CHAPTER 12

The Teaching of Statistics in the Secondary Schools of Sudan

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This short review describes the present situation of statistics in the secondary school system in Sudan.

At the end of 1969 and during 1970 there were many changes in the syllabuses of the secondary schools. In particular, the predominant language of instruction in the senior years changed from English to Arabic. In 1971, Statistics was included for the first time in the school curriculum. There were further changes in 1977.

There are common examinations called the school certificate for all Sudan, although a few private schools take foreign examinations such as Oxford, Cambridge or London Board GCE examinations. As a result there is more homogeneity in the syllabuses than in many countries. When they are 18 years old — that is, after three years in senior high school — the students sit for the school certificate examinations, and to pass they must reach an acceptable standard in Mathematics, Arabic, English, Religion (Islam/Christian) plus at least two subjects from a list including Physics, additional Mathematics, Chemistry, Biology, History, French, etc. To continue into higher education, students must pass the school certificate. The compulsory Mathematics course includes some Statistics, but the additional Mathematics course does not. We therefore merely consider the compulsory Mathematics syllabus.

The compulsory Mathematics course includes algebra, calculus, trigonometry, euclidian and co-ordinate geometry, statistics and some linear programming as an application of inequalities. The statistics syllabus is as follows: —

> Histograms, pictograms.
> Mean, mode and median.
> Range, quartiles, and variance.
> $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.
> Conditional probability and independence.
> $P(A \cap B) = P(A|B)P(B)$.
> Bernoulli and binomial distributions.
> Simple distribution functions.

The form of the examination bears upon what is actually learnt. The examination is split into two sections: the first section has 3 short easy questions and the second section has 5 questions of which 3 questions should be attempted. There is always one statistics question and one linear programming

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inequality question in the second section, but these subjects have no questions in the first section. Furthermore, 3 completely correct answers in the first section will just about yield a pass. It is not yet clear how seriously the students are taking their statistics. However, basic statistics is in the syllabus of a subject that must be passed by a student wishing to enter higher education in Sudan.

The Appendix illustrates the type of statistics and linear programming questions in the compulsory Mathematics paper, by presenting extracts from the Elementary papers of 1975 and 1977.

APPENDIX *Extracts from the Higher Secondary School Certificate Papers of 1975 and 1977*

Subject: Elementary Mathematics

1975 Section 2

. . . .

6. If the mean of four numbers, x_1, x_2, x_3 and x_4 is 0.9 and the standard deviation of the numbers is 0.3, prove that:

(a) $x_1 + x_2 + x_3 + x_4 = 3.6$
(b) $x_1^2 + x_2^2 + x_3^2 + x_4^2 = 3.6$.

7. A girls' school decides to raise money for charity. They have in stock 82 metres of cloth material, in three different colours. 20 metres of these are green, 30 metres are yellow and 32 metres are brown. They can make two types of dresses with these materials. The first (A) requires $\frac{1}{2}$ metre of green cloth, $\frac{1}{2}$ metre of yellow cloth and 1 metre of brown cloth. The second (B) requires $\frac{4}{5}$ metre of green cloth, $1\frac{1}{2}$ metre of yellow cloth and $\frac{1}{2}$ metre of brown cloth. Assuming that they can make a profit of £s. 1 on type (A) and £s. 2 on type (B), find how many dresses of each type they should make to obtain the maximum profit.

1977 Section 2

. . . .

5. (a) Ali is a football player. The probability that he scores a goal in the second half of a football match is twice as likely as that in the first half. Find the probability, in a certain match, that:
    (i) he scores a goal in the first half,
    (ii) he scores a goal in each half,
    (iii) he scores no goals in the first half and a goal in the second half.
  (b) In Yambio, the probability of a newly born child being a boy is $\frac{3}{5}$. If three children were born there on a certain day, find the probability that:
    (i) all three of them are girls,
    (ii) at least one of them is a boy.

6. (a) Define the following statistical terms:
    (i) the range
    (ii) the median
    (iii) the mean deviation
    (iv) the standard deviation.
  (b) Amin owns a farm 18 acres in area. He intends to split the planting of it between two crops: potatoes and tomatoes. One acre of potatoes costs £s. 6 and needs the care of one farmer, while an acre of tomatoes costs £s. 3 and needs the care of two farmers. If Amin has only

£s. 84 and 30 farmers; assuming that he plants x acres of potatoes and y acres of tomatoes, write down three inequalities that must be satisfied by x and y.

CHAPTER 13

Statistical Education in South African Schools

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Each of the four provinces of South Africa has its own education authority and syllabuses differ from province to province. All pupils who complete twelve years of schooling write matriculation examinations either set by the province, or the Joint Matriculation Board. Changes in the structure of the matriculation examination are being made at present, and it is now possible to take subjects in one of two grades, lower or higher. This has made it possible to include extra topics in the higher grade syllabus. Differentiation between the subjects starts at Standard 8 when pupils are about 15 years old.

Very little statistics is taught in schools at present and what is does not form part of the official syllabus. Some teachers do teach children about histograms and bar charts, and simple averages in Standard 5 — the highest class of the junior school. These are taught as an extension of arithmetic and, in more enterprising schools, the children collect data as class projects.

At present the mathematics syllabuses are being revised and there is considerable interest in including statistics and probability in the new syllabus. The South African Statistical Association has been consulted and has recommended that statistics and probability replace some of the geometry in the present syllabus. No officially recognised new syllabus has yet been produced. There is no agreement among statisticians as to exactly what should be included in the syllabus either.

The Mathematical Association of South Africa, whose members are mostly mathematics teachers, have a working party (The South African Mathematics Project), which is revising the entire mathematics syllabus from standards 5 to 10. They have achieved more than the official committees, and although their syllabuses have no official standing with the education departments, their proposals will be given serious consideration by them.

This proposed new syllabus includes some statistics and probability in each of the standards from 5 to 10 (for children from about 12 to 17 years). Also a statistics/probability option is included in the higher grade standard 10 syllabus. The content in the proposed syllabus is based largely on what is done in England at present. Basically it includes histograms, frequency polygons, mean, median, mode, interquartile ranges, standard deviation, regression, and standardisation of scores using the normal distribution. Methods of drawing samples, and discussion of use and abuse of statistics are also included. Mutually exclusive and independent events, addition and multiplication rules, the binomial distribution and uniform distributions is the main content of