

Experiences as a Statistics Teacher in The Gambia

Nasim Ahmad - Serrekunda, The Gambia

1. Statistics in the formal curriculum

The Gambia is a small country in the extreme west part of the African continent. It is one of the five members of the West African Examinations Council (WAEC), a common examination board of West African states, namely, The Gambia, Sierra Leone, Ghana, Liberia, and Nigeria. Established in 1952, the Council, jointly funded by these countries, is a highly prestigious and efficient establishment. It conducts a variety of national and international examinations in the member countries and has highly commendable standards. It also formulates and updates examination syllabuses. In The Gambia, besides other examinations, the WAEC conducts examinations at the following levels:

- | | | |
|-------|----------------------|---|
| (i) | Primary Education: | The Gambia Common Entrance Examination |
| (ii) | Secondary Education: | The Gambia Secondary School Leaving Certificate Examination |
| (iii) | High School: | WAEC Ordinary Level School Certificate/General Certificate of Education |
| (iv) | High School: | WAEC Advanced Level School Certificate/General Certificate of Education |

At all these levels of education, it is particularly pleasant to note that not only is statistics included in the curriculum, but that it is given enough emphasis. This is well reflected in the terminal examination papers. At primary and secondary levels, statistics is integrated into the mathematics syllabi while at 'O' and 'A' levels, we have statistics available as an independent subject. At the same time, a substantial part of statistics is included in the mathematics syllabi at both 'O' and 'A' levels. A summary of the syllabi (statistics part) of different stages of education is given below.

1.1 *Primary level*

The entry age is 6 to 8 years and the primary education runs for six years (Primary 1 to Primary 6). On completion, The Gambia Common Entrance Examination is held. For quite a number of students this is a terminal examination.

Summary of primary school statistics syllabus: Collecting and recording simple information about children in the class and representing this using stick figures; interpreting pictograms of stick figures; calculating the arithmetic mean of a set of data; comparing the differences between arithmetic mean and each item above and below it; drawing graphs of averages; interpreting graphs of averages; collecting simple information and tabulating this information; deducing information from tables of relationship through questioning; simple pie charts and deducing facts from diagrammatic representations, e.g. pie charts, block and bar charts: dividing circles into several equal sectors (2, 4, 8, etc); representing information in pie charts made up of equal sectors.

1.2 *Secondary level*

The entry age is 12 to 14 years. The Gambia Common Entrance Examination determines the entry requirements. Students spend four years at this level and then take The Gambia Secondary School Leaving Certificate Examination. For the majority, this is again a terminal examination. A few find places in high schools in the upper forms.

Summary of secondary school statistics syllabus: Bar graphs and pie charts; the mean, median, and mode of ungrouped data, each giving a kind of "middle value"; basic properties of the mean of discrete data; determining the deviations about the mean; frequency tables: choosing number of classes and interval of each class; limits and class boundaries of classes; reading and interpreting frequency tables; calculating mean from classified frequency tables; reading and interpreting histograms; travel graphs; the mean and range of distributions; distinguishing between plain average and weighted average; classifying events into levels of likelihood, i.e. examples of events which are certain, likely, equally likely, unlikely, and impossible; experiments with loaded die/coin; effects on the mean of extreme values; probability of simple events (practically and calculation); index numbers; usefulness of statistics (discuss misuses as well).

1.3 *High school 'O' level*

The entry age is again 12 to 14 years. The Gambia Common Entrance Examination determines the entry requirement (on merit). The students, after completing primary level, branch out either to secondary schools or high schools, depending on their performance in GCEE. Those with high performance are taken into high school; here they have five years of education leading to ordinary level WAEC School Certificate/

General Certificate of Education. This is an international examination and common to all the member countries of WAEC. At this level, and as an independent subject, statistics was introduced in The Gambia in 1971 (at Nusrat High School) and has now become quite a popular option.

Summary of 'O' level statistics syllabus: Range of problems requiring statistical investigation; nature of statistical investigations; sources of statistical data; types of data; planning of surveys; basic ideas of random and non-random sampling; method of random selection; units and method of enumeration; design of questionnaires; post-enumeration survey; discrete and continuous variables; frequency distributions; diagrammatic presentation of data: frequency polygon, frequency curve, histogram, ogive, bar diagrams, pie-chart, pictogram, histogram; measures of central tendency and of location; arithmetic mean, median and mode, quartiles, deciles, and percentiles; measures of dispersion; range, interpercentile range, interquartile range, semi-interquartile range or quartile deviation; mean deviation from the mean, variance and standard deviation.

Meaning of probability; calculation for simple events; calculation for compound events; binomial distribution: meaning, expansion, mean and standard deviation; normal distribution: normal curve, calculations using standardised scores, areas under the normal curve; use of standard normal distribution tables; normal approximation to the binomial; parameters and statistics; confidence intervals of population mean for known population variance; relationship between two variables; representation by scatter diagrams; graphical treatment of regression and correlation; estimation of the regression equation $Y = bx + a$, from the graph; computation of: product-moment correlation coefficient, Spearman's rank correlation coefficient.

Time series: components of time series; determination of secular trend only; weighted averages and index numbers; consumer and wholesale price indices; quantity or volume index; value index; crude and standardised rates.

1.4 High school 'A' level

On completion of high school 'O' level education, students spend two years at 'A' level schools (at the moment only two - the entry is quite competitive). At present, none of the schools offer statistics as an independent subject, mainly because it was only recently (about four years ago) that WAEC included this in the list of subjects offered at 'A' level. However, as part of the mathematics syllabus, it has always been available, and the two 'A' level schools are considering offering statistics in the near future.

Summary of statistics content of 'A' level syllabus: Mathematical background, up to differentiation and integration of functions of a single variable.

Probability and probability distribution; sample spaces and events; relative frequency definition of probability; conditional probability and independence; additive and multiplicative laws; total probability rule;

Bayes' theorem and its applications; random variables; probability distribution: discrete and continuous; the cumulative distribution function; expectation (mean) and variance of a random variable; standard probability distributions; discrete Bernoulli: binomial, hypergeometric, Poisson and geometric, continuous uniform, exponential and normal; use of binomial and normal tables; mean and variance of a linear combination of random variables.

Statistical methods; population and sample; simple random sampling; stratified random sampling; descriptive measures of frequency distributions: geometric mean, harmonic mean, mean deviation and coefficient of variation; skewness; bivariate data; scatter diagram; linear regression; covariance; product moment; coefficient of correlation; rank correlation; Spearman's and Kendall's coefficients.

Sampling distributions; parameters and statistics; sampling distributions of mean and variance for samples from normal populations; use of the students' t , χ^2 and F tables; central limit theorem; estimation of population mean, variance and proportion; confidence intervals for: population means (variance known or unknown), difference of means (known variances or unknown common variance) and population variance for samples from normal populations; proportions and difference of proportions for large samples from binomial populations; test of hypotheses: simple and composite, null and alternate hypotheses; critical region; Type I and Type II errors; significance level; χ^2 test for contingency tables.

Applied statistics: organisation and operations; population statistics: sources of population data, population distribution by age and sex, measurement of fertility and mortality, measurement of population growth; economic and social statistics: national income and expenditure, statistics of employment, trade, education, health, agriculture and finance; index numbers: price and quantity relative index numbers of prices, quantities and value; weighted index numbers: cost of living index and its uses; time series: components of time series, determination of secular trend and seasonal variation; statistical quality control: control charts for items, mean, range, fractional defective and number of defects. (Note: At both 'O' and 'A' levels of WAEC, statistics is available to candidates through private tuition.)

The syllabi at 'O' and 'A' levels are reviewed and updated periodically (about every three years) by international panels formed by WAEC representing member countries.

2. Aiding factors

The students in general are highly motivated and very cooperative. In fact, it is one of their traditions to be highly respectful of the teachers. As such, there are hardly any disciplinary problems. Again, due to economic reasons, there is a general lack of educational institutions and only a small number of students find their way into high school education. Those who do, make a real use of the opportunity and are very

receptive and willing. Then, there is a high level of the sense of sacrifice both on the part of the students and of their parents. One is impressed to see the amount of care - financial and otherwise - both parents and children have for each other. These things together make a wonderful atmosphere of teaching/learning - something hard to find elsewhere.

As a result of the general shortage of teachers, many international agencies, religious organisations, etc. send volunteers to teach here. Many of these come with a spirit of help, sacrifice, and dedication (a few, of course, only for sunshine) and so offer valuable service which aids teaching.

In general, mathematics is feared and many students, initially, even fear making an attempt. This fear is now fortunately fading and some schools have gone to the extent of making it compulsory. This experiment has proven very encouraging. Statistics falls into the same group as mathematics for the award of the 'O' level School Certificate and students may offer one of these two or both. It is quite encouraging to note that a good number go for both. The students, as a whole, find statistics interesting and less "mathematical" and it is popular in schools that offer both mathematics and statistics.

3. Adverse issues

The medium of instruction is English throughout the member countries of the WAEC. This being a second language, students naturally find it difficult to use in understanding and expressing concepts. I have noticed that candidates frequently avoid answering descriptive questions.

In The Gambia there is a shortage of high school teachers and a good proportion of teachers are expatriate. These teachers come from various backgrounds and thus have various accents, styles, teaching methods, and expectations. The students as well as the teachers find it, at least initially, hard to adjust. Then there is a frequent change of staff because the foreign teachers come for varied durations. Fortunately, the government is aware of this problem and the Teachers' Training College has been recently upgraded to produce high school teachers as well.

The lack of teaching materials has been a major problem. In view of the small market here, major publishers have not shown any interest in publishing books suited to the needs of students and the WAEC. Most books in circulation are meant primarily for British schools and are very expensive. The majority of students cannot afford them. Some EIBS titles are available for 'A' level statistics (not specific to WAEC 'A' level), but none for high school 'O' level standard. The situation is really pathetic in this regard.