important advantage is that a student can now determine his/her own rate of study. This will cater to a large extend for the hds students.

## SUMMARY

South Africa have a substantial problem with many students that can be classified as historically disadvantaged. Statistics Departments cannot dissociate itself from this problem. The main problem , for statistics, is the mathematical background and ability of a large number of its students. A second serious problem is language. Socio-economic background and the computer literacy of statistics students are also stumbling blocks in effective statistics teaching.

Present measures proposed to overcome some of the problems, are: bridging programs in mathematics, the use of local textbooks, study manuals in stead of textbooks, and the restructuring of syllabi by the introduction of a modular system.

However the perception is that some of the mentioned problems are temporary of nature and will gradually become something of the past. The upgrading of the school system and other general socio-economic developments will hopefully lessen the problems in future.