DOCUMENT RESUME

ED 082 329 EA 005 441

AUTHOR	Kendall, W. L.
TITLE	Statistics of Education in Developing Countries. An Introduction to Their Collection and Presentation. Statistical Reports and Studies-13.
INSTITUTION	United Nations Educational, Scientific, and Cultural Organization, Paris (France). International Inst. for Educational Planning.
PUB DATE	68
NOTE	89p.
AVAILABLE FROM	UNIPUB, Inc., P.O. Box 443, New York, New York 10016 (Stock No. B.2394, $1.50)
EDRS PRICE	MF-$0.65 HC Not Available from EDRS.
DESCRIPTORS	Comparative Statistics; *Data Analysis; *Data Collection; *Developing Nations; *Educational Planning; *School Statistics; Statistical Analysis; Statistical Data; Statistical Surveys; Statistics

ABSTRACT

This document attempts to state in simple terms what is necessary as a minimum to ensure the adequate provision of educational statistics in developing countries. It has been developed for the use of Ministries of Education and other interested departments in developing countries to help them develop the basic set of statistics necessary for national reporting and planning. The publication begins with a general discussion of the educational statistician and educational statistics. It then examines the problem of collecting educational statistics both within and outside of the school system. Chapters dealing with the analysis and reporting of educational statistics discuss records and reference tables, analytical tables, diagrams and graphs, averages and comparisons, enrollment and entry rates, wastage, forecasting, and publishing. The document concludes with suggestions for organizing a statistical department and suggestions for further research. A selected bibliography is included. (Author/DN)

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statistics of education in developing countries

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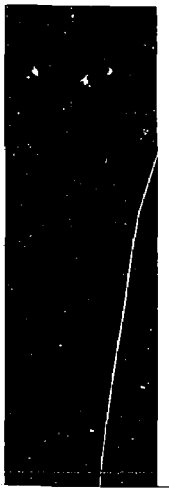

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statistics of education in developing countries

An introduction to their collection and presentation

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Printed in 1968 in the Workshops of the
United Nations Educational, Scientific and Cultural Organization,
Place de Fontenoy, Paris 7e, France

ST/S/13
COM/SS.67-XVI-13A
Printed in France

B.23947 $1,50; 9/6 (stg); 5,50F

PREFACE

The series of Unesco Statistical Reports and Studies is designed to examine methodological problems in statistics of education, science and culture.

The present study (No. 13) attempts to state in simple terms what is necessary as a minimum to ensure the adequate provision of educational statistics in developing countries. This is the first time that a study of this kind has been attempted, dealing with the problems of collecting the statistics as well as simple procedures for presenting and analysing them. It is hoped that it will prove of use to the Ministries of Education and other interested departments in developing countries in ensuring a basic service of statistics necessary for national reporting and planning.

It should be emphasized that the study is concerned in a specific and practical way with the immediate tasks of statistical units serving Ministries of Education. The statistical services of other departments will also be required for educational planning and these are mentioned but they are not discussed. As the field of educational statistics expands, many matters of concern to the statistician require further research and more detailed discussion before guidance can be given as to methods; examples are given in Chapter 17 of topics on which further work is required.

The author of this study is Mr. W.L. Kendall, Chief Statistician of the Statistics Division of the Ministry of Overseas Development, United Kingdom; the views are his own and not necessarily those of the Ministry in which he is employed. Similarly, the views he expresses are not necessarily those of Unesco.

The study was discussed at the Regional Seminar on Educational Statistics for Africa organized by Unesco at Yaoundé, December 1966, and the present text reflects the many valuable comments made on that occasion.

CONTENTS

Chapter 1

EDUCATIONAL STATISTICS AND THE EDUCATIONAL STATISTICIAN

1.1 The administration of an educational system depends in a great measure upon the production of statistics (paragraph 2.3) and in most developing countries there is already a substantial flow of material, much of which is published. While a number of important gaps still remain to be filled in this material, the immediate problem is less that of a scarcity of statistics and more that of *improving their quality* and of developing the skill of those who, from teachers to senior officers, are responsible for collecting and using them.

1.2 These problems are considered in this volume from the viewpoint of the officer responsible for statistics in a Ministry of Education, and called the *educational statistician.* There are many others who are also concerned with educational statistics, either as producers or as consumers: officers of the local authorities or in the local education offices; officers in the universities; those concerned with taking population or other censuses; the members of planning units or commissions; and officers in the central statistical offices. Each has his own problems to which he gives emphasis. The key person for producing the statistics required in educational planning, and for advising on their use, is nevertheless the educational statistician.

1.3 Although the term educational statistician suggests a technically qualified person, and the appointment of such a person is eventually necessary (paragraph 16 and following below), it may happen that a country with very limited resources is not in a position to appoint an officer with academic qualifications at the outset. Since it is possible for a substantial amount of the basic work of the educational statistician to be carried out by someone without academic qualifications in this field, the term educational statistician is taken to cover him as well.

1.4 Those officers meeting the statistical problems in educational matters for the first time, with little or no formal statistical training, may find this volume of particular help. For others, much of the material may be well-known, but the volume can serve as a check-list of their problems. They may also find it of use in providing junior officers or new entrants with an introduction to their work, and also a manual for in-service training or even more formal training courses. It might also be found of help to those who use the statistics provided by Ministries of Edution, or by those in schools or elsewhere who may be called upon to provide the basic material.

1.5 The limitations of this volume must be made clear. It is concerned chiefly with the statistics required for educational planning in its various meanings (see paragraph 2.10 below) and not with that important section of educational statistics concerned with psychological and other tests applied to pupil aptitudes, intelligence and other matters[1] necessary for judging the quality of education. Nor is it concerned so much with such statistics necessary for educational planning as are provided by sources outside the Ministry of Education (population statistics, labour force statistics and so on). *It is concerned rather with those statistics, obtained mainly from the schools themselves, for whose collection and analysis the educational statistician is solely responsible.*

1.6 The main emphasis is thus on the practical problems facing the educational statistician. No body of rules covers all situations and the particular needs of any given country may demand a special solution. Moreover, general experience to date may still be insufficient to indicate more than a number of alternative procedures to be tested in the light of local experience. The Ministry of Education must, in any event, develop its own expertise and methods. The purpose of this introductory volume is to show the need for a proper system, to help in initiating such a system along sensible lines and to suggest a number of points to which attention should be given in planning further developments.

1. See, for example, Summer, W.L. *Statistics in School* Blackwell, Oxford, 1958 and the further list in N.K. Henderson: *Statistical Research Methods in Education and Psychology.* Hong Kong University Press, 1964

1.7 Once the statistician is clear about his particular problems and is aware of the essentials of good statistical practice, he should be prepared to experiment in methods in the light of his local conditions. Standard technical practices which have evolved in developed countries have often to be amended when applied to the conditions in the less developed countries, and educational statistics are no exception. A number of possible fields for further experimentation are given in paragraph 17.4 below. Others will suggest themselves.

Chapter 2

USES FOR EDUCATIONAL STATISTICS

GENERAL

2.1 Statistics are not an end in themselves. They are tools for use in making decisions. Good statistics are expensive to collect and analyse; bad statistics are not worth the money spent on them. Not to have a clear idea of the purposes to which statistics are to be put will mean that they will be inefficiently collected and inadequately analysed and presented, and thus the scarce resources of developing countries are wasted.

2.2 Two groups of people need educational statistics as tools for making decisions, the *administrators* and the *planners*. When statistics have been collected for these purposes, it is also useful to *publish* a summary or a selection, as tools for other policy-makers. This is broadly the right order of priorities. The publication of statistics is not the first aim of the educational statistician.

STATISTICS AND ADMINISTRATION

2.3 Education is a large-scale operation that may account for 10 to 25 per cent of government expenditure in developing countries. It must therefore be subject to detailed accounting as part of the annual budgeting control of government and the provision of estimates. Detailed financial statistics are required for this purpose. Education is further a decentralized activity with a large local and voluntary element. The maintenance of national standards and of sound practices relies upon the provision of reports, including statistics, from below, complementary in many cases to the provision of financial assistance from above. The Ministry of Education is moreover one of the largest employers in the country so that its personnel records must be considerable; it is one of the more important providers of buildings so that it must maintain details of building costs; and it is responsible for registering in its schools as much as 15 per cent of the population, on whose activities and progress it must keep an eye. As a result, the operation of the educational system must result in a considerable supply of statistics. They are statistics on:

(a) pupils
(b) teachers and other personnel
(c) buildings
(d) finance.

2.4 Faced with this situation, the role of the educational statistician is *not* to attempt to control every statistical document produced. In certain fields, for example in the departments dealing with accounts or personnel records, it must be recognized that special training is required and the statistics have been designed to meet the special day-to-day needs of these departments. Statistics are not made for the statistician but for the user, that is the administrator or planner.

2.5 At the same time, it is not the function of the statistician merely to bring together whatever happens to be collected by the administration, and in whatever form, and publish it. In the first place, the general rules of care and checking, and of the efficient design of forms and procedures, are applicable to all statistical records of whatever kind, and the skill and experience in these matters of the educational statistician should be at the disposal of all branches of the administration. In the second place, these administrative records form a substantial part of the basic records that the educational statistician needs for his own purposes (see paragraph 2.7 and following below). He must as a result ensure that they are suitable for these purposes. In the third place, the statistician is in the best position to comment on the use of statistics for evaluation and planning. He can best judge the system of statistics as a whole, decide where the gaps are, and advise on the best methods of filling them.

2.6 He will be able to carry out these duties if he is himself well versed in the administration of the educational system and in touch with the administrators at all levels. One of the tests of a

good statistician will be the extent to which he can influence the supply and interpretation of administrative statistics without appearing to be meddling unduly in the affairs of other officers. A constructive statistician will always be welcomed by his administrative colleagues; a busy-body will be avoided. He should in particular acquaint himself personally with the processes by which the statistics are actually produced or collected. He should also be known by all concerned to be available for advice at all levels, and he must be in a position to provide it. It must be recognized that he is finally responsible for all the statistics required for general Ministry policy and publicity; but this recognition will only be given if he can in fact provide suitable statistics when required.

2.7 It is not always easy to obtain from the administrators a clear statement of their minimum statistical requirements. In some cases they are not sufficiently numerate (that is, able to use "numbers" or statistical material) and for this reason may not know how to formulate their needs. In other cases they may be too ambitious and expect more than the statistician can realistically provide. For the former, the statistician will endeavour himself to estimate the minimum requirements and, by providing a suitable selection of statistics, assist the administrator in becoming more numerate. In the latter, the statistician must keep his own limitations in skills and staff in mind, and make it quite clear what are the resources of both necessary for any statistical service. He will also have in mind the technical limitations set by the nature of educational statistics (see for example paragraphs 3.1 and following below).

STATISTICS AND THE EVALUATION OF THE EDUCATIONAL SYTEM

2.8 The first major task of the educational statistician is to use the statistics provided by the administration and such others as he may be able to collect himself to provide *an overall statistical picture of the extent and working of the educational system.* He seeks to provide quantitative answers to such questions as how large is the system, what kinds of education is it providing, how rapidly is it growing, in which regions is it lagging, what use is being made of the teachers and of the schools. Adequate answers to these questions are necessary to justify the budgeting expenditure and to make possible sound estimates of future expenditure; to give the educator an idea of what is happening and a firm basis for considering future development; and to provide the politician and public in general with a precise impression of the nature and extent of one of the major social services. He will find additionally that, according to the degree that he can manipulate his material, administrators and others will turn to him for answers to special queries necessary for their work.

EDUCATIONAL STATISTICS AND PLANNING

2.9 The statistical evaluation of the educational system is also necessary for educational planning. The present educational facilities represent the *stock* immediately available for future developments and its measurement is thus the first step in planning. Further, the recent history of the educational system, when measured by means of *flow* statistics, provides a good basis for indicating how the educational system is working and how it may change in the future. *Forecasting* by the statistician is thus a further operation required for planning.

2.10 Educational planning has a number of aspects. It may be looked at first as a matter of expanding facilities so that as many as possible may enjoy them. Education is thus a consumer good that should be made available to all at the primary level and, at the higher levels, to all qualified by ability and attainment to benefit from education. Given the political decision as to the rate of expansion of consumption the community can afford over the next five or ten years, it is for the educational statistician to estimate the number of places and the different types of schools required, the supply of teachers involved and the claims which these make upon the national economic resources, so that his Ministry can make the necessary plans.

2.11 Educational planning is also required for the production of the qualified manpower required by the country's economic plan. First, a *Manpower Survey,* sometimes elaborated into a econometric model, estimates future demands for manpower. Second, estimates of future supplies of qualified manpower are used ro build up a *Manpower Budget.* This budget will reveal the shortages or gaps which have to be met or filled if the development plan is to succeed. The educational statistician is concerned first because the Ministry of Education itself employs a substantial part of the nation's highly qualified manpower (namely, the teachers) and information about them is required for the Manpower Survey. Second, statistics showing the possible output from the educational system are necessary to build up the Manpower Budget. Third, meeting the shortage will require principally the expansion of particular educational facilities.

2.12 New econometric techniques are also making it possible to consider the educational system in the same way as any other large economic enterprise, that is to say, as consuming national resources and contributing to national productivity. Educational expenditure is thus viewed as an

investment[1] ; or the *contribution of education to the growth* of the national income and of capital formation can be estimated[2]. Generally speaking, the information required for such exercise goes well beyond the resources of developing countries at present. There are conceptual difficulties in both exercises and, generally speaking, the information required goes well beyond the resources of developing countries at present

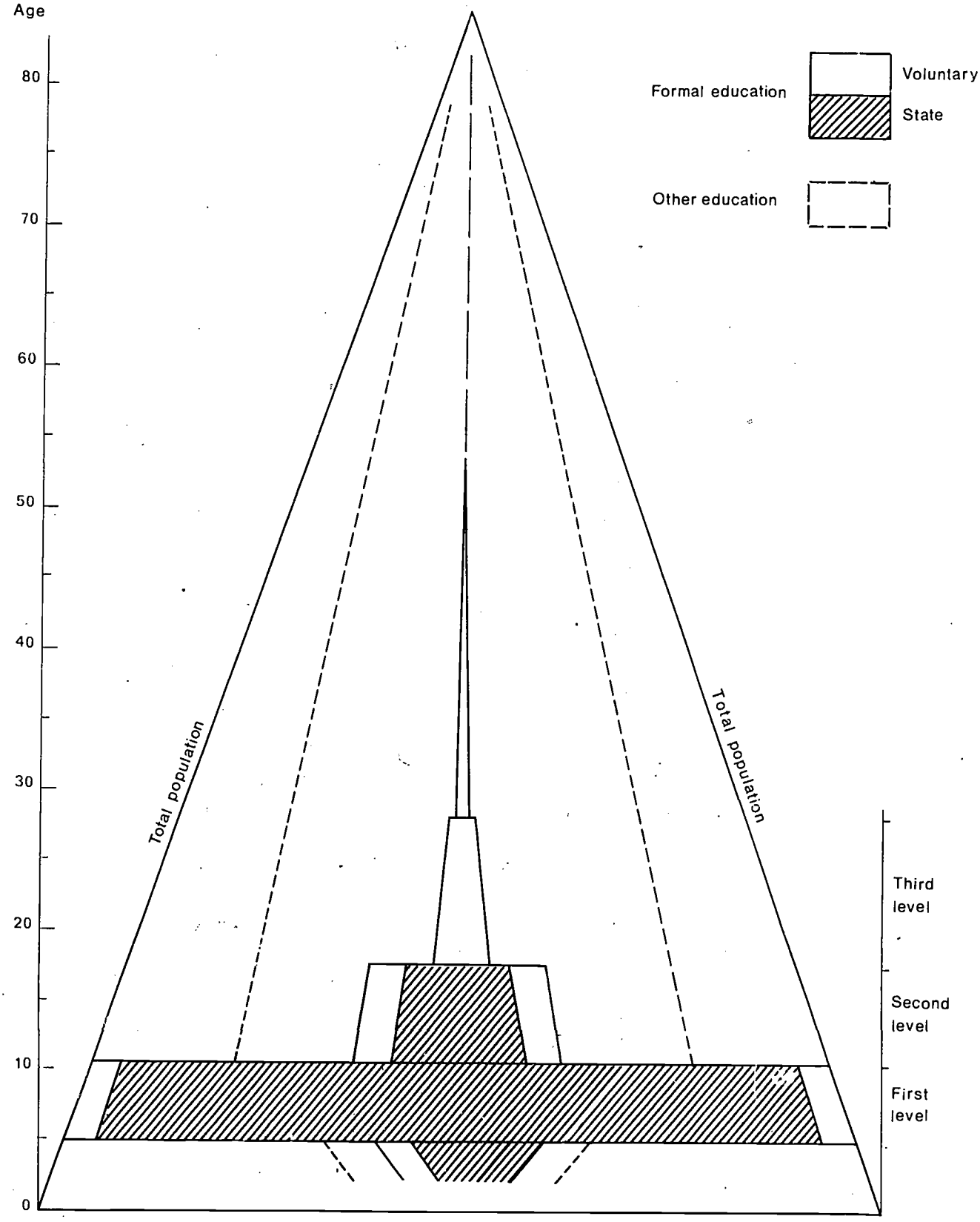
2.13 Neither manpower budgeting nor educational investment planning means that economic considerations have replaced cultural considerations in the planning of education. Both are necessary. Nor do they require the educational statistician to become a labour statistician or an economic planner. Nevertheless these wider uses for educational statistics make it necessary more than ever for the Ministry of Education to provide staff and other facilities so that the educational statistician can supply the necessary information. Further, the more skilled he becomes the more he will be able to contribute constructively to the deliberations of the planners within his own Ministry, of the manpower planners, and of those responsible for the government's overall development plan

PUBLICITY

2.14 Less important than planning, publicity is nonetheless very useful. Although statistics should not be collected solely for this purpose, modern publicity requirements make it an important consideration when statistics are being collected and used. Not only governments themselves usually publish educational statistics there are also requests made of governments for statistical information, including the requests by international agencies, and particularly by Unesco, for statistical information to document the world position and make comparisons between national systems, and the many requests, for example, from universities and other research bodies and from business interests, which the Ministry of Education normally endeavours to meet, sometimes on the basis of a reciprocal information service.

1. For example, by comparing with the present value of earnings over a life time generated by, say, one year's additional education, the present value of the additional current and capital costs of providing it (compare below paragraph 8.21 (a)).
2. That is, to make possible such statements as that of the 10 per cent annual increase in the national income, 1 per cent (or one tenth of the increase) is attributable to education.

Diagram I. NUMBERS AT DIFFERENT AGES RECEIVING EDUCATION



Chapter 3

THE COVERAGE OF EDUCATIONAL STATISTICS

FORMAL EDUCATION: THE EDUCATIONAL SYSTEM

3.1 Education in its widest sense extends from birth to death since individuals never cease to learn in one fashion or another, but the educational statistician's initial concern is with the educational system for which the State is directly or indirectly responsible. This constitutes the greater part of what is known as *formal education*, that is *systematic* instruction provided in *schools*. The relation of this formal education to other education is illustrated in Diagram I which shows the diminishing numbers of those in the population with increasing age, giving the shape of a pyramid[1]. At the centre of each age group are those receiving formal education; it is the *educational system* as usually understood.

3.2 This education comprises, first, those schools *maintained and managed by the State*. These consist both of " primary " and " secondary " schools; since these terms often have an emotional rather than a logical definition in some countries it is preferable to use the more neutral terms *first level* and *second level*. The State also provides an increasing amount of education at the pre-primary level, and this type or level of education is increasingly regarded as part of the educational system, linking up the modern curriculae in the junior first-level classes.

3.3 Education at these levels is also provided in schools *managed by voluntary bodies*, mainly religious organizations. These so-called independent schools are the concern of the statistician since they also form an integral part of the country's educational system and the State is responsible for ensuring that they maintain certain standards in teaching and equipment. The State may provide financial assistance to this end; or such schools may be " recognized " by the State as adequate. The statistician has therefore to allow for three main types of non-State schools:

(a) assisted schools
(b) unassisted but recognized
(c) others

3.4 Post-secondary (or *third level*) education, which covers instruction at universities and colleges, is also outside the direct control of the Ministry of Education although the State furnishes considerable financial assistance and the management is by a public body of varying degrees of independence. The statistician must obtain information about these third-level activities in order to complete his documentation of the complete educational system.

3.5 " Systematic instruction in schools according to State policy " sufficiently describes the greater part of the educational system. It will include part-time as well as full-time instruction, and also a certain amount of pre-primary schools as noted above. Nevertheless, in practice there are difficulties in determining what should be included: what is *systematic* education? What is a school? The following guidance is suggested:

(a) the voluntary extra-curricular activities of schools that are included for other reasons should be documented although it is not necessarily systematic; these activities may nevertheless be difficult to measure statistically, and should be given less priority than the basic statistics listed below (paragraphs 3.11 and following);
(b) in-service courses of government departments and of business houses, where these are systematic, even if unassisted, should be included because of their importance to technical education. For this purpose the Department or firm concerned will be treated as the " school managers ";
(c) independent schools that are not *recognized*, for example, private " commercial" schools, Koranic schools or Bible classes, should be excluded;
(d) short-lived rural or " bush " schools present a special problem; this is partly an administrative problem of locating and registering and their subsequent treatment by the statistician will

1. Developing countries with high birth rates and thus a preponderance of small children would show a pyramid with a much wider base.

need to be decided with the administrators. One possibility is to maintain a separate list of such schools with estimates of their pupil enrolment;

(e) adult education (including literacy campaigns) is part of the educational system but there are difficult statistical problems involved where education is less formal (see paragraph 3.6 below). It must be treated separately and according to the resources available. Some of this education falls within the sphere of Community Development and will be documented by these officers. The educational statistician can advise these officers on suitable records and analyses.

STREAMS AND SPECIAL SCHOOLS

3.6 In first-level (and pre-primary) education the instruction is initially general. Sooner or later specialization occurs and eventually it is necessary for the pupils to break up into separate streams. At the second level this may take the form of separate schools as such. Although the problem this raises with the statistician is principally that of presenting the information he collects to show these streams, there is also a coverage problem. For first-level education he must see that all *schools* are covered. For second (level which may include some senior primary) he must see that all *streams* are covered, and problems regarding some technical education have been noted in paragraph 3.5 item (b). At this level part-time and evening instruction also claims a large proportion of pupils in the educational system – and of course of those caught up in "other education". Thus at the second level questions of coverage may become complex.

3.7 Initially, the statistician can only take institutions as he finds them in his country and as described by the administrators, with such records as the institution possesses, and evaluate them accordingly. Eventually he should be able to improve their records, where required; he will also assist, by his statistical services, in the clearer formulation of the educational system by the educators. So long as "secondary" is ill-defined, for example, or the definition is changed from one period to another he will find it particularly difficult to provide a satisfactory generalized picture, but for example "primary education" is clearly limited to seven grades and a clear distinction is made at the second level between *"high schools"* (concerned with education preparatory to third level), a *general secondary education* organized as the completion of the second level-course, and *technical schools,* the quality and usefulness of the statistics are much enhanced.

3.8 Both at first and second level there are special arrangements for educating the *physically and mentally handicapped children* and *socially maladjusted children.* Where separate schools are established for these special cases, their necessary statistical recording is straightforward.

3.9 *Teacher training* in developing countries, because of its crucial importance and sometimes makeshift arrangements, calls for separate and rather special reporting. The Ministry of Education's interest in these schools or courses is twofold: as a special stream of pupils; and as the source of future teacher supply.

OTHER EDUCATION

3.10 Having distinguished between the educational system and "other education", the statistician still retains an interest in the latter – even the Boy Scout movement has an educational element. Information about this sector can be quite important both in evaluating and in planning the educational system. Collecting such information may nevertheless pose problems of definition, lack of suitable records, how to obtain access to what records do exist and similar matters; generally speaking, the farther the statistician moves away from the formal system of education the more expensive in time and resources does the collection of statistics become. In consequence the statistician cannot *initially* promise the administrator or planner a great deal of information of this kind and he must carefully scrutinize any requests he does receive for such information in the light of his own resources. Such work should not be allowed to interfere with the basic documentation of the main educational system.

BASIC COVERAGE OF EDUCATIONAL STATISTICS

3.11 To provide the basic information required for evaluating and planning in a sufficiently comprehensive and accurate fashion and promptly is the first objective of the educational statistician. The following are the basic items:

(a) *Statistics of Schools* should show by type of management and for each level (or stream where appropriate)
  (i) number;
  (ii) size and location; and
  (iii) equipment.
  By "school" is meant "educational institutions"; such an institution may consist of several buildings. A single institution in which pupils follow several streams would be counted more than once when these streams are separately recorded, but in the basic school list (see paragraph 6.2 below) each institution is to be recorded once.

(b) *Statistics of Teachers* should show their numbers by sex, general qualifications, whether part-time or not, in each type of school and at each level. At the second and subsequent level information on subjects taught is necessary. Some indication of each teacher's position immediately prior to teaching, and details of resignations and death are needed if the general characteristics of teacher supply are to be understood.

(c) *Other Staff Statistics.* Statistics, for example, of the number, type and cost of the staff in the Ministry of Education itself and of its local staff, are the direct responsibility of the establishment and personnel departments of the Ministry. These are, nevertheless, elements in the educational system to which the educational planner must pay some regard, and they also represent an important burden on the resources of skilled manpower in developing countries which the manpower planner must also take into consideration.

(d) *Statistics of Pupils (Students)* should show their numbers by sex and age (in each grade for first- and second-level schools), in each type of school and at each level; subjects studied – in part in second-level schools and more fully in third-level institutions; numbers of repeaters (paragraph 4.14 below), transfers and deaths in first and second schools; and of successful leavers (paragraph 8.7 below).

(e) *Financial Statistics* should be available to make it possible to know or estimate the cost of each pupil, teacher and building unit at each level, and the total annual recurrent and capital expenditure at each level and for administration.

Chapter 4

EDUCATIONAL STATISTICS IN DEVELOPING COUNTRIES

STATISTICS IN DEVELOPING COUNTRIES

4.1 In common with other statisticians working in developing countries the educational statistician is confronted, first, with:

(a) a very limited provision made for statistical work in government; this arises usually from an inadequate recognition in the immediate past of the need for a proper statistical service – in the case of the educational statistician he is still in the very early days of recognition;

(b) the acute shortage of qualified manpower at all levels, not only at the professional level but also at the middle level, and even of experienced clerks. Despite technical assistance from international agencies and under bilateral programmes from developed countries (see paragraph 16.29 below) this shortage will continue to afflict all developing countries;

(c) despite (a) and (b), a rapidly growing demand for statistical information for planning and other government purposes; under pressure for quick results the statistician will need to keep to a strictly realistic set of priorities (see paragraph 3.11 above) and to utilize every type of shortcut.

4.2 Secondly, the statistician in developing countries experiences considerable difficulty in collecting statistics because of

(a) poor communications – transport, postal etc;

(b) the low educational levels of many of those from whom information has to be obtained.

Progress is inevitably slow as a result and quality difficult to maintain. The emphasis must in consequence be on statistical material that is simple and good rather than more complicated information, however desirable, which runs the considerable risk of being poor in quality. The educational statistician is particularly handicapped at this point by the decentralized character of the educational system which it is his task to document.

EDUCATION AS A LOCAL ACTIVITY

4.3 It is not possible to run the nation's educational system as a single administrative unit, in all areas and at all levels. Apart from the administrative impracticability, it would also offend against the philosophy of education which, starting from the uniqueness of each individual, endeavours to give that individual opportunities for developing himself according to his gifts within the framework of national standards. The development of educational planning has not altered this position. The educational system thus takes the form of a partnership between government on the one hand and regional and local authorities on the other. Furthermore, the administrative unit of the educational system is the *school*, ranging from bush schools to universities, the actual instruction taking place in several tens of thousands of separate institutions of this kind, each under its own *head*.

4.4 This means that the principal source of material for the educational statistician lies in the records of this vast array of institutions, scattered throughout the country, some in the remotest areas, whose size, efficiency and general conditions must vary widely. Moreover, access to many of these records can only be obtained throught managements that may be partly or wholly independent of the State. The educational statistician who in developing countries endeavours to collect the necessary material from behind his desk at headquarters, by merely sending out inquiries to all and sundry, will be subject to too many unknown factors. Experts may be called in to help him solve his technical problems of analysis, but proper access to the basic material will in the last resort depend upon his (and his staff's) undertaking the maximum amount of field work: personal contacts with managements, visiting schools, advising local officers, maintaining contact with the more remote parts and so on. Unless there

is adequate provision for this field work, the educational statistician cannot guarantee either the adequate coverage or the accuracy of the statistics he provides.

THE ROLE OF THE LOCAL EDUCATION OFFICER OR INSPECTOR

4.5 In particular the statistician must be in touch with these local officers. Contact between the schools and the Ministry of Education is maintained by the Inspectorate or by the provincial (or regional) and district or local education officers. Primary schools are usually the concern of the local officer or inspector and secondary schools of the provincial or regional officer. He is the channel through which State grants are made to different schools and for this reason requires, and can obtain, a detailed statement of their activities. He is in constant touch with the local authorities and the voluntary boards of management, and in the course of his duties builds up detailed knowledge of all the schools in his area. He maintains records of his own for these purposes and for reporting to the Ministry. Where not himself responsible for completing the annual return required by the Ministry, he assists the headmaster in this operation and himself checks the results. Thus, on his efficiency depends much of the quality of African educational statistics.

THE SPECIAL PROBLEMS OF EDUCATIONAL STATISTICS IN DEVELOPING COUNTRIES

4.6 Conditions in developing countries also confront the statistician with a number of special problems in collecting and analysing educational statistics. These problems arise out of :

(a) the uneven development in education;
(b) the payment of fees;
(c) the lack of reliable information on births and deaths;
(d) the wide age range found in a single grade;
(e) the high rate of absenteeism;
(f) the high rate of repeaters;
(g) the high rate of drop-out.

The difficulties that are encountered in meeting these problems are sometimes held to justify the present limited supply of statistics, but it is usually found that if they are *not* met in some suitable fashion this limited supply has little real value and planning suffers in consequence.

UNEVEN DEVELOPMENT IN EDUCATION

4.7 For historical reasons, certain types of education, or schools for particular groups or regions, may have been more fully developed than others. Resources are not available to remedy this in a short time. Moreover, regional positions continually change as the result of such social factors as rapid urbanization or the mass migration to seek employment. In these circumstances, the regional and group differences need careful statistical documentation and this requires a special effort to secure the necessary details.

PAYMENT OF FEES

4.8 In some educational systems in developing countries fees are paid by the parents, at the first as well as at the second level. The financial statistics are thus complicated and, what may be even more of concern to the educational statistician, an additional burden placed upon the ability and time of the headmaster to maintain adequate school records. The effect may be to provide an additional check on enrolment figures; but the return of these figures to the Ministry may be delayed, and other statistical duties of the headmaster also suffer.

LACK OF RELIABLE INFORMATION ON BIRTHS AND DEATHS

4.9 The information required for educational planning on the ages of children entering the educational system and on the age composition of the general population is provided by population censuses and by birth certificates. Reliable *censuses* are still recent events in many developing countries and, where they have been taken, the information on age composition may be no more precise than five-yearly age groupings, possibly with single ages shown for the 0 to 5 age group. While this situation holds - and the position may be substantially improved as a result of the round of censuses in connexion with the United Nations' 1970 World Population Census - the production of the educational statistics for planning will be difficult. This is a situation which the educational statistician can help to remedy only in part. More can be expected from the increasing awareness of the need for proper demographic statistics on the part of governments in developing countries and the general improvement in census work

4.10 A similar improvement is also necessary in the field of *birth and death registration*, but progress in this direction, remarkable as it has already been in some countries, cannot in the nature of things be rapid. It takes time to build an institution that requires a wide network of efficient local officers particularly in the background of the shortage of qualified manpower. Further, vital events will not be fully registered until those concerned fully

regognize the need to do so: to rely solely upon legal enforcement to produce the information is as unproductive in this field as in other fields of statistics. Parents are, nevertheless, becoming more aware of the need to register births. One main reason for this is the requirement, on enrolment at the school, to provide particulars of age and as parents are increasingly anxious for their children to receive education, the educational statistician and his colleagues in the educational system have here an opportunity to help improve the demographic information which they and others ultimately require. Nevertheless, educational planning cannot await the introduction of a country-wide system of registration of births; in the interim, *ages have to be estimated.*

WIDE AGE RANGE

4.11 A wide age range in the school grades is characteristic of educational systems at an early stage of development. Where, for example, the normal age of entry, usually six or seven, is not or may not be enforceable for a number of reasons, children of ages even up to 16 may enter schools at the first level in grade I. This may be prevalent at the first level, particularly in backward regions, and is not unusual at the second level. At the primary level it can be aggravated by the presence of repeaters (see paragraph 4.14 below). Since classes with a wide range of ages are difficult to teach and hamper the working of a graduated system of education, account must be taken of this situation when the statistician is evaluating educational facilities. Moreover, the wide age span presents special analytical problems. Collecting the necessary statistical information nevertheless raises problems: a special burden is placed on the more backward schools, and accurate records of the ages of children have to be obtained where this information may, in practice, be most lacking.

ABSENTEEISM

4.12 A large degree of absenteeism also characterizes educational systems in early stages of development. This may arise solely for physical reasons in that pupils may be drawn from a wide area and communications at certain times of the year are difficult or hazardous. It may arise from a casual attitude of parents towards education, reinforced in some cases by the view that work at home or on the domestic holding has prior claim on the child's time. Some of these causes have much less weight than formerly. On the other hand, absenteeism can also arise from an over-eagerness of parents to place their children in schools with the result that the schools may over-enrol. Finding themselves crowded out, pupils may not be sufficiently interested to attend. For whatever reason, the extent of absenteeism, particularly at the first level, may render ordinary enrolment figures a poor indicator of the extent to which education is in fact being provided. Enrolment figures need to be amplified by information on actual *attendances.* In developed countries attendance records are required largely for the purposes of the local attendance officer in keeping an eye on particular children. In developing countries they are also valuable for the educational planner.

4.13 Absenteeism means a waste of educational facilities. This loss may be greater than apparently shown by the figures if there are *repeaters* who maintain the numbers in the grade; eventual wastage is measured by *drop-out* (paragraph 4.15 and following below).

REPEATERS

4.14 Repeaters are pupils who remain in the same grade for more than one year. This situation arises when the child fails to qualify by examination or other means of promotion to move into the next grade. Although it is increasingly the policy in developing countries to adopt automatic promotion to the next grade, repeating still occurs. It can arise as a result of prolonged illness on the part of the pupil, or because children entering school at a higher age may lack the basic training to enable them to keep up with the others. It may also occur because teaching facilities continue to be inadequate. Excessive repeating is a defect in an educational system since it limits the amount of education being received by children and is thus an uneconomic use of resources. This may be particularly severe should it happen at the second level since facilities at this stage are expensive to provide. It is also necessary to measure the extent of repeating if the drop-out is to be calculated.

DROP-OUT

4.15 A pupil who drops out leaves school before completing his education at any particular level. This is a frequent occurence in developing countries; it is, in effect, an advanced state of absenteeism, arising for the reasons given above. There may be a very high rate of drop-out during the first four grades at the first level (particularly the first grade) and it is not unknown at the second and even higher levels. As with absenteeism, it involves an uneconomic use of educational resources and, if the education is paid for by fees, of the money of parents. The consequences can be serious to the child

because if a pupil leaves before the fifth grade of the first level, even if literate at that point, he can easily relapse into illiteracy.

4.16 The reason why a child is lost to a particular school may not of itself reflect upon the efficiency of that school. A child may die before completing its school course, or he may be transferred to another school and there continue his course. So far as *mortality* is concerned, the educational statistician is again hampered by the general lack of death registration in Africa although in this case the teacher can usually discover what has happened. *Transfers* may more easily be noted but the size of this problem has to be recognized, where for example there is a great deal of internal migration. Further, the practice of children travelling considerable distances seeking education not only encourages absenteeism but may lead to a high occurence of sudden transfers as new schools are built. This is a further reason why regional statistics are of importance.

Chapter 5

COLLECTING EDUCATIONAL STATISTICS: GENERAL

SOURCES

5.1 The immediate sources of educational statistics are the *records* of:

(a) schools and universities
(b) local and regional education offices
(c) departments within the Ministry of Education;and
(d) other Govemment Departments, chiefly the Central Statistical Office, the Department responsible for the census and for the registration of births and deaths, and the Public Works Department.

5.2 In addition, the statistician may undertake *special inquiries*, for example at schools or at parents' homes.

METHODS

5.3 The three main methods for obtaining the necessary information are:

(a) personal inquiry
(b) postal census
(c) sample inquiry

5.4 *Personal inquiry* usually suffices to obtain such information as is available from universties, other departments in the Ministry and other Government Departments. It is strongly recommended that the personal approach should also be considerd in dealing with local officers and with local school managements, an approach which, in *the first instance* at least, should be literally personal. A discussion with those concerned often helps to discover what is available or could be made available under certain conditions and to secure the cooperation of voluntary or independent organizations, without which educational statistics will remain seriously defective. *Subsequently,* written communication may be sufficient, particularly where an *agreed* periodic return can be introduced. In the early days, at least, the statistician must also be a salesman.

5.5 Personal contacts are not feasible with more than a few *schools* at a time and to obtain the information from them either a postal census or a sample inquiry is necessary. Athough personal contact is ruled out in the case of a postal census, it is recommended that even postal communications should be as personal in tone as possible.

5.6 The greater part of educational statistics are collected in practice by means of a *postal census* in the form of a questionnaire sent annually, or occasionally more frequently, to the heads of all schools in the educational system, either directly or through local officers. The school heads are called upon to report on the " population " (of pupils and teachers) for which they are responsible, in the same way as in the normal Population Census the heads of households have to report on the persons for which they are responsible. The major difference is that in the latter case specially trained enumerators question the heads of households personally, since these heads may be illiterate and some of the information may not otherwise be easy to obtain. Nevertheless, the similarity is close between the two censuses and there is much that the educational statistician can in consequence learn from the demographer. One of the subjects in which the educational statistician might usefully be trained is demography.

5.7 Since the annual questionnaire has become the usual method of collecting educational statistics and presents a number of conveniences to the statistician, there is the danger of misusing it to gain information that could properly be obtained elsewhere, from local authorities or from other departments within the Ministry of Education. If the requirements of the sound collection of statistics are to be met (see paragraph 4.2 above and paragraphs 7.6 and following below), the questionnaire must not be overloaded, and the alternative sources of information must be fully explored.

5.8 Special *sample inquiries* may either take the form of a postal questionnaire to a selected sample of schools, or of homes etc., or – which is usually

found to be the more rewarding and at times essential, in developing countries – by arranging for trained enumerators to visit these schools or homes etc. The sample inquiry is a new and increasingly important source of information in developing countries ; but its use calls for resources not always available at present to the educational statistician (see note at end of this chapter). Nevertheless, professional training in sampling techniques, as well as demography, will be increasingly required of him.

5.9 Two *general rules* in deciding methods for collecting statistics are :

(a) suit the method to the requirements of the information, to the convenience of the informant and to the resources available to the statistician; never to the ease of the statistician;
(b) personal knowledge of the source, of the records and of the people using them will help the statistician to frame his inquiries realistically.

TYPES OF INFORMATION AND OF RESPONDENT

5.10 Where individual details are required, for example, in examining the home backgrounds of particular types of pupil or their individual school histories, sample inquiries are usually necessary in order not to have an unmanageable mass of material or information that is too vague or inaccurate, and also to keep the costs of the inquiry down to reasonable figures. The respondent in such inquiries need not be specially numerate to provide suitable answers since it will be the interviewer's responsibility to obtain and record the necessary information.

5.11 The greater part of the information required by the educational statistician is of a different kind : he needs totals or aggregates of, say, pupils of a particular age in a particular grade. For this purpose, the individual items in the records of the schools, or in other sources, have first to be summarized before being entered in the postal questionnaire. The initial statistical work of this simple kind has to be carried out at the source, in the school, for example, by the headmaster.

5.12 The apparent simplicity of the postal questionnaire method rests in this way upon the ability and opportunity of the respondent to carry out this preliminary work for the statistician : this is a situation that must always be kept well in mind by the statistician. In developing countries, particularly at the first level, many schools are staffed with teachers inadequately trained, grossly overburdened with work, and ill-supplied with facilities at home or at school. The headmasters themselves, although likely to be among the best educated individuals in a developing country, may not as such be competent in maintaining the school records ; not all well educated persons are necessarily good at figures. They may, moreover, delegate the work to a teacher or a clerk and not themselves adequately check the results.

5.13 The educational statistician can help in a number of ways. He should as far as possible gain personal experience of the conditions under which teachers and headmasters have to work in maintaining records. Not only is this an essential prerequisite for a good design of basic record ; it would enable him also to explain the importance of such matters as accuracy and cross-checking on the spot and also the valuable uses to which this information when correctly presented can be put. There are clearly physical limits to such personal help by the educational statistician or members of his staff but a talk or an appeal by him at district meetings of teachers, the organization of local seminars on educational statistics (possibly in relation to planning techniques) and even the introduction of short courses on elementary statistical techniques in training colleges or in the refresher courses organized by the inspectorate, are all possibilities that should be considered. Not the least to benefit from such arrangements would be the educational statistician himself.

5.14 With regard to other sources – other departments of government or the universities – the statistician must assume that those responsible for the preliminary shaping of this material have the necessary skills and opportunities to summarize and if necessary analyse their records, and he will shape his inquiries accordingly. Should this assumption not hold, usually for temporary reasons, he will need to draw upon his tact and own skill in assisting the respondent to meet his requirements (see above paragraphs 2.3 and following).

NOTE TO CHAPTER 5: SAMPLE INQUIRIES

1. It is possible to apply modern sampling techniques in obtaining additional information required by the educational statistician particularly in the field of pupil statistics. The invaluable contribution made by sampling techniques in solving a number of problems confronting the central statistical offices

in developing countries – in agricultural, demographic and household budgetary surveys – has resulted in an increasing body of knowledge about the practical problems of sampling techniques in such countries. With access to this experience, the educational statistician can consider inquiries based on samples of educational institutions, pupils or parents and in this way:

(a) check his existing information for gaps and incompletions, on the assumption that trained enumerators will be more accurate than, say, headmasters;
(b) collect detailed background information which can only be obtained by an expert interviewer asking questions of the headmaster, the pupil or his parents.

2. The basic idea of sampling is straightforward but expert knowledge is essential for designing an actual sample inquiry (see paragraph 17.4 below). With this knowledge it is possible to calculate by how much the results obtained from the sample are likely to differ from the results obtained from a complete census: the difference is called the sampling error.

3. The advantages of sampling are chiefly:

(a) the sampling error can be calculated;
(b) the costs can be kept down by keeping to the maximun acceptable error; and
(c) by reducing substantially the number of units to be enumerated, much more detailed and precise information, collected by a small corps of skilled enumerators, can be obtained.

The disadvantages are:

(a) it presupposes a good "frame" or comprehensive list of the units (schools, pupils or parents), each fully identifiable and able to be located, from which to draw the sample;
(b) it can be costly both in money and in human resources; and
(c) "human errors" (as distinct from the sampling error) that arise when, for example, the enumerator makes a mistake or allows personal bias to flavour the replies, can be magnified in the result. This is why sampling is expensive in highly qualified manpower, since the enumerators must be persons of good intelligence, suitably trained.

4. The extent to which the educational statistician can use sampling in developing countries will in the immediate future depend for the most part upon the facilities available in the Central Statistical Office (see paragraph 16.6 below). It is a field which is likely to expand.

Chapter 6

THE SCHOOL LIST AND SCHOOL RECORDS

6.1 In order that satisfactory satistics can be collected from the schools a few basic records must be properly maintained: the school list; in certain conditions the school register; and the class register.

THE SCHOOL LIST

6.2 The statistician must first have available a list of all the schools that he wishes to document. This is necessary to ensure that all schools are sent the necessary inquiry forms from the statistician and as a check on the response rate. It can also be used as a "frame" from which to draw a selection of schools when a sample inquiry (see Note to Chapter 5) is contemplated. The information, suitably transferred to a *school map*, is also of use to the planners. The list must record as a minimum for each school its full address and the name of the headmaster. For use as a sampling frame further particulars (level and type of school, numbers of pupils, with sex, and of teachers) would be desirable. In developing countries these lists are seldom fully satisfactory as regards their comprehensiveness, the details collected and the way in which they are maintened.

LEGAL DEFINITION OF A SCHOOL

6.3 It is increasingly the practice to make it a legal condition of operating a school that it should be licensed by the Ministry of Education. Applications for a license, if passing first through the hands of the local officer, can be checked by him from his knowledge of local conditions and sent on to the Ministry with his recommendations; it is also possible for him to extract the information required for compiling a school list.

6.4 A "school" is generally defined[1] as a group of pupils (students) of one or more grades organized to receive instruction of a given type and level under one teacher, or under more than one teacher and with an immediate head. For legal purposes this definition needs further clarification. There must first be a limit put on *size*. To be workable compulsory registration of schools should legally define a lower limit to the number of pupils, as for example by defining the school as "an institution providing education to five or more pupils between the ages of 5 and 19". The age range depends upon the age at which children enter primary schools and leave at the secondary schools, and upon the extent to which it is proposed to include pre-primary schools and those dealing with further education. Institutions of higher learning, it should be noted, require a much simpler treatment: they are fewer in number and they are normally established under public acts of various kinds.

6.5 What is meant by "education" may be more difficult to define and some guidelines are given above in paragraph 3.5. It is necessary to make as clear a distinction as is possible between, for example, a Koranic school and an institution of pre-primary education or primary education. What types of instruction to include under the various levels of education will be determined by those responsible for educational policy in the country. A frequent omission in practice are many types of technical training that are of special interest to manpower planning. Part-time education poses special problems as to what to include.

COMPREHENSIVENESS OF THE SCHOOL LIST

6.6 Once the appropriate definition of a school has been determined, the prime consideration is that the list should be comprehensive. Relying solely upon legal registration may result in omissions because of:

(a) inadequate enforcement of the law;

1. For this and other definitions see Unesco: *Manual of Educational Statistics*, 1961.

(b) the existence of important marginal cases. Full responsibility for remedying these omissions should rest upon the local officer in the first instance. A school can be defined once its activity is inspected. The local officers should know their district sufficiently well to be aware of the existence of a new school and to be in a position, without delay, to inspect its work. They will consult the list of schools which missions and other non-official bodies prepare for the schools they are operating, and also, as a further check, teachers' payrolls where these are available from employing authorities. At the same time, the rôle of the statistician is not a passive one. He or his representative should visit selected areas periodically to examine the lists. If gaps are thought to exist, the statistician will discuss how they may be filled.

MAINTAINING THE SCHOOL LIST

6.7 One possible system for maintaining the school list is to use the actual application forms required to obtain a license. The information required could, for example, be supplied on the reverse side of this form and the form designed accordingly. If completed in duplicate by the applicant a copy could go to the Ministry for ultimate use by the statistician, but this should not remove from the local office the final responsibility for the school list as such, for reasons noted in paragraph 6.6 above. The law or ordinance that requires the licensing of schools should also provide for the supply of this information as a condition of the license. A further method would be to prepare separate sheets for each kind of school, state, voluntary and special, and to bundle them first according to level and then into districts. Such an arrangement would make possible quick summary statements of the stock position. Yet another possibility is that the lists should consist of a card index; the school cards could be quickly sorted to reply to particular inquiries, or for drawing a sample of schools.

6.8 Whatever the method used, the schools should be separately *coded,* that is given a letter or number or both for quick and informative identification. The level of education provided by the school might be coded in a simple fashion and added to the district code to give an informative registration number to each school. Thus a *primary* school in the district of S..... might be registered S/P/9. Where mechanized data processing (see paragraph 16.19 below) is in operation, the school code number will be purely numerical and based on the requirements of punched cards or other means used for feeding information into the sorters.

LOCATION OF THE LIST

6.9 In some developed countries all the detailed information collected by the Ministry of Education from schools and about schools, not only at registration but subsequently, is recorded by the Ministry on a master list. Magnetic tape recording makes it possible both to keep the information on this record up to date and to have quick access to it for analysis purposes. Developing countries are unlikely to have or to afford such equipment. For them to endeavour to maintain a list in any detail at headquarters would mean considerable manual copying: this leads to error and is probably a wasteful use of manpower in the circumstances. Until more favourable conditions obtain, it is more realistic to maintain lists at the district offices, available for consultation by the educational statistician, so far as *first-level schools* are concerned. For *second-level* and *higher-level schools,* the number involved being much smaller and the information required more extended, the possibility should be considered of maintaining a record by the statistician in the form, for example, of a separate file for each school; there could also be a nominal card index (that is arranged alphabetically by name) of these schools giving the registered number and location, for quick reference.

6.10 As the statistical work of the Ministry develops, contacts with the local office will become more extensive. Should this eventually take the form of appointing regional or district statisticians, located in the local office, the maintenance of the school list will come more directly under the supervision of the educational statistician. If increasing use is made of sample surveys by the statistician this closer co-ordination will be necessary since the coverage and description of schools required for these purposes could differ in some regards from those required solely for administrative purposes.

SCHOOL RECORDS

6.11 The basic school records are the *school register,* where one is maintained, and the *class register.* Whatever care is subsequently taken with the statistics compiled from these records, their quality and coverage depend upon the skill and facilities available in the school itself when these registers are originally made up. In principle they constitute a continuous record of the population at school. In practice they easily become unreliable where school conditions are unsatisfactory, teachers are inadequately trained and the headmasters lack the time to produce good records.

SCHOOL REGISTERS

6.12 The school system of enrolment or registration varies from one institution to another. Where class organization is less formal, as in the universities and some marginal further education schools (normally where attendance is not considered to be administratively a special problem), the *school register*, consisting of a list of pupils having enrolled, with particulars for each, is the main record. At the other extreme, at the first level, no school register as such may exist, initial enrolment being recorded direct into class registers, which then carry the subsequent history of the pupil.

6.13 At the *second level* a school register in one form or another is usually maintained in addition to class registers. The number of pupils is smaller than at the primary level; they are older and have already been documented at lower schools and are better educated; recording facilities - space, documents, clerical help and the level of education of those in charge - are better. These school registers, which record the pupils' record while at school, are of increased importance the less the weight that is given to examinations in assessing the pupils' achievements. A system of *cumulative record cards*, a card for each pupil being added as he enrols, the card being removed as he leaves for one reason or another, is recommended for this purpose. Such a system lends itself extremely well to the provision of both stock and flow statistics. Entrants and leavers can be sorted out according to type, and the number of repeaters similarly found. It is a local form of the individualized data sytem (see paragraph 7.2 below).

6.14 In those countries where pupils are provided with identity cards, that follow the pupil from school to school or level to level, the collection of cards in the headmaster's possession provides a sytem of record cards that has many of the advantages of the cumulative card system, if designed and used for that purpose. Care must be exercised to guard againts loss in the course of transfers and promotions and to ensure that the particulars are up to date.

6.15 It is unwise to introduce a system of records whatever its advantages on other grounds, if the time, the willingness to maintain them and the human resources to maintain them are not certain to be forthcoming. Nevertheless if headmasters can be provided with better facilities and if, as a result of such measures as those suggested in paragraph 5.13, they have an interest in good statistics, they could maintain a school register of one kind or another which could be of considerable help to the educational statistician. Such an arrangement would have the special advantage of placing the responsibility for all initial enrolments clearly on the headmaster rather than upon the teacher. Until such arrangements are possible the class registers will continue to provide the main original record for many primary schools.

CLASS REGISTERS

6.16 Class registers are, particularly for first-level schools, the main source for statistics of:
(a) pupil enrolment;
(b) pupil attendance; and
(c) the pupil's school history.
There are thus strong grounds for their being designed at the outset as statistical as well as administrative documents. They should be durable, laid out for the convenience of the teacher and for ease of statistical summary, and printed in a standardized form. There should be ample room to record against each pupil: *class number* (or registered number, see below paragraphs 6.24 and following), *sex, age, previous grade* (stating whether in another school) and *reason for leaving*. This will provide a clear record of repeaters, deaths and transfers. The problem of recording ages is referred to below in paragraph 6.18.

6.17 The registers should be designed in the light of the school conditions. It may be helpful to design special simplified registers for schools in the more backward areas. In the more developed areas, the information collected might be extended, for example, to include *the occupation of the parents*. If a cumulative card system is introduced (see paragraph 6.13 above) the class registers can again be simplified.

RECORDING AGES

6.18 Once the age of the child on entry into the school is correctly known, and subsequent records properly maintained, the remaining information about the age structure of pupils is obtained simply by adding a year to the age after each year of schooling. Where the child's birth has been registered, there is no problem beyond that of ensuring that the informant is speaking the truth. In those areas where registration does not exist, the age of the entrant will have to be estimated. It is possible also that the ages of some of the children in higher grades will also have to be estimated since age assessment in the past may have been carried out on the basis of snap judgments by headmasters or teachers, or by using certain very general rules such as the assumption that the existence of two eye teeth indicates ten years of age. The statistician should see that more rigorous tests are applied to new entrants and either treat the early information with special caution or endeavour to improve its quality.

6.19 In the school register each child's age should be recorded as at the last birthday. It will

help the educational statistician if the entry is also coded, for example, C = Certificated; E = Estimated, so that the number or percentage of ages that are estimated in each grade can then be noted. This would serve to indicate how far the statistician could rely upon these statistics and also serve as a yardstick of the progress being made in obtaining better information about ages.

ESTIMATING OR CHECKING AGES

6.20 The limit of knowledge on the part of the individual in most developing countries of his age is a problem to which demographers have had to devote considerable attention in recent censuses and techniques have been developed to meet the situation. Merely recording the numbers in five-yearly age groups, from 5 - 9, 10 -14, and so on, is of little help to the educational statistician who must know the ages by individual years. (In any event this system appears to have provided very little additional accuracy in estimating the ages.) The two major types of procedure widely used by demographers are:

(a) use of a calendar of events; and
(b) obtaining information on relative ages; the idea of chronological age is often foreign to the psychology of people in pre-literate societies but there are often clearer views regarding seniority rights and relations to companions of similar age.

The latter approach may be of some assistance to the educational statistician where the age of a child's companion is known with some certainty; but the possibilities are limited.

6.21 The *calendar of events* approach is more hopeful particularly at the very young age level. It consists in relating the birth in the memory of the informant to a particular historical event the date of which is already known to the interviewer. The great increase in census activity in developing countries will help substantially in working this procedure. There is, first, the increasing awareness of age amongst the younger people as the result of the census operation itself. In the second place, a census officer will have already prepared a calendar of events applicable to the locality and this calendar of events could be either borrowed, or the experience of the officers who were concerned drawn upon, for compiling a similar one for use in the schools. The census itself could be included in the calendar of events as this undertaking will have remained in the memory of many and parents may remember the assessed age of the child. Finally, the teachers themselves, and in some cases sixth form secondary scholars, may have been employed as enumerators in the census and will have received a training in assessing ages and had practice in the actual operation. Where the census is a recent event, the teacher may have already assessed the age of a particular child about to enrol.

6.22 These techniques of age assessment are particularly suited to the discussions and talks of the kind mentioned above in paragraph 3.13. The statistician should also arrange for checks of the actual procedures adopted by headmasters or other recording agents both to acquaint himself more clearly with the problems involved in particular localities, and also to ensure that the fullest use is being made of what techniques are available. In addition, the local officer could keep a special eye on this activity.

6.23 Some developing countries are experimenting with *sample recording areas* for the purpose of obtaining better information on births and deaths. The arrangement broadly is that of appointing a trustworthy recorder in selected areas of a size that makes it possible for him to obtain information on vital events both by personal inquiry and by his being known and recognized in the area as appointed for that purpose. In areas where this arrangement is in operation contact between the local headmasters and the recorder could prove mutually helpful. The educational statistician should andeavour to keep in touch with developments in the field of civil registration in order to seek ways of improving the information on ages.

PUPIL REGISTRATION NUMBERS: CODING

6.24 Each pupil will receive a number on the class register which will correspond with that on the school register, if one is maintained. It is desirable that he should be given a unique number that identifies him throughout his school career. Checking at every stage would be helped by this device.

6.25 It is possible to use the registration number not merely to identify the pupil but also, by applying a simple system of numerical coding, to show some of his individual characteristics. Thus[1] assuming a child enters grade 1 at age 6 in 1960, a registration number could be given to him showing first, the year of entry, 0 (since the final integer in the year figure is sufficient to identify the child's entry date), second, his age, 6, and third, his grade, 1. His registration number 061 (a number he himself might easily remember) would thus give these particulars wherever he eventually finds himself, school or grade. An examination of the class or school register in 1966 which shows that the child has

1. The system briefly summarized in the text is proposed and fully detailed in Goldstone L: A School Cohort Coding System. Unesco, Paris.

reached the sixth grade, also shows that in doing so he has been promoted regularly. By comparing the number of all those children in the sixth grade everywhere having the registration number 061 with those having this number in lower grades, a measure of drop-out is quickly obtained. Further information about those in the latter group could be obtained by extending the code number, but this encounters the possibility of error in the original recording and subsequent copying. It should be noted that it has not yet been tried out in practice to discover, for example, how best to report the information so obtained, whether it should be derived direct from the class register or from a school register in the form of a cumulative card index.

Chapter 7

COLLECTING SCHOOL STATISTICS: THE ANNUAL QUESTIONNAIRE

7.1 Although the use of an annual questionnaire completed usually by the head of the school will remain the main method of collecting school statistics for many years, in developed as in developing countries, mention is made in the following paragraphs of some alternatives.

THE INDIVIDUALIZED DATA SYSTEM (the I.D.S.)

7.2 The advantages of I.D.S. are such that its advocates claim that it will eventually provide the main source of all educational statistics. The idea is straightforward. On entering the educational system the pupil, or his parent, completes a questionnaire with the required information on sex, age and such background information as may be needed. It might even include psychological facts about the child of interest to the educator. This information is entered on a separate card for each pupil in every school and kept in a *central register*. At the same time, the pupil is given a unique code number which also appears on his card. This code number will accompany the student's name on all class registers and other documents in the educational system and each change of grade or institution, or examination success, or similar events of interest, would be recorded in the central register. Similarly, important changes in his home circumstances, such as the death of a father, would be reported. This reporting need not be at shorter intervals than every year provided that the educational institution records the events as they occur. With such a system, complicated problems of flow statistics can be dealt with almost in a routine manner: any cohort or other group of pupils (for example, coming from certain types of homes) could be examined in relation to its present place in the educational system and to that of previous years. Forecasting models of the most complex kind could then be built.

7.3 The I.D.S. is neverthless very much a question of the future. In developed as in undeveloped countries there may be emotional resistance to the idea of submitting a child's educational career to such impersonal treatment. Further, decentralized statistics are required in a decentralized educational system and under the I.D.S. there could be a difficult problem of the necessary feed-back of statistical information to the locality. The sheer size of the school population to be recorded is also a daunting prospect, although using a sample of pupils only for the fuller information, and continuing to maintain the traditional system of enumerating all schools for the basic information, might meet the requirements of planning. So far as developing countries are concerned, that the central register would need to be maintained on magnetic tape by an electronic computer, in view of the amount of information to be processed, and that the procedure would put an even greater burden than at present on those responsible for obtaining the initial information, rule it out. The cumulative card system noted above (paragraph 6.13), perhaps used with coded registration numbers (paragraph 6.24), could provide a central register of individualized data for each school. To tap this source the statistician would continue to use a questionnaire.

DUPLICATION OF REGISTER ENTRIES

7.4 A simple variant of I.D.S. is to provide headquarters with copies of the class register entries, leaving it to the statistician to extract and summarize the information, either on an individual pupil basis or in aggregates. Thus if the register were interleaved with two perforated sheets, and the register proper carbon-backed, a copy of the entries would automatically appear on the first perforated sheet. This copy might be detached shortly after the commencement of the school year and sent to the statistician. Subsequent additions and amendments to the register would appear on the second perforated sheet, which could be detached and sent

to the statistician towards the end of the school year. In this way information would reach the statistician with a minimum of error and delay, the burden on headmasters or local officers would be considerably lightened, and there would exist records of individual children at headquarters which could be analysed either in terms of stock and flow. On the other hand, a relatively extensive and reliable statistical unit would be required to deal with this information and there would be a similar problem, as with the I.D.S., of the necessary feed-back to local officers unless these were required to obtain an additional return from the schools. Whether a system of this kind, limited to the dispatch of register copies to the local officer, is feasible could be determined by a simple trial in a selected area (see also paragraph 17.2 below).

MONTHLY PAY VOUCHERS

7.5 The monthly pay voucher has been used from time to time as the source of such school statistics as pupil enrolment. This is a source which is particularly subject to error (sometimes conscious error on the part of teachers) and gives rise to difficulties when defining "enrolment" (see paragraph 12 below). A questionnaire drawing upon the information in the class registers is to be preferred.

THE ANNUAL QUESTIONNAIRE: DESIGN

7.6 The main statistical method for obtaining school statistics is the *questionnaire*, issued annually, or at more frequent intervals, by the Ministry of Education to heads of schools. The form of this questionnaire is the direct responsibility of the statistician and he should design it with the conditions under which it is to be completed clearly in mind. At no other point in the arrangements for collecting statistics is it so important to obtain the best advice on design. Considerable experience has been gained in recent years by office efficiency experts and business records firms in the field of record and questionnaire design and expenditure incurred in introducing a modern system is a sound investment. Help should also be obtained from the Central Statistical Office (see paragraph 16.6 below).

7.7 The form should be *clear*, that is to say, easy to read, clear in its instructions, unencumbered with unnecessary detail and specific both in regard to the kind of information requested and the date to which it refers. Extremes of size should be avoided. If too small it may easily become crumpled or get lost. If too large it could become unmanageable and also forbidding to the eye. Specifically, this "questionnaire" is a set of summary tables of a simple kind (compare paragraph 5.11 above) rather than a set of questions, and it should conform to the conditions of a good table (see paragraph 9.16 below). Space should be provided for figures to be entered clearly and easily (and the paper chosen to this end), and for them to be aggregated for cross-checking.

7.8 These conditions may require more than one form, if it is not to be too large or too crowded, and in this event each should be clearly identifiable. It is certainly not convenient to have a single questionnaire for all types of schools at all levels: the information required differs in coverage and accessibility; and the quality of the informants differs. Separate forms for each type of school at each level is desirable and these may be distinguished by colour to avoid confusion in distribution and subsequent sorting. The questionnaire should also be designed not only to make it possible for the informant to supply the information as conveniently as possible but also with its use in view as a more or less permanent record in order to avoid further copying of the material at headquarters.

7.9 To avoid a mass of letter-press on the tables, simplified instructions could be printed on the reverse side, or more fully in an accompanying leaflet. In either event, it is useful to offset the impersonal character of such a document by a covering letter, and couching the instructions in suitable language. Opportunity should be taken to explain the use to be made of the statistics and the tone of the communication should indicate that the statistician is aware of the respondent's problems. These considerations suggest that the form should be printed in a standard form on standard paper, accompanied by the necessary information, and not sent for reproduction by local offices or voluntary organizations.

7.10 If a new form is proposed it is essential that it should first be given a trial by a *pilot test* in a selected group of schools, before it is sent for final printing.

A BASIC FORM

7.11 Both to illustrate the problems of a suitable design for the annual questionnaire and to provide an elementary model, which could be adapted for use by a particular country, the form opposite shows a simple basic design. The proposed design would fit comfortably into a form 35 cm. by 25 cm. which is a manageable size. It provides for basic information on:

(a) enrolment
(b) repeaters
(c) deaths and transfers
(d) teachers, and
(e) buildings

with a space for additional information and office use. This last will be found useful for the initials of a checking officer and any brief office comments. For purposes of illustration the scholastic year is assumed

PRIMARY

MINISTRY OF EDUCATION

ANNUAL RETURN 1967

I. Enrolment on Registers at Nov. 1st 1967

AGE / GRADE	5 and under		6		7		8		9		10		11	
	B	G	B	G	B	G	B	G	B	G	B	G	B	G
I														
II														
III														
IV														
V														
VI														
VII														
TOTAL														

III. Number of Teachers at Sept.11th, 1967

	Qualified		Unqualified but trained		Untrained		TOTAL	
	M	F	M	F	M	F	M	F
Full-time								
Part-time								

Signed ..... Position

District .....

School name .....

Number .....

II. Deaths, and Transfers to and from the School, in each Grade during year ending Sept.10, 1967

	Deaths		Transfers			
			To		From	
	B	G	B	G	B	G
I						
II						
III						
IV						
V						
VI						
VII						

12		13 and over		TOTAL		Numbers Repeating Grade	
B	G	B	G	B	G	B	G

IV. School Buildings at Nov.1st, 1967

	Class rooms	Other
Number of Rooms		
Area sq. feet (estimated)		

For official use

.....

Date .....

Instructions overleaf

to begin on September 11. For the timing of the questionnaire see paragraph 7.16 below.

7.12 The enrolment table (I) requires ages at the last birthday since the age information is usually recorded most conveniently in this portion in the class registers[1]. The alternative is to give the year of birth, and this some statisticians find an advantage, the ages being quickly calculated when required; but the form would have to be printed afresh each year. The instructions must emphasize that by enrolment is meant *all pupils on the class registers at the date stated.* Attendance statistics are another matter and are not suited to the annual questionnaire method. Items (b) and (c) are required for the calculation of drop-out; they remain essential while repeating continues on any substantial scale. The instructions should make it clear that this table refers to events *occurring during the previous scholastic year,* for example, the numbers transferred to Grade I from another school during the year 11 September 1966 to 10 September 1967. The reasons for the difference in date between table II and table I are discussed below in paragraph 13.9.

7.13 For teachers it is simplest to record those in the establishment at the commencement of the school year. It will be necessary to define "part-time" in the instructions; it can only be a broad classification and part-time teachers will be those who teach for less than what is customarily regarded as full-time at the particular level of education. It may be helpful to provide for more detail about qualifications; nationality may also be required. The annual questionnaire is not, neverthless, the appropriate means for obtaining full details about teachers (this should be obtained from employing bodies) but only that information which it is necessary to have on a school basis. Much more detail, for example, on salaries and experience is required when considering the general question of teacher supply but,, for example, at the first level, the main features of their distribution between individual schools can be obtained from the suggested information.

7.14 Similar considerations hold for building statistics. Full documentation on State schools should be provided by the Department responsible for these buildings and the particulars of other buildings should be available at time of registration and on the occasion of any subsequent rebuilding. Nevertheless, although further detail is inappropriate to the questionnaire and should be obtained by special inquiry of the schools or the builders, the small table in the basic form will provide minimum information for all schools, useful both as a check on other information and for giving a general picture of accommodation. It should be emphasized that it is not a straightforward matter to answer these simple questions: when desks flow out into a corridor or office, are "classrooms" created? It must be left to the headmaster to decide. Further, the area in fact may have to be *estimated* by him, and the instructions should mention this. This does not necessarily invalidate the information if the statistician is aware of its approximate character.

7.15 The blank box for official use might be reduced to provide space for such additional information as the number of shifts (with shift classes it is evident that one *grade* may consist of more than one *class*[2] and it may be helpful to know the number or even size of classes: or the number of boarders. *Financial statistics are best omitted altogether and obtained by other means.*

DISPATCH OF THE QUESTIONNAIRE

7.16 In order to minimize the burden on the respondents a single annual questionnaire is to be preferred. It is true that if a return is made at the beginning and at the end of the school year it is possible to collect more information: that, for example, on transfers need only appear in the second return. There is nevertheless the possibility that the first return may be completed hastily if it is known that a second will also be required, and it is the first return that is the more important if information is to be made available to planners as soon as possible. The best time for completing a return by the headmaster is the middle of the second term but in practice the need to obtain early information means that the questionnaire is completed during the first term, after sufficient time for the registers to be made up and the initial school arrangements to settle down[3].

7.17 A time-table for the dispatch of the questionnaire is considered further below (paragraph 16.11).

COMPLETING THE QUESTIONNAIRE

7.18 The completion of the questionnaire is a statistical exercise requiring careful reference to the sources, such as class registers, and aggregating and cross-checking the figures. Thus, the total of pupils can be obtained either by aggregating the bottom totals or the side totals. Both operations should be carried out and the figure used should agree with both. It is a sound principle that a single

1. "How old are you?" may elicit more accurate answers than "When were you born?" and it may be desirable not to ask the teacher to convert age into birth year. This position will, however, change with the increasing use of birth certificates.
2. A *grade* is a stage of instruction usually covered in the course of a school year (or standard, form or year of study); a *class* is a group of pupils usually instructed together by a teacher (or a group of teachers).
3. Where there is a fee-paying system, enrolments may not be firm until well into the school year.

person should be responsible for such a return and the *headmaster* is clearly indicated. He should be helped by the local officer. *As an interim measure*, the returns could be the personal responsibility of this officer but only where it is possible to get good staff in the local office. If the questionnaire is left as an additional task for an over-burdened or possibly inefficient local office secretariat, considerable error and delay can result. On the other hand, where the local officer can make this his personal responsibility, and he is aware of the need for good statistics, his detailed knowledge of the conditions in the different schools would make it possible for him to complete the questionnaire satisfactorily. It would not be necessary for bundles of class registers to pass to the local office for this purpose. For example, arrangements could be made for a special *enrolment list*, included as a standard blank form in the class register, to be filled up by the teacher on the date required and sent to the local officer. This entails yet a further record, it is true, that requires copying from the class register, and since the person responsible for the questionnaire would as a consequence be one stage further removed from the source of his information, the situation can breed errors. On the other hand, the arrangement has obvious advantages in districts where schools are poorly staffed and where in any event a local officer's detailed help is needed in completing the return. The eventual objective nevertheless is for the headmaster to be personally responsible for this exercise.

7.19 The same considerations hold in the arrangements for returning the completed questionnaire. It should be sent to the Ministry through the local officers, rather than direct, since the personal knowledge of the local officer enables him to check the return. It is, nevertheless, essential that only the person responsible for the questionnaire should sign it; a joint responsibility can lead to errors of omission and to delay. Where the return is subsequently checked, and inconsistencies are found, the checking officer should clear his corrections with the person responsible for completing the questionnaire in the first place before sending it on. This may take time but if, in completing a questionnaire, the informant knows that another will himself correct the information, the informant may be casual. The checking officer should also initial the questionnaire.

7.20 Copies of the return are usually required by the employing bodies as well as local officers and the Ministry. Where and by what method it should be duplicated for these several uses depends in a large measure upon local conditions. A form that is completed in a clear hand (and this at least should be expected of headmasters) can be easily and relatively inexpensively reproduced by modern methods, but it is doubtful whether a machine of this kind could be justified except in the Ministry of Education itself. On this matter expert advice of the kind mentioned in paragraph 7.6 should be obtained. An alternative to duplication by the Ministry is to supply carbon sheets, or preferably carbon-backed paper, for use in special pads of annual return forms To have questionnaire forms of different colours to be sent to different bodies has been found of assistance.

7.21 After the check by a local officer, there is little point in a further check at a higher level, province or region, before reaching the statistician. This means further delay without usually the time or detailed knowledge on the part of the officer concerned to undertake a proper check. On the other hand, the provincial officer may be the appropriate person to receive the annual returns *direct* from *secondary* schools.

IMPROVING THE RESPONSE RATE

7.22 Inaccuracy and delay are the chief defects in present arrangements for the annual questionnaire in developing countries and these defects may be encouraged by the effort to increase the coverage of the school list. The above consideration will serve to improve not only accuracy but also the extent to which questionnaires are completed and returned promptly to the statistician, that is the *response rate*.

7.23 In this field, as in others, it should be a condition of granting financial assistance to voluntary bodies that suitable statistics are supplied promptly to the statistician and that this should be made quite clear to the bodies concerned from the start. It will then rest upon the statistician, for these and other schools, to make arrangements that will have in view the convenience of the respondent to make himself known to them and familiar with the conditions under which they work, and to minimize the burden he places upon them while demonstrating the importance of the material that he does request from them.

Chapter 8

COLLECTING OTHER STATISTICS

8.1 Statistics other than those collected from the schools by means of the annual questionnaire will be needed. The questionnaire, if it is to be kept manageable in the conditions obtaining in developing countries, is not suited to great detail in some matters and is wholly unsuited for example to statistics on *pupil attendance* and *pupil background*.

ATTENDANCE STATISTICS

8.2 Statistics of *absenteeism*, as distinct from enrolment, are obtained from attendance records. The annual questionnaire asks for statistics as at a particular date, but attendance may vary considerably from day to day and, where there is a high degree of absenteeism, the number attending on a particular day may not be very informative. Some kind of continuous records over a period must be introduced. One convenient way of doing so is for the headmaster to make a monthly return to the local officer, showing as a minimum:

(a) the number enrolled by grade ;
(b) the weekly average attendance for each morning and afternoon session.

The headmaster could, as a weekly routine, examine the register and complete his calculations for that week. Alternatively the *total* sessional attendance could be noted by the teacher at the time of each roll-call, and handed to the headmaster at the end of each week. It should be the normal duty of the local officer to make periodic spot checks to check the accuracy with which the register is maintained. An eye should also be kept on the weekly attendance return. The headmaster could either complete the monthly attendance return and send this with his *comments* to the local officer (and presumably to the employing authority) ; or send the weekly attendance records to the local officer who would store them and himself complete the monthly attendance record.

8.3 The average used should be the arithmetic mean (see paragraph 11.2 below). The statistician will also be interested in the extent to which sessional attendances fluctuate around this average. One rough indicator of this fluctuation is to show on the monthly attendance return the number of sessions at which *not more than five pupils were absent.* The definition of these "best sessions" would depend upor local conditions ; a too optimistic standard shou.d not be used since the result would be merely a succession of noughts, which is not helpful.

8.4 Some idea of the causes of absenteeism can be gathered from the monthly attendance report ; for example, if a weekly average is abnormally low the headmaster will comment for example that it was due to a local festival. Further analysis would require a special inquiry by the statistician, consulting the weekly records or the class registers directly. He may be interested solely in a particular region or type of school ; and he may use a *sample* of returns, schools or pupils, for the purpose, which would make possible an investigation into the family and other background of the pupils concerned, information that is essential to a proper study of absenteeism.

PUPIL BACKGROUND STATISTICS

8.5 A full understanding of the pupil's progress, or lack of it, at school requires information on his home background. Such information, to the extent that it will throw light on the educational output of different types of homes and, in its turn, the kind of homes resulting from different types of education, is also necessary if the requirements of long-term educational investment planning are to be met. The main types of information for this purpose are:

(a) occupation of father
(b) educational attainment of parents
(c) family income and size of family
(d) ethnic and religious group.

8.6 Some of this information could, in favourable circumstances, be obtained on the occasion of the annual return and some developing countries includ- item (d). Fuller information requires a special inquiry,

in a selected region or on a national basis, and based upon sampling techniques. Such inquiries clearly merge into others undertaken for different purposes; for example, family income and size of family are obtained in the course of a household budgetary survey undertaken by another Government Department usually in connexion with a retail price index. For such information to be of use to the educational statistician, it must also include matching information on the children's education but this raises problems, for example, of overloading the schedule of questions to be answered and the department responsible for the inquiry may resist these additional questions. This resistance will be effective if the educational statistician is not clear in his own mind what he wants to know and how this information can be reduced to a minimum.

STATISTICS OF LEAVERS

8.7 Statistics of *examination successes* provide a measure of the "output of education" and also a partial but valuable guide as to the supply of qualified persons for the economy. Detailed records are maintained by the examining body as well as by the school and the former might be more readily tapped by the educational statistician. At the third level it is important to know the output by type of degree (see paragraph 8.14 below) and by subject. At the second level, as a minimum, the statistician should have figures by type of examination and, where subjects are separately taken, by selected subjects of importance. At all levels some idea of the failure (or success) rate is also necessary, so that the output can be set against the input.

8.8 The possibility of an end of course return by the headmaster should also be considered. Some broad information on the *intentions of leavers* in regard to further education or employment could be obtained from pupils who are leaving and this in a summary form would greatly assist the planner's estimates of output. Local officers would also be interested. Preliminary investigations should accordingly be made into what is practicable. These data, it should be recognized, may not be very reliable since intentions are not always realized.

TEACHER STATISTICS

8.9 The educational statistician is in a special position in regard to teachers since he should be able to document in detail both the supply and the demand of what, in a developing country, is a critical category of highly-qualified manpower. The schools both produce teachers and provide their employment.

EMPLOYING BODIES' RETURN

8.10 An annual return from each employing body should supply the following information for each type of school:

(a) numbers of teachers in post on the first day of the school year by kind of qualification (for example, whether holding a teaching certificate, or degree; in the latter case the subject should be noted);
(b) numbers for whom this was their first appointment;
(c) previous employment of those appointed since the last return and not covered by (b);
(d) numbers leaving since previous year due to:
  (i) transfer to another school
  (ii) leaving the teaching profession (if possible with an indication of their new occupation for example household duties, industry, etc.)
  (iii) retirement
  (iv) death
(e) average salary paid in each grade.

It should be noted that a simple classification (for example, of household duties, government service, industry, other) is necessary for both items (e) and (d) (ii). With this information combined with that of the annual questionnaire it is possible to evaluate the total stock of teachers by qualification, and by different types of school, by regions and for the country as a whole. A general idea can be obtained of wastage and also of the immediate sources of teacher supply. Finally, there will be an approximate figure of the cost per teacher. The information can be cross-checked from material within the Ministry where superannuation schemes are in operation.

TEACHER SUPPLY: COLLEGE RECORDS

8.11 Since the fresh part of the supply of teachers derives directly from colleges and universities, their records of leavers will provide a detailed account of this sector of supply. Consolidated information can be obtained from teacher-training organizations where such exist or, at the province officer level, from returns from the colleges. These officers, or those from the Ministry, will be in touch with employing bodies either directly or through local officers concerning future staffing requirements in relation to the likely supply from the teacher-training colleges, and some matching of college leavers and first appointments recorded in the employing bodies' returns is possible. The supply of teachers with higher qualifications is less easy to show because of the variety of occupations open to university leavers, and much will depend upon *records of first appointments after leaving university;* these records are likely to be kept to an increasing extent by

universities and other bodies, partly in connexion with their own appointments' guidance work and partly to help in documenting the flows of and demand for highly-qualified manpower.

I.D.S. FOR TEACHERS

8.12 It is highly desirable that the cumulative card system should be introduced in teacher-training colleges, giving to each student a unique registration number. Either the card itself, or a new card linked to the old by the registration number for each teacher on appointment to a school, could be then used for a central index. Cards would also be supplied for each teacher coming from other sources. If this card index were maintained centrally, either by a periodic return from the employing authority or by this authority sending to the central registry a carbon copy of each note of appointment or dismissal or retirement, *which would obviate the need for the annual return from the employing body* it would provide the most flexible source of information possible both for assessing teacher supply and for answering ad hoc questions about it. Where facilities are not yet available for such a system in the Ministry, and this may apply to a number of developing countries, the maintenance of these teacher records on an individual basis by employing bodies, and possibly by the local officer, is desirable.

STATISTICS OF THIRD-LEVEL INSTITUTIONS

8.13 The educational statistician is dependent upon what statistics are made available by the university bodies and similar authorities. Their own requirements for planning will make these bodies increasingly sensitive to the need for good statistics. In a developing country there may be insufficient statistical advice available within the administration of the university or other body and the educational statistician should, where required, provide guidance in the keeping of records and on the application of statistical techniques. He should endeavour to ensure that total enrolment statistics are readily available, classified according to the subjects of study[1] and supplemented by examination statistics. Similarly teacher records should be fully adequate and related to those from other sources.

8.14 The main difficulty in analysing statistics of institutions of higher education is the absence of division into years of study or grades; there is no record comparable to the class register in the schools at the first and second levels. Further, distinction must be made between those studying for first degrees and post-graduate students. As a result, the normal concepts of "wastage" cannot be applied: in the absence of distinct grades, "repeating" has very little meaning. The alternative is to collect information which shows, in addition to numbers of new entrants, total enrolment of students and their distribution by *actual number of years' study undertaken to date*. This will reveal, for example, the extent to which there is any *retardation* (as distinct from *repeating*), that is to say, students taking longer than the minimum period to complete the course of study, for either the first or a higher degree.

8.15 It will be necessary to take into account at this level the numbers who go *overseas* to study or of *foreign students* studying in the home universities; these can be significant in the case of developing countries. The latter figure is usually easily ascertained. A large proportion of the former are known since they are financed from public funds either from the host countries or from the home countries; the main gap will be that of those wholly financed privately. Migration returns may assist in filling this gap and some help is possible from the statistics of the countries where the students are enrolled.

SCHOOL EQUIPMENT

8.16 This is time-consuming to record and difficult to classify. Statistics, for example, of the number of volumes in school libraries may be collected but, unless the quality and accessibility are also known, the figures may not mean much. It is preferable to consider using such records as exist in the local offices for the purpose, since the local officer has a considerable amount of information acquired in his allocating funds for, or a pool of, school equipment of various kinds. A direct inquiry would serve this end.

SCHOOL BUILDINGS

8.17 At some point, the statistician should make a complete inventory of school buildings, linked with the School List to ensure that it is complete. The inventory may be shown as a Map. Detailed information on new buildings should then be obtained by means of a return from those responsible for building schools for the purpose of keeping the inventory up to date and to observe progress. An annual return should suffice showing at a *specified date* (which might be that of the annual questionnaire in order to cross-check the information)(see following page).

1. A suitable system of classification is given in the Unesco *Manual of Statistics*.

	Value	Type	Classrooms		Number of places
			No.	Area	
Buildings *started* during previous 12 months					
Buildings *in progress* during previous 12 months					
Buildings *completed* during previous 12 months					

It may not be possible to proceed at once to a full analysis of this material but it is basic information for planning.

FINANCIAL STATISTICS

8.18 Information on financial resources and expenditure is of crucial importance for all types of educational evaluation and planning but collecting suitable statistics for this purpose presents such technical and conceptual difficulties that simple recommendations in this field must be of a limited character until considerably more research into methods and possibilities in developing countries has been carried out.

8.19 The *technical complexity* lies in the nature of the source material: the accounts and budgets of the various bodies, public and private, national and local, that are concerned with education. Even confining 'education' to the formal system still entails a mass of material which in developing countries may be ill or inexpertly maintained and certainly based on a great variety of conflicting classifications. Mere access to the material is thus an operation which alone demands time, special skill and diplomatic tact.

8.20 The *conceptual complexity* arises from the inadequacy of the accounting procedures of the various bodies, sometimes even for their own immediate purposes of budgetary control, and certainly for the wider purposes of educational planning. Basically what is required is the calculation of expenditure at each level of education per 'unit' of pupils, teachers, building etc., distinguishing between capital and recurrent expenditure. This information could then be used in analysing educational expenditure and for example to forecast outlay to achieve particular targets, and to relate these outlays to alternative uses of available income.

8.21 Some of the problems involved may be indicated[1]. Many relate to definitions:

(a) *What is the appropriate 'unit.' ?* If the student, should this be 'student-hour' ? And based on enrolment or average attendance? For school buildings, is the unit the whole building, the classroom, the pupil place?

(b) *the distinction between capital and recurrent expenditure* (capital outlay being the expenditure on land, buildings, equipment etc.) is not always clear. In particular, the *initial* capital outlay may affect the subsequent maintenance and running expenses so that some account should be taken of the expected life of the premises or other object of capital outlay;

(c) *the allocation of actual expenditure to particular purposes.* This may be a technical matter of reclassifying the accounts of the spending body. It can also be a conceptual matter as, for example, in the treatment of teachers' superannuation payments; or the tracing of the eventual outlay of a grant from a central body for expending by a local body;

(d) *the "cost" of education.* The term 'cost' has been used to mean actual expenditure (for which *outlay* is the preferred term) and *economic cost* or the total resources used up: thus part of the 'cost' of producing a student who otherwise would be a member of the labour force is the income foregone by that student. This must be entered against the eventual benefit the economy receives from his being educated. Such cost benefit calculations are proposed for example for educational investment planning, but much research is yet required on the economics of education before suitable concepts for these wider uses can be formulated[2].

1. They are discussed further in Friedrich Edding: *Methods of Analysing Educational Outlay,* Unesco 1966.

2. See for example the conclusions reached in Balogh T. and Streeten P.P. *The Coefficient of Ignorance* in Bulletin of the Oxford University Institute of Economics and Statistics, May 1963; and Merrett, Stephen *The Rate of Return to Education: a Critique* in Oxford Economic Papers, November 1966.

8.22 This is a field in which the educational statistician can helpfully obtain the advice of the national accounts statistician with experience of developing countries. He will necessarily confine himself initially to collecting and classifying information on income and expenditure of bodies in the formal educational system, working first on the accounts of public bodies, national and local, with whose accountants he should be able to discuss his problems, drawing also upon the experience of those in the Central Statistical Office or Ministries of Finance who may already have worked upon the functional classification of government accounts. He may find it necessary to accept as an interim arrangement the accounting usages of the bodies concerned in regard to the distinction between capital and recurrent, and the allocation of outlay to particular purposes. With this information he should show:

(a) the *sources* of educational finance, at each level, distinguishing between *public funds*, central and local, and foreign aid; and *private funds*, fees and other sources;
(b) *expenditure on education*, distinguishing between *capital* and *recurring* outlays separately for each of the main types of institution (for example, government schools and others) at each level; with recurring expenditure analysed into outlays on administration, teachers' salaries and other expenditure; and capital expenditure on main types of outlay (land, equipment etc.), public and private. *Debt servicing* should be shown as a separate category.

8.23 It is preferable to record that which is specifically known and can be verified, with all its limitations, than to hazard guesses. When the information is presented every care should nevertheless be taken to ensure that the gaps in the coverage are quite clearly stated[1].

STOCK OF EDUCATION

8.24 From a narrow point of view a country's stock of education is described by its educational facilities and the numbers using them. For wider planning purposes and for assessing the level of education of the country as a whole a measure of the number of educated persons within and outside the educational system is necessary. Such statistics are usually obtained by means of the general *population census* and the information, which has in consequence to be provided by the head of the household, has to be simple in character.

8.25 One or more of the following questions are asked in these censuses; they refer to those 14 years of age or more:

(a) number of years of full-time or formal education received;
(b) highest level and grade completed;
(c) qualifications obtained;
(d) age at which full-time education ceased.

Educational planners are particularly interested in (a) and (c). The opportunity may be taken in relation to (c) to get particular details of those highly qualified persons in short supply at the time. This information is of value to manpower budgeting.

8.26 The information about length of schooling is of importance to developing countries since their educational statistics may not have been in existence for a sufficient number of years to give an alternative estimate of this stock. A general summary every ten years of the amount of education that has been received at that date provides, in any event, a useful check on the results of educational plans.

LITERACY

8.27 Literacy statistics have their greatest use in the more backward countries where educational facilities are meagre and a *minimum education indicator* such as the extent of literacy can be expected to show how quickly conditions are improving. Literacy can nevertheless only be approximately measured and the basis can vary between one census and another and certainly between one country and another. The reason for this is that a person's ability to read or write is not a simple matter to determine on the threshold of a house by an enumerator who may be far from skilled in this particular field. Generally speaking, as the country's educational system improves, measures of literacy become less valuable than those showing the amount and kind of education being received.

8.28 When literacy statistics are being collected at the time of the general population census, a more satisfactory test could be applied to an inquiry limited to particular rural or urban areas, or on a sample basis. In multilingual countries it is necessary either to limit the inquiry expressly to a chosen language or collect statistics on a multiple basis. It is also helpful to consider a category of *semi-literates* (those who only read) in order to describe the actual position more precisely; and also those who read and write by rote only (in connexion with ritual literature) should be a separate category.

1. See, for example, J.B. Knight *The Costing and Financing of Educational Development in Tanzania*. Unesco: International Institute for Educational Planning. African Research Monograph 4, 1966.

Chapter 9

RECORDS AND REFERENCE TABLES

9.1 When material has been collected by the statistician it must be *scrutinized,* suitably *recorded* and *processed* for further use. It should be emphasized that this is only one stage in the "processing" that in fact commenced when the statistician first planned his set of returns, continued with the various statistical exercices carried out for him by the headmasters, the secretaries of voluntary bodies or the statisticians in other Government Departments, and continued further with the handling of the material through such intermediaries as local officers. At all of these stages there is need to scrutinize and record as a preliminary to processing and the general comments about those activities set out below relate to all stages. Outside his own staff, the extent to which the statistician can directly enforce them is nevertheless limited. He should nevertheless make full use of whatever opportunities present themselves to introduce sound practices.

ERROR IN STATISTICS

9.2 Errors arise in several ways and all statistics are subject to them. The chief causes are:

(a) *ignorance.* The exact coverage of the statistics and the extent of any error may not be known to the statistician. An unavoidable error (for example, in obtaining exact ages) may have small effect on the result, but if it is not known *where* it is or *what* it is, the whole mass of statistics concerned becomes suspect;
(b) *carelessness* especially in copying or in checking;
(c) *inaccuracy* in recording or in the arithmetic;
(d) *rounding* or *estimating*: a figure may, for convenience, be rounded, say, to the nearest 1,000, or the precise figure may not be known and is estimated, often in a rounded form[1];
(e) a *sample* may give a result that is only approximately equal to the true answer; if the sample is correctly drawn this type of error can be calculated.

9.3 The first three types of error can be reduced by stricter control of the work. The other two types arise out of the nature of the material or the statistical technique used. In these latter two cases, it is essential that the statistician draws attention to the imprecision in his material when presenting it. Some simple rules are suggested below to minimize the other errors:

(a) the statistician should obtain personal knowledge of the sources and methods of collecting the information;
(b) *manual* copying should be kept to a minimum; carbon-backed paper and mechanical reproduction should always be considered;
(c) information should be recorded on sufficiently durable material, with special regard to the:
  (i) climatic conditions;
  (ii) hazards of transport;
  (iii) storage conditions;
(d) *more haste less accuracy;* sufficient time should be allowed for all the recording, transporting and processing that is necessary;
(e) tidy records make for accurate records;
(f) at all stages, *scrutiny of the information should be automatic*;
(g) checking should always be done by someone other than the person responsible for the original record, and preferably after the completion of the work;
(h) all checking should be signed by the officer personally responsible for the check.

SCRUTINY AND CORRECTION OF ERRORS

9.4 Scrutiny cannot be adequate unless it is recognized that:

1. Rounding is dealt with in Conway F.: *Descriptive Statistics*, Chapter 5.

(a) the most suitable opportunity to scrutinize and check is at the point of collection (the school or local office) rather than the point of receipt. No amount of skill at headquarters can compensate for lack of checking at the source:
(b) those responsible for the headquarters scrutiny must be sufficiently senior in position to match up to this responsibility and be experenced in the problems of collecting the statistics.

9.5 Proper scrutiny will reveal errors due to:
(a) *incredibility.* The officer responsible must know his material sufficiently to spot unlikely information: the omission of a final 0, showing a fall during a single year from 196 to 19 pupils in a particular stream, gives an incredible result;
(b) *incongruity.* To show a male teacher in a wholly girls' school may be accurate but its incongruity suggests further inquiry;
(c) *arithmetic error.* All totals and cross-totals should be checked; it is unwise to check solely by adding sub-totals; all items should be included.

9.6 The correction of errors may be automatic where it is a simple matter of arithmetic. Where confirmation of an item is necessary this should be referred back to the source. This should not mean waiting for the reply before proceeding with the editing. Delay must be avoided and it may be possible to proceed with the processing of the material by making an estimate of the true figure. Under pressure to produce quick results, the editor may abuse this procedure, and such decisions must in consequence be left to the *supervisor*: on his skill and ability to maintain discipline and organize the routine work of scrutiny rests the efficacy of the work. Casual organization of the work can result in lack of provision, for example, to ensure automatically that all returns are in fact checked. The design of the return should in any event include a box for the initials of the checking officer in the statistical unit.

A SYSTEM OF RECORDS

9.7 A system of records should be flexible, that is in a form for quick reference for all purposes. A set of standard tabulations for internal use should be available as well as facilities for preparing special tabulations to meet specific inquiries, facilities that are increasingly important since educational planners of all kinds wish to deal with specific planning situations. For answering a specific query a full scale inquiry may have to be carried out including the collection of additional information but this would be an exceptional procedure. Normally the statistician will draw upon his own records or such records of the local officer or the local authority as are easily accessible. The statistician must nevertheless keep a sense of proportion in regard to flexibility. To aim initially at too detailed a system of records may over-tax available resources and threaten both the reliability and speed of the statistical service.

BASIC RECORDS

9.8 The statistician will first arrange for the housing of his *basic records*, consisting of:
(a) the School List (paragraphs 6.2 and 6.7 above);
(b) school statistics derived from the annual questionnaires (see following paragraph);
(c) the annual returns of teachers from employing bodies or preferably, a card index of individual teacher particulars (paragraphs 8.10 and 8.12 above);
(d) the school building inventory (paragraph 8.17 above).

9.9 The annual questionnaires are the most versatile source and their treatment, after scrutiny, will vary widely according to the resources of the statistician. If they are properly designed, and on paper of suitable quality, they can be used as a basic record. The questionnaires from *first-level schools* would then be retained in a useful order. Thus, all the schools in each local area or district could be brought together in the alphabetical order of districts, or according to regional groupings. Within these groupings they could be ordered according to their registered numbers, possibly sub-divided between government and independent schools. There is no point in posting the information they contain into ledgers. Ledgers are usually unsuitable, in any event, for recording much detail. When facilities are ultimately available for a more flexible system a card index is usually to be preferred. The cards can be stored more safely in metal cabinets and they can be quickly sorted for particular inquiries. On the other hand, individual cards can easily go astray. As regards *second-level schools,* there is an advantage in having a separate record for each institution, ordered according to the registered number of the school within regions. Within each school record, the annual returns for successive years could be placed chronologically. Where mechanized sorting is in operation (see paragraph 16 below), the questionnaires will be edited and a card punched for each school.

TABULATIONS

9.10 The statistician must next decide what tabulations should be undertaken. He will be guided in this by the requirements of the planners and

administrators, whom he should consult to determine what their requirements are (see paragraph 2.7 above). It can be assumed that both users will be interested in the enrolment figures as soon as these are available; the timing will depend upon the degree of detail required and this in turn upon the resources available to the statistician and how well they are organized. As a simple basis on which to plan a tabulation programme it is recommended that priority should be given to a set of tables for each area, showing enrolment separately for each level (first and second) by sex, age and grade; and a table showing national aggregates similarly. Further detailed tables of enrolment, tables on teacher supply, and on buildings and finance should be discussed with the users – it will probably be found that they would like to receive certain information regularly. An eye will also have to be kept on the eventual requirements of any proposed publication. *It is essential above all to organize a progressive tabulation programme* that is one that will release the information progressively according to the specific requirements of users and the publication programme. To issue, sporadically, detailed tables as the material comes more or less fortuitously to hand is not the best use of resources.

CLASSIFICATION

9.11 To commence with, the statistician should ensure that consistent rules of classification are used on all occasions. Classification is a process of definition so that like can be added to or compared with like, and is the necessary first stage in preparing useful tables. Thus classification problems arise in connexion with the definition of higher as distinct from secondary education in the matter of teacher training; of "technical" as distinct from "vocational" education; of "qualified" and "unqualified" teachers. Help in introducing suitable classifications can be obtained from the *Unesco: Manual of Statistics*, but each country will need to establish its own system to reflect most clearly the needs of its administrators and the planners. This is not a problem to which there are necessarily simple answers (see also below paragraphs 15.9 and following).

9.12 It has been noted (see paragraphs 6.3 and following above), for example in the definition of "school", that in practice there are marginal cases. A working definition should be set up by the statistician to be adhered to in all classifications if the tabulation programme is to proceed smoothly and the results are to be clear. If it should be a question of not knowing precisely where to place a particular item, and this item is large, the statistician could place it in a particular class of his choosing but show it as a separate item. The reader of the table can then use his own discretion. If the items are small, it may not be important into which class they are put. Another type of problem is illustrated by the treatment of part-time pupils and part-time teachers when part-time education is included in "education". Where information is available on the number of hours of teaching, estimates can be made of the number, statistically speaking, of teachers or pupils represented, using a suitable definition of "full-time", for example, six hours teaching a day and dividing the total of hours of teaching by this number. This is necessary to obtain sensible estimates, for example, of teacher work load. In default of this information, some general estimate, such as two part-time pupils to equal one full-time pupil, must be made.

9.13 Having agreed a workable classification, its use must be clearly described, when the tables are presented, for the convenience of the reader. In a publication, this may take the form of a set of notes applicable to all the tables. In single tables, how best to give this information (heading, footnote etc.) sets a rather more difficult problem.

PRESENTATION OF TABLES

9.14 The manner in which statistics are presented largely contributes to their usefulness. It is not enough that the information should be accurate; it should also be both convenient to handle and clear to read. The statistician must in consequence pay special attention to the tables he presents – not only those in his publications, but also those called for, perhaps in a hurry, by the users in government.

9.15 The presentation will vary according to the detail being presented and the use to which it will be put. Simple tables of a few aggregates appearing in the text of a report will, for example, require less explaining than a separate detailed table intended only for reference. There are many types of table design lying between these extremes. Some general rules may nevertheless be noted.

9.16 The two main requirements of a good table are that it should be *easy to read* and, by reference either to the table itself or to any accompanying text, *self-sufficient*. Defects found in tables[1] are:

(a) *there is too much text.* The statistics should speak for themselves and the greatest economy should be used in text, whether in headings or footnotes, and the greatest clarity of expression. Often the shorter words can be the more easily understood, and are easier to fit into a design;

1. Some are illustrated in the Note at the end of this chapter.

TABLE A

AFRICAN PRIMARY SCHOOLING IN UGANDA, 1962

Reported enrolment in aided schools as a percentage of boys and girls aged 7 to 13: by district

Description	Estimated numbers of children aged 7 to 13 January 1962		Reported enrolment in grant-aided primary schools 1962		Enrolment in aided schools as percentage of children aged 7 to 13	
Sex	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*
Units	'000	'000	'000	'000	%	%
Buganda	132	125	58.0	45.0	44	36
Eastern:						
Busoga	43	43	22.0	12.5	51	29
Bukedi	29	26	20.3	9.0	70	35
Bugisu	28	24	15.5	8.2	56	34
Teso	28	28	17.9	8.9	64	31
Total	128	121	75.7	38.6	59	32
Northern:						
Karamoja	16	14	3.2	0.6	20	4
Lango	29	26	17.6	8.1	61	31
Acholi	24	21	19.8	7.7	82	37
West Nile (and Madi)	37	31	24.3	8.1	66	26
Total	106	92	64.9	24.5	61	27
Western:						
Bunyoro	8	7	6.0	4.1	75	59
Toro	27	25	14.2	6.6	53	27
Kigezi	40	36	18.1	7.0	45	19
Ankole	40	39	15.7	6.7	39	17
Total	115	107	54.0	24.4	47	23
TOTAL	481	445	252.6	132.5	53	30

Sources: Ministry of Education and Statistics Branch, Ministry of Economic Affairs.

Notes: (1) The enrolment figures were as reported, and may not be complete in every case. Excluded are the pupils at unaided schools, for which statistics are not available for 1962. In 1961, there were 122,407 males and 55, 991 females at mainly African unaided schools.

(2) The statistics for Mbale Town and Madi were too small to warrant separate statistical classification. Madi was amalgamated with West Nile. Mbale Town was divided equally between Bukedi and Bugisu.

(b) *the table is too long or too wide for easy use.* Of the two the wide table is more difficult to use; a long table can have appropriate cross spaces, It is better to have two tables rather than a single unwieldy table;

(c) *the table is cramped and untidy.* Ample margins should be allowed, and sufficient space in order to print column headings without too many abbreviations. Unnecessary lines should be avoided and footnote numbers kept as small as possible. On the other hand, all type should be easy to read. Varied type helps; typewritten tables, even if well reproduced, are more confusing than printed tables. The eye should be helped by keeping to a minimum the spaces between the statistics and the items to which they refer;

(d) *lack of precision in the heading and references.* The title and footnotes should be suitably phrased so that the table explains itself; *the unit, locality and time reference should always be clearly stated and a note as to the source of the statistics included,* where this is not self-evident;

(e) *spurious accuracy.* The table should not present estimates as precise figures.

9.17 Because of these many considerations it is seldom possible to prepare a table without preliminary drafting and experimenting with different forms; but with experience the statistician can provide neat and clear tables that present the statistics effectively and with comfort. An example of a suitably-designed table is Table A.

NOTE TO CHAPTER 9: TABLE DESIGN

1. The table opposite (Table B) has been devised to illustrate a number of faults found in table design

   (a) space is inefficiently used;

   (b) the title is imprecise;

   (c) the table is not self-explanatory;

   (d) the "totals" are confusing and some unnecessary;

   (e) the size is unwieldy;

   (f) it is evident that the average ages are estimates, each being rounded to the half-year;

   (g) the choice of design is wrong; there is no age spread for each grade so that a two-way table is inappropriate.

2. The statistics shown could be more usefully presented as follows.

TABLE C

Enrolment by Sex at Primary and Secondary Levels

As at November 1st 1966

Primary

000

Grade	Average Age(a) Years	Number Enrolled	
		B	G
I	6	731	432
II	7	601	453
III	8	621	484
IV	9	522	485
V	10	522	506
VI	11	372	368
VII	12	363	309
Total		3732	3037

Secondary

000

Form	Average Age(a) Years	Number Enrolled	
		B	G
I	13	50	23
II	14	46	21
III	15	41	22
IV	16	18	15
V	17	14	12
Total		169	93
Total Primary and Secondary		3901	3130

(a) Estimated

Source: Ministry of Education Return

TABLE B

(See Note to Chapter 9)

ENROLMENT OF SCHOOLS - THOUSANDS

Primary Grades

Average Age in Years	Grade I		Grade II		Grade III		Grade IV		Grade V		Grade VI		Grade
	B 000	G 000	B 000	G 000	B 000	G 000	B 000	G 000	B 000	G 000	B 000	G 000	B 000
Yrs. Mths													
6 6	731	432	-	-	-	-	-	-	-	-	-	-	-
7 6	-	-	601	453	-	-	-	-	-	-	-	-	-
8 6	-	-	-	-	621	484	-	-	-	-	-	-	-
9 6	-	-	-	-	-	-	522	485	-	-	-	-	-
10 6	-	-	-	-	-	-	-	-	522	506	-	-	-
11 6	-	-	-	-	-	-	-	-	-	-	372	368	-
12 6	-	-	-	-	-	-	-	-	-	-	-	-	363
13 6	-	-	-	-	-	-	-	-	-	-	-	-	-
14 6	-	-	-	-	-	-	-	-	-	-	-	-	-
15 6	-	-	-	-	-	-	-	-	-	-	-	-	-
16 6	-	-	-	-	-	-	-	-	-	-	-	-	-
17 6	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	731	432	601	453	621	484	522	485	522	506	372	368	363

Secondary Grades

VII	Total		Form I		Form II		Form III		Form IV		Form V		Total		GRAND TOTAL	
G 000	B 000	G 000	B 000	G 000	B 000	G 000	B 000	G 000	B 000	G 000	B 000	G 000	B 000	G 000	B 000	G 000
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	731	432
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	601	453
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	621	484
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	522	485
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	522	506
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	372	368
309	3732	3037	-	-	-	-	-	-	-	-	-	-	-	-	363	309
-	-	-	50	23	-	-	-	-	-	-	-	-	-	-	50	23
-	-	-	-		46	21	-	-	-	-	-	-	-	-	46	21
-	-	-	-	-	-	-	41	22	-	-	-	-	-	-	41	22
-	-	-	-	-	-	-	-	-	18	15	-	-	-	-	18	15
-	-	-	-	-	-	-	-	-	-	-	14	12	169	93	14	12
309	3732	3037	50	23	46	21	41	22	18	15	14	12	169	93	3901	3130

Chapter 10

ANALYTICAL TABLES, DIAGRAMS AND GRAPHS

TYPES OF TABLES

10.1 As the basic material is sorted and classified the process of statistical analysis has begun. The statistician will then continue the analysis by presenting his material in the form of tables. By using tables drawing upon a suitable *selection* of material, or upon a suitable *summary* of the material, he moves away from reference tables to analytical tables. With too much detail the eye is confused, comparisons are made difficult and judgment is hampered. Analytical tables are designed to bring out particular features of the material. Usual types of these tables are:

(a) those showing *geographical distribution* as illustrated by Table A on page 42;
(b) those comparing one year (or other period) with another and thus showing a *time series*;
(c) a *two-way* table;
(d) a *frequency* table.

10.2 It is necessary when presenting a *time series* to specify quite clearly *the date to which the statistics refer*, and their *definition*, to ensure that they are common throughout the period covered. If there are changes of definition during the period, a common occurrence when the coverage and efficiency of the statistical service are being rapidly improved, all changes should be clearly indicated in the footnotes or in the figures themselves (for example, by using italics).

10.3 Presenting enrolment by age and grade, as in the basic questionnaire shown above (paragraph 7.11), is an example of a *two-way table*. The grades are shown vertically *(columns)* and the ages horizontally *(rows)*. In each square *(cell)* is the number of a particular age in a particular grade. Two-way tables are most useful to the educational statistician.

10.4 A further useful type of table is a *frequency table*, showing how often a particular characteristic occurs. In the simple illustration given below the characteristic is primary schools where the highest grade taught is grade I, grade II, grade III and so on. Especially when expressed as percentages, this frequency table gives a quick impression of the level of teaching reached in primary education.

Highest grade taught in primary schools

	Highest Grade								Total of schools
	I	II	III	IV	V	VI	VII	VIII	
No. of schools	166	170	180	740	401	402	1,682	780	4,521
	%	%	%	%	%	%	%	%	%
Percentages	3.6	3.8	4.0	16.3	8.9	8.9	37.2	17.2	100.0

10.5 A development of the frequency table is the *grouped frequency table*. A table such as the following showing total enrolment of boys has grouped together all for example "at age 5", that is all at 5 years and under 6 years of age:

Age	5	6	7	8	9	10	11	12	13	14	15	16
No.	229	288	245	244	265	212	191	147	163	121	37	12

These figures can be grouped further

Age	5 - 7	8 - 10	11 - 13	14 - 16
No.	762	721	501	170
%	35.4	33.5	23.3	7.8

to show clearly the main features of the frequency distribution. Once again the use of percentages helps to indicate the shape of the distribution. In compiling such a table it should be noted that if the age groupings were 5 to 8, 8 to 10, etc., those aged 8, 10 etc. would appear in two different categories and they would be double-counted. The ages taken should be those of the child on the last birthday to avoid difficulty in rounding. The following

table shows the grouped frequency distribution of pupils in classes of varying size. The numbers of pupils have been rounded in order to simplify the appearance of the table:

Size of Primary Class

(1) Size of Class	(2) Number of Pupils (Thousands)	(3) Pupils in (2) as percentage of all pupils
1 - 15	4.0	1
16 - 20	11.7	3
21 - 25	25.6	6
26 - 30	52.8	14
31 - 35	98.0	24
36 - 40	1,40.2	35
41 - 50	67.6	17
51 and over	0.5	0.1

DIAGRAMS

10.6 Diagrams take the process of classifying simplifying and summarizing statistical data one stage further. By this means comparisons between quantities may be more easily grasped by the eye than in a table. There are a great variety of ways, some highly picturesque, whereby this can be done and it is usually of great assistance to the reader of a report if some of the salient features of the information can be shown in this way. The limitations on their use are broadly twofold. First, they can only present the simplest of summaries since if too much detail is incorporated in the diagram it becomes confusing to the eye and of much less value than a table. Thus, diagrams may supplement tables but seldom replace them. Secondly, the areas of some diagrams or their shape or profile can mislead the eye.

10.7 This is a particular disadvantage attaching to a so-called *pictograph* used, for example; when enrolment in a school in a particular year is shown as a silhouette of a pupil of a particular size. It is not easy to compare such a drawing with one of a smaller size representing a smaller enrolment. If pictographs are used they should be in the form of a silhouette of a standard size representing a unit of, say. 1,000 pupils and reproduced according to the number of times there are 1,000 pupils in the total enrolment. Repetition of a constant symbol is also used in marking dots on a map, each dot to represent units of population (say, 1,000 or 10,000) to produce a *population density map* for the demographer. Such a map, showing in this way, for example, the density of school enrolment by regions, could be of similar value to the educational statistician.

10.8 A convenient way of depicting the components of a total, say, the numbers of all enrolled pupils in schools at the three main levels, is the so-called *pie-chart*: a circle divided into sectors proportional to each of the components. The eye is helped in this case if the sectors are differently shaded. It is possible to a limited extent to compare components of different totals in this way, each total being a separate " pie". The diagrams II and III show the proportion of classes of differents sizes at three intervals of time.

10.9 More flexible in use are *bar-charts*. Bars of a standard width are drawn (they need be no wider than a thick line) the *heights* of each being proportional to the quantities portrayed. Placed side by side, either horizontally or vertically, these bars make possible quick comparisons. The scale used for drawing the heights of these bars must be selected with care. Thus if in comparing the quantities 6, 36, 4, 2 and 1, a scale is chosen to accommodate 36 the differences between the other quantities may not be quickly seen. If these differences are important it may be better to have a larger scale, reducing the height of the 36 by breaking it in the middle. Shading can usefully help to distinguish one bar from another. The components of an aggregate can be shown as differently shaded sections of a bar, a variant of the pie-chart. Components of a series of items can be shown in this way, for example, as a succession of bars, in each of which the similarly shaded sections represent the same component each year. Thus the diagram IV shows the time series of total pupil enrolment, and separately those in government and private schools.

10.10 A particularly useful development of the bar-chart is the *histogram*. If not only the height alone but the *area* of the bar is proportional to the quantity shown, and the bars are placed touching each other, the diagram can show the distribution of a grouped frequency table, each range of values being represented by the width of the bar, and the area of the bar the frequency of occurrence of this group of values.

THE EDUCATIONAL PYRAMID

10.11 If reference is again made to Diagram I on page 12 it will be seen that if the numbers enrolled at each level are drawn as areas against a vertical age-scale, a pyramid results giving the distinctive profile of the educational system (Diagram III on page 50). This is in fact a highly abstract version since the age spans at the different levels overlap, and this is not allowed for in the diagram. A more accurate picture of enrolment is to show the numbers enrolled of each age group. If a central vertical age scale is used, the information for boys can be shown on the left and those of girls on the right, each in the form of a half pyramid. Or total enrolment could

be compared for two years, say, at the beginning or end of a five-yearly period; or two countries compared. Two *profiles* contrasting the position in two countries are shown in Diagram V page 51). It is useful, as in this diagram, to express the enrolment as the percentage of those in the relevant age group. In constructing such a pyramid it is best to use single age groupings. Where the groups are larger, for example, five-year age groups, care must be taken to see that the groups are all the same size, otherwise difficulties in drawing the pyramid arise.

10.12 In developing countries, where children may be late in enrolling, the pyramid shape is distorted at the lower ages. This distortion usefully indicates the stage of development in the educational system, the objective being to achieve the full pyramid profile. Where there is a falling birth rate, this profile may not emerge, although this is unlikely to be the case in a developing country. These educational pyramids can be drawn either for separate levels of education (as in Diagram V) or for all enrolment; in the latter event the level cannot be shown because the ages overlap.[1]

STOCK AND FLOW STATISTICS

10.13 The simple educational pyramid can serve to illustrate a fundamental distinction in educational statistics: that between stock and flow. The *stock* position shows the level of educational facilities reached at a specific date, as for example, the enrolment of pupils at various levels on I November, or the numbers and types of teachers in post at the commencement of the school year. The planner is also interested in the *recruitment* of teachers during any year, that is the *flow* of teachers into the profession; or the flow of pupils into the school system (entrants to individual grades) and out of the school system (leavers) or within the school system (promotion from one grade to another or from one level to another).

10.14 The flow can be measured *directly* as when the supply of *teachers* is measured by totalling the recruitment during the period and deducting losses by way of death, resignation or change to other work. Flow can also be *inferred* by comparing the stock levels at two precisely similar dates. For *pupils*, stock measurement at successive points in time is more usual. If the educational pyramids for three years (t, t+1 and t+2) are compared (Diagram VI, page 52) it will be seen that there are three flows. First-level education t feeds second-level education t+1, which in turn feeds third-level education t+2. Or, to take four years of first-level education (Diagram VII, page 52), grade I t feeds grade II t+1, which feeds grade III t+2, and then grade IV t+3. Thus a pyramid can be constructed showing the flow into higher grades of an original entry into this type of education (Diagram VIII, page 53). Showing in this way the subsequent experience of a particular group of entrants – or *cohort* – is a valuable measure of the activity of the educational system and, in its simplest form, as shown in the diagram, does not draw upon information additional to that already collected; but statistics must be available for as many years in succession as the course lasts. It is much more useful than a pyramid that simply shows the stock position in one year since the meaning of the pyramid cannot be easily assessed: the numbers in grade II, for example, cannot be directly compared with the number in grade I since the latter figure also includes the effect of changes over the two years of increasing the number of children entering the educational system. (See Diagram VII, page 52).

INPUT AND OUTPUT OF THE EDUCATIONAL SYSTEM

10.15 The flow diagrams help in understanding the *output* of the educational system in relation to its *input*: as regards each level; and for the educational system as a whole. For each *level*, the input is the number enrolled in grade or class I, and the output is the number of *successful leavers* from the final grade or class of the course, either by completing the course or by successfully passing the examination that terminates it (graduates). If no losses have occurred from one grade to another, the pyramid becomes a rectangle. The difference between this rectangle and the pyramid recorded shows the ***wastage*** that has occurred (Diagram VI, page 52). During second level education, losses may be less than at the first level; but at the second level the break up of the cohort into several flows in parallel gives rise to different classes of output and, where end of course examinations are held, two kinds of successful leavers: those who do and those who do not pass the examination, for even the latter have had a significant quality of education. At the third level, there is a similar position with those who fail their degree or other examination, or leave after their first degree.

10.16 The flows *between one level of education and another* measure less the efficiency of the educational system and more educational policy: on the part of the parents in regard to individual pupils, and the State in regard to the numbers who should continue their education. The initial potential entry into the school system at the first level in any one year is the number of children in the general population of school age. How far this is met is shown by the

1. "The use of the educational pyramid to show also the spread of ages in classes is illustrated on page 84 of J.D. Chesswas *Educational Planning of Development in Uganda.* Unesco: International Institute for Educational Planning. African Research Monograph 1, 1966".

numbers enrolled that year in grade I of the primary schools. The numbers available for entry into second-level schools are the successful primary leavers; the entry into grade I at the second level shows the number of places made available to those who wish to continue. For the transition from second to third level, the appropriate secondary flows are those who study for entrance to higher educational institutions and those who moreover are sucessful in the school-leaving examinations; the institution may also impose its own additional entrance examinations or tests.

GRAPHS

10.17 If the centre points of the top lines of bars, evenly spaced in a time series or those in a histogram depicting a frequency distribution, are joined by a simple line and the bars removed, the result is a graph. So many and varied uses can be made of graphs that this type of diagram is the one most favoured in many statistical exercises. At the same time, many of these uses are not suitable for simple presentation or analysis.

10.18 The graph has a number of advantages. In a graph it may be easier to depict the main features of the information presented since there is but a single line in addition to the horizontal and vertical scales. In the case of the time series, the main direction of the line, up or down through the years (that is to say, the *trend*), can be clearly seen. In the case of a graph of a frequency distribution (called, when smoothed into a curve, a *frequency curve*: Diagram IX page 53) its shape will stand out quite clearly: whether the peak occurrences are at the lower or higher values, whether values are more or less evenly spread to give a broad hump or concentrated round a few values to give a sharp peak.

10.19 With graphs, attention must be given to the scales used. In a time series, for example, whether the upward trend *appears* to be large or small may depend entirely on whether, compared with the horizontal scale, a large or small vertical scale is chosen. The ease with which a graph can mislead a reader calls always for special care in their design. *It is necessary on all occasions to show the zero point clearly.*

10.20 The graph form lends itself particularly to comparing a set of trends, for example, a comparison over a period of years of the numbers sitting and the numbers passing examinations in different schools by means of two curves on the same sheet. Care must nevertheless be taken not to overload the graph since the result may be confusing, and the same scale must be used when more than one series of values are being compared on a single sheet. Where it is difficult to include all the series to be compared on a suitably sized sheet, or in those cases where the units employed are not the same, for example, when comparing over a period of years the average age of a class sitting examinations and the number of examination successes, a simple expedient is to calculate each series as an *index* (see paragraphs 11.18 and following below) so that *percentage changes* will be plotted as a graph. In this case special care must be taken in deciding which year should be the base year (= 100). Different base years should be tried out experimentally in quickly drawn graphs and the one selected that is best suited to the purpose of the statistician.

INTERPOLATION

10.21 In linking the points on a graph to provide a continuous line, it is usual to draw a smooth curve since the assumption is that values change in this smooth fashion rather than in sharp changes at each point marked. The graph can then be used to estimate values *between the marked points* by taking a reading on either the horizonzal or the vertical scale and, at the appropriate position on the curve, read off the corresponding values on the other scale. This process is called *interpolation* and is of particular use in estimating values in a frequency distribution: an example is given below (paragraph 11.5).

Diagram II. CLASSES OF DIFFERENT SIZES, 1947 to 1965.

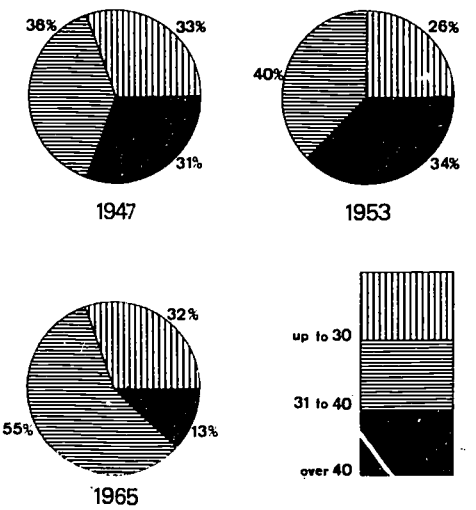


Diagram III. NUMBERS AT EACH LEVEL OF EDUCATION

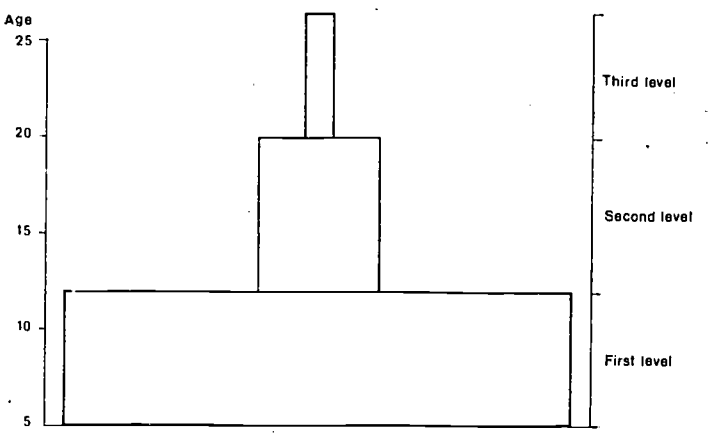


Diagram IV. PUPIL ENROLMENT IN GOVERNMENT AND PRIVATE SCHOOLS 1931 to 1957

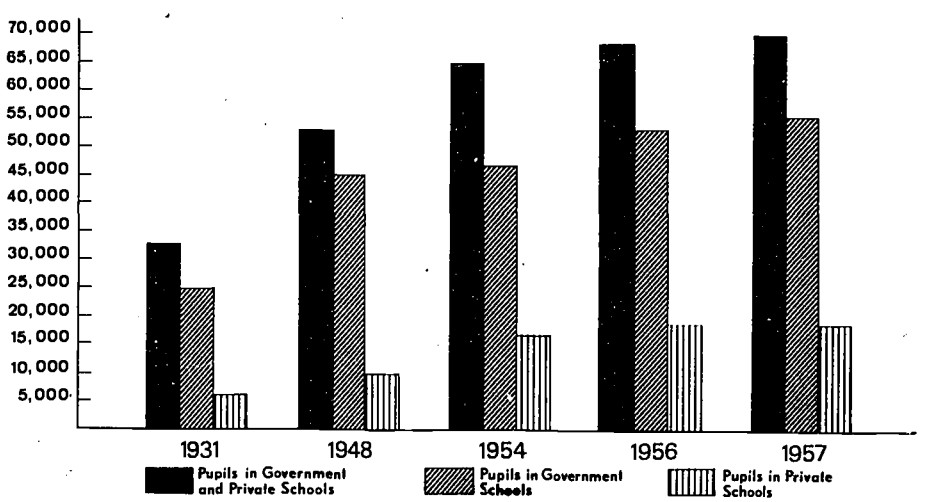


Diagram V. EDUCATION PYRAMID OF CONTRASTING COUNTRIES: PRIMARY EDUCATION

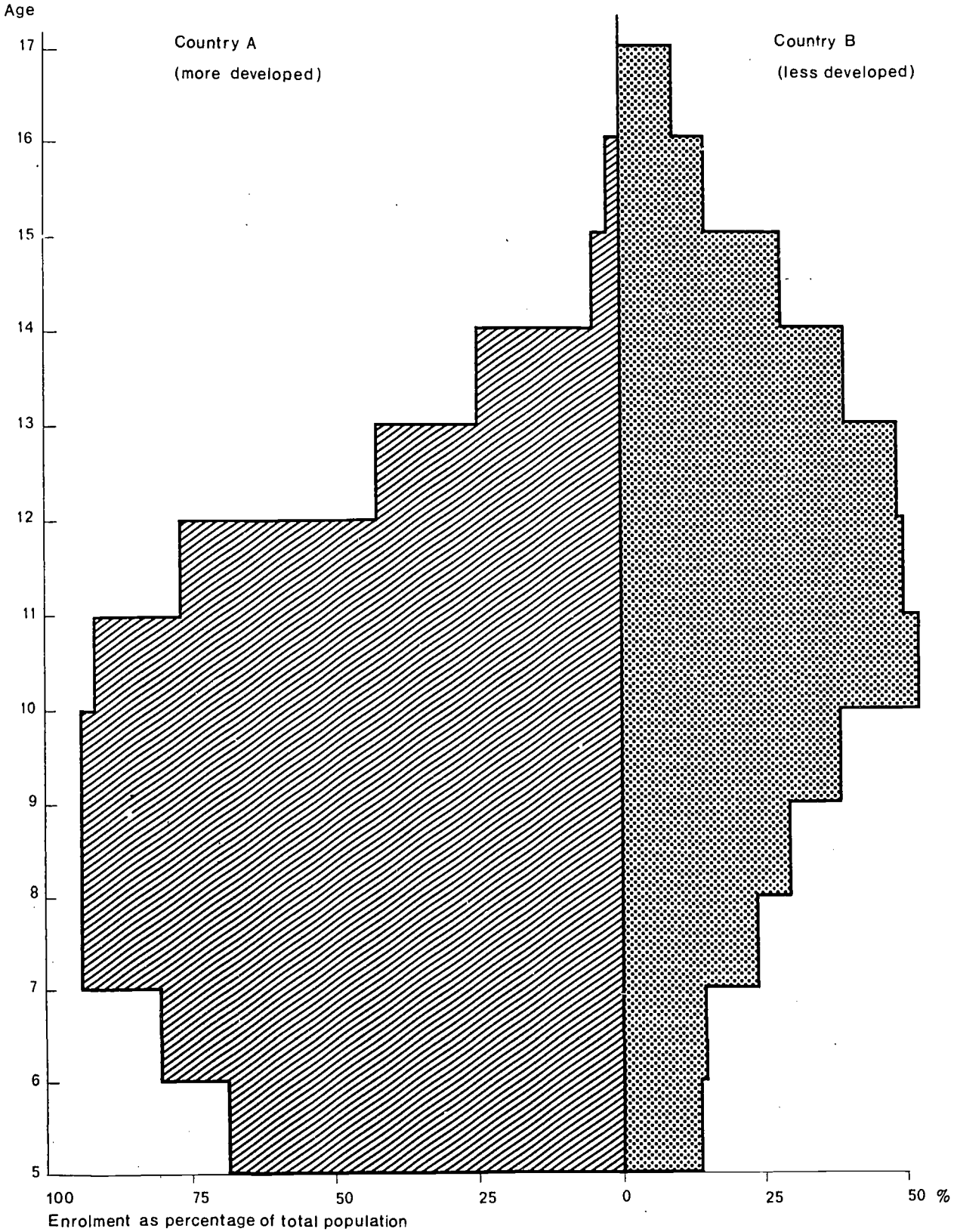


Diagram VI. FLOW OF PUPILS FROM ONE LEVEL TO ANOTHER

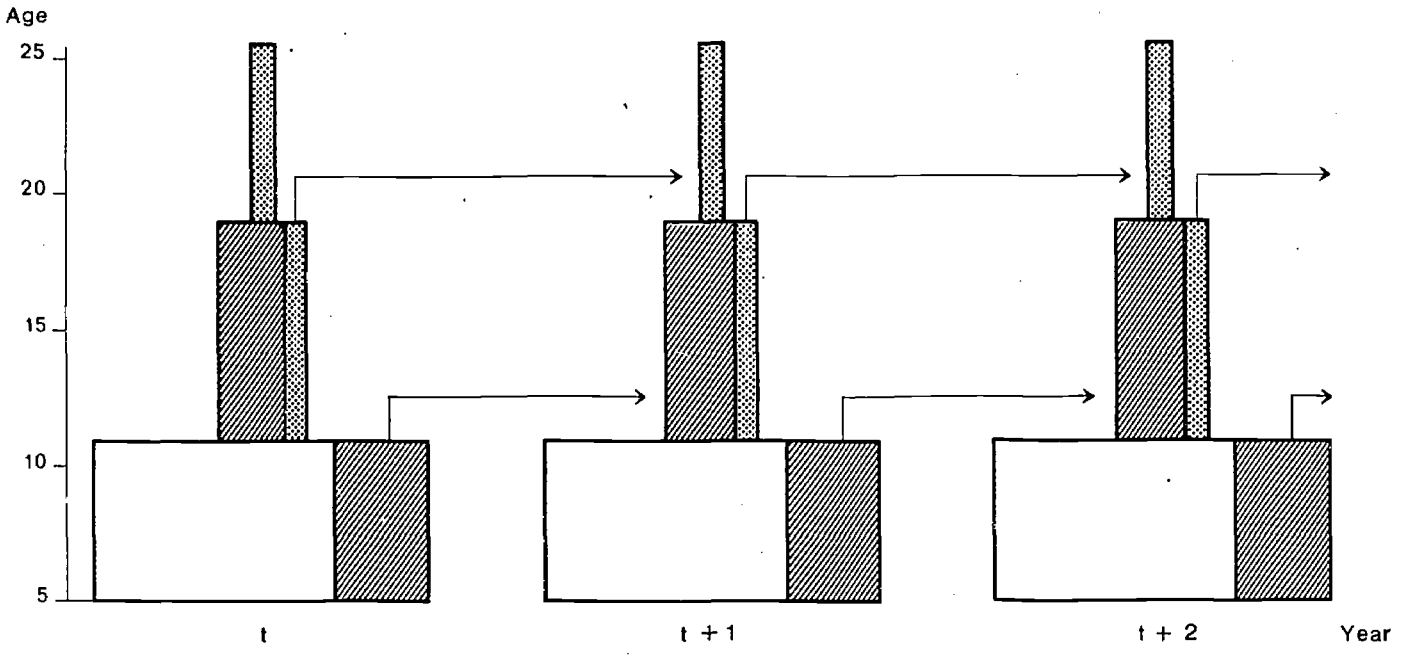


Diagram VII. EFFECT ON STOCK POSITION OF INCREASING ENTRY IN GRADE I

No wastage is assumed

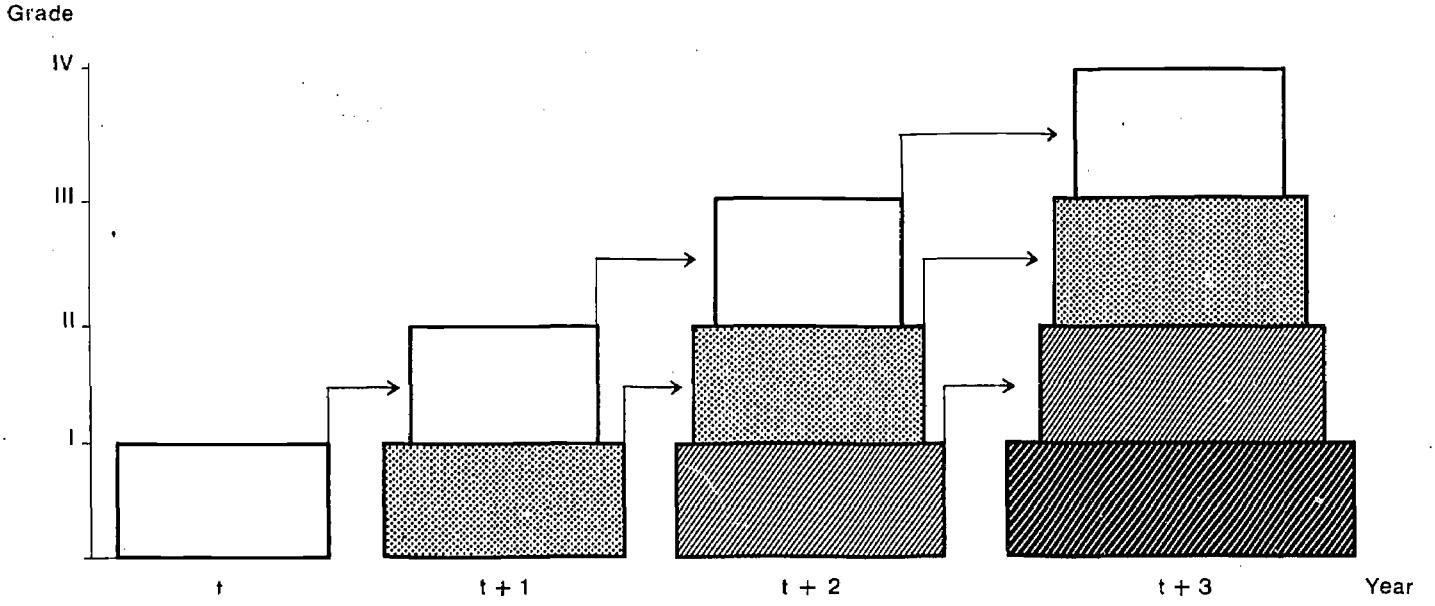


Diagram VIII. ENROLMENT FLOW
The dotted area represents wastage

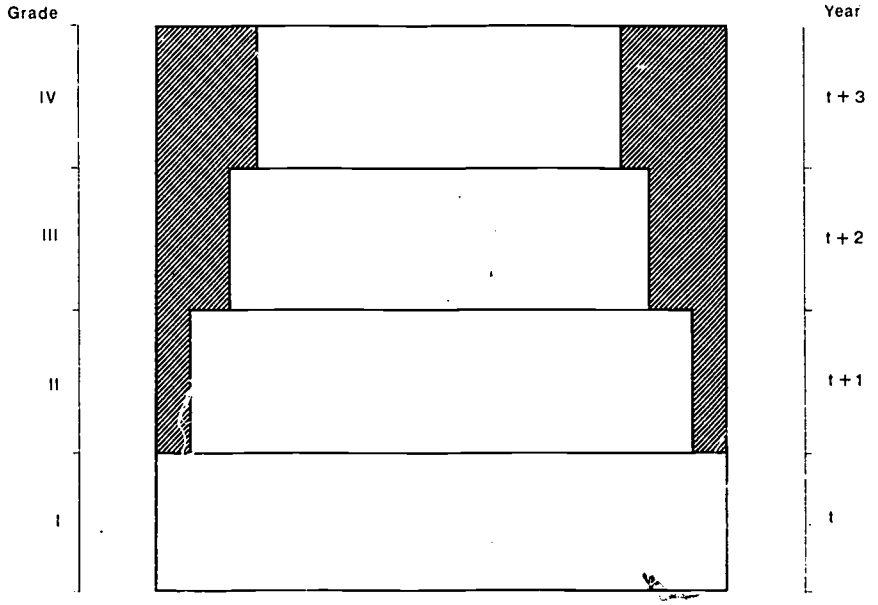
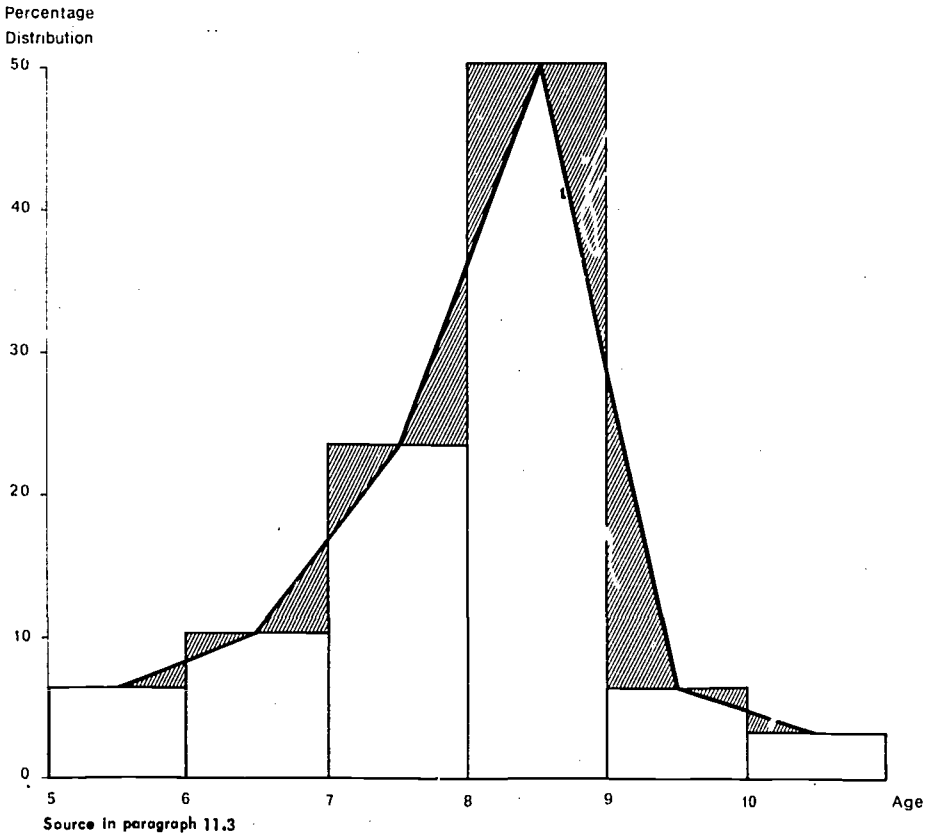


Diagram IX. FREQUENCY DISTRIBUTION OF PUPIL AGE



Source in paragraph 11.3

Note: The shaded triangles within and outside the heavy lines joining the mid points of the bars are equal so that the area under the heavy lines corresponds to the frequency. When smoothed, these lines show the frequency curve.

Chapter 11

AVERAGES AND COMPARISONS

AVERAGES: MEAN, MODE AND MEDIAN

11.1 The use of analytical tables and diagrams depends largely upon the eye. An alternative method of summarizing a series of figures, which has wider statistical applications, is to express the whole series as a single figure in an *average*. This has obvious uses in making comparisons of all kinds.

11.2 The average most commonly adopted is the *arithmetic mean*; it is simply calculated and easy to use so long as its limitations are kept in mind. The arithmetic mean (sometimes simply called the mean) is calculated by adding all the values and dividing by the number of items, as in the following sets of age statistics. In example I below, there are 6 pupils at successive years of age; the remaining examples are each of 30 pupils, in II equally distributed among the ages, in III unevenly distributed with the peak in the middle, and in IV unevenly distributed with the peaks at the ends. The mean age in all examples is the same 7.5; this average may serve well enough for the first three examples but it may be felt to misrepresent example IV, where the age 7 to 8 is the *least* represented, or has the *smallest weight*, in the distribution.

								Totals	Mean Age
Example	Age	5	6	7	8	9	10	45	7.5
I	Number	1	1	1	1	1	1	6	
II	Number	5	5	5	5	5	5	30	7.5
	Total age	25	30	35	40	45	50	225	
III	Number	2	3	7	15	2	1	30	7.5
	Total age	10	18	49	120	18	10	225	
IV	Number	10	3	2	0	7	8	30	7.5
	Total age	50	18	14	0	63	80	225	

11.3 These weaknesses in the arithmetic mean may be offset in particular cases by using another type of average, or by adding a measure of dispersion (paragraphs 11.6 and following below), or both.

11.4 One alternative average is the *mode*. It might be more informative in example IV to say that the most frequent occurrence was age 5 and the next age 10, which are the values corresponding to the peak or peaks of the frequency distribution. In the above examples there is no mode in I and II. In example III it is 7 years and in example IV, as noted, 5 and 10 years. The mode is clearly important when ascertaining the most typical item of a group, for example, the usual age for leaving a secondary school. It is, moreover, easily understood. On the other hand, it may not be easy to locate and, with the median, is far less suitable than the arithmetic mean for further statistical manipulation.

11.5 The *median* is also an average unaffected by the values at the extremes. It is calculated from a frequency distribution in the following manner, using example III above

Age	Frequency	Cumulative Frequency		Quartiles
			%	
5	2	2	7	
6	3	5	17	I = 6.4
7	7	12	40	II = 7.2 (Median)
8	15	27	90	III = 7.7
9	2	29	96	
10	1	30	100	

The median is the value lying half way in the distribution, that is where the cumulative frequency reaches the 50 per cent mark. It lies clearly between 7 and 8, and much nearer 7 than 8. The precise value can be calculated according to simple rules set out in the textbooks; alternatively the cumulative percentage frequency can be graphed (the horizontal scale showing the age and the vertical scale the percentages to give a useful[1] cumulative frequency

1. Two or three frequency distributions may be compared in this way, for example, the age composition of primary schoolchildren in 1950 compared with that of 1960.

curve, Diagram X) and the age at the 50 per cent mark read by means of interpolation (paragraph 10.20 above). Where the peak in a frequency distribution is placed in a regular central position, the median will correspond to the mean. In the present example the median is less than the mean because the shape of the distribution when graphed will show that it is "skewed" that is, weighted, towards the lower ages.

MEASURES OF DISPERSION

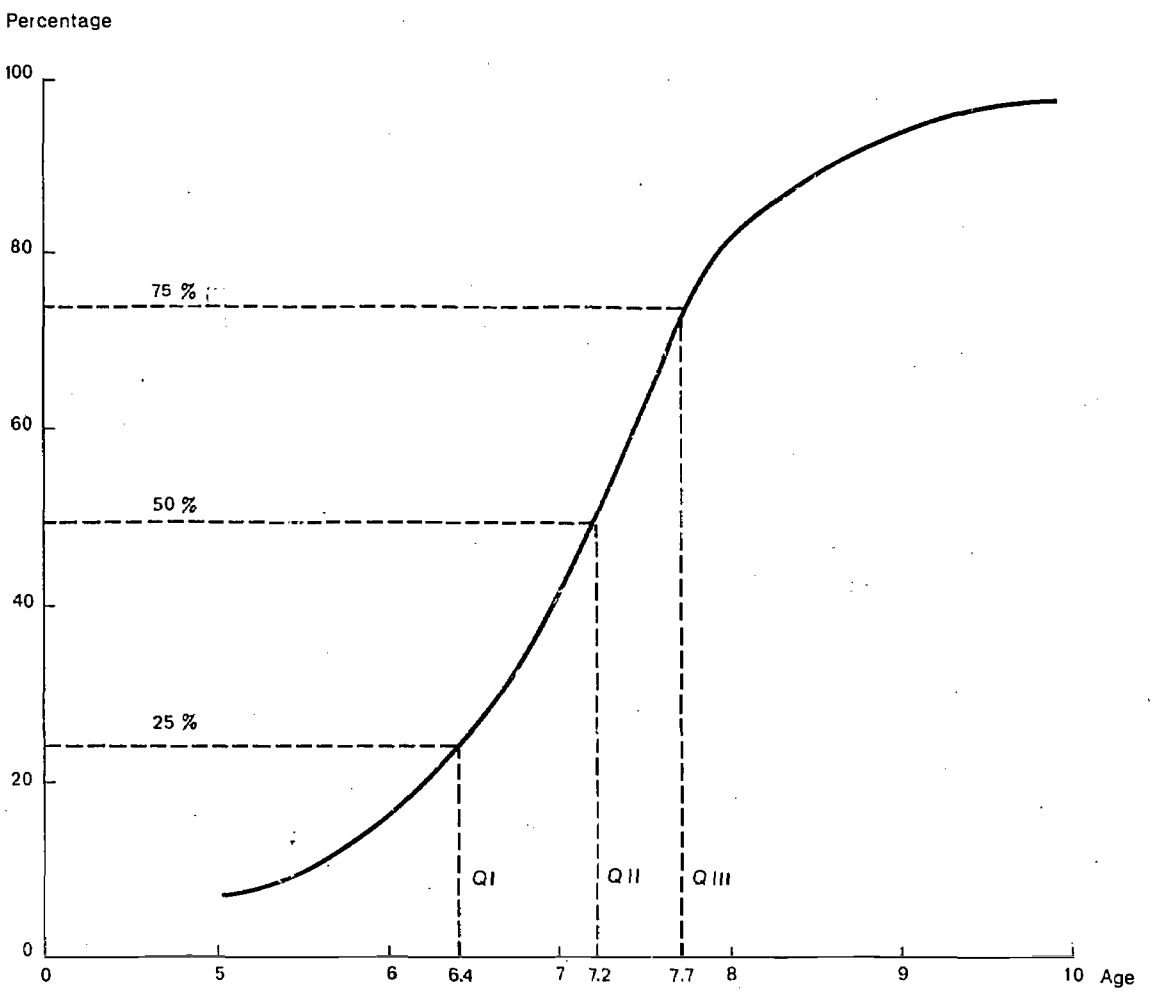
11.6 Whatever the type of average selected, it gives an idea of the most frequent or central value of the series and not of the extent to which values are dispersed, widely or otherwise, around this average value. This defect can be remedied by supplementing the average with measures of dispersion.

11.7 The simplest measure of dispersion is the range, which is the difference between the largest and the smallest values, and is illustrated in the following table of the age distribution of three groups:

Group	Individual Ages	Mean Age	Range
A	- - 5 6 7 8 9 10 -	7.5	5
B	- - - 6 7 8 9 - -	7.5	3
C	4 5 6 7 8 9 10 11	7.5	7

This measure is useful for describing the variation in the ages of pupils in a class or salaries paid to teachers of particular qualifications. Its serious disadvantage is seen from the series 40, 4, 3, 2, 1; the inclusion of one single item of 40 results in a very wide range.

Diagram X. CUMULATIVE CURVE OF PUPIL AGE DISTRIBUTION
Showing three Quartiles



11.8 If the extreme ends of a series could be neglected the main disadvantage of the range as a measure could be removed. For example, in example III above it is easy to see that 22 out of the 30 pupils, that is over two-thirds, were aged 7 or 8. In more detailed distributions it is possible to make a similar but more precise statement by the *quartile deviation.* Using the cumulative frequency curve described above, paragraph 11.5, it is possible to read off the value below which occur one quarter or 25 per cent of the occurences and also the value below which occur three-quarters or 75 per cent of the occurrences. The difference between these two values covers the central 50 per cent of all occurrences and this range (called the *inter-quartile range*) is the one in which we are interested. There are three quartiles (QI, QII, and QIII), the values below which fall 25 per cent of the occurrences, 50 per cent of the occurrences and 75 per cent of the occurrences. It will be seen that the second quartile is the median. The difference between the first and third quartiles divided by 2 is called the *quartile deviation.* Where it is desired to measure a wider range than the inter-quartile range, the inter-*decile* range is used, obtained by excluding the first and last *10 per cent* of the frequency distribution. The kind of summary statements these measures make possible are that half of the pupils in the example quoted are between the ages of 6.3 years (QI) and 7.7 years (QIII); or have a variation in age of 7.7 - 6.3 = 1.4 years ; or have an average dispersion around the median 7.2 of 0.7.

11.9 A further measure of dispersion is the *standard deviation* which is described in the textbooks. Of considerable use in more sophisticated statistical analysis, particularly in sampling (see Note at end of Chapter 5 above), the standard deviation is not so simply used as the other measures of dispersion.

11.10 In a time series, the differences from the annual mean, shown for example by monthly values, can be represented on a graph as plus and minus above and below a horizontal zero line. A more refined picture can be given by calculating the *moving average*: that for January is obtained by averaging the values for the twelve months around January, for February, the twelve months around that month, and so on. The values so found for each month, when plotted on the graph, will show the *trend*; and the monthly differences or *deviations* can be calculated from this trend.

RATIOS AND RATES

11.11 A large part of statistical analysis consists in making comparisons. Simple comparisons are made be expressing one value as the proportion of another and a great deal of the analysis required in educational statistics depends upon such simple comparisons in the form of rates and ratios.

11.12 If among 460 teachers, 92 teach mathematics, the position can be simply stated as 1 mathematics teacher to every 4 teachers of other subjects, a *ratio* of 1 : 4; or 1 mathematics teacher to every 5 teachers of all subjects, a ratio of 1 : 5. Either ratio can be expressed as a percentage thus 25 : 100 and 20 : 100, or more usually: mathematics teachers represent 25 per cent of all other teachers, or 20 per cent of all teachers. The ratio shows the position at a point of time: the stock position. If the above figures referred to the recruitment of teachers (the flow position) it is usual to call the proportion a *rate:* mathematics teachers are being recruited *at a rate* of 1 in every 5 or 20 per cent.

11.13 When using ratios or rates, as percentages or otherwise, it is important to remember that both measurements are fractions and that the value depends upon both numerator and denominator. To say that 20 per cent of teachers taught mathematics in 1965 compared with 15 per cent in 1964 could mean (a) *more* teachers chose the subject, if the supply of teachers is at least the same in each year; (b) the *same number* chose the subject, if the total supply fell proportionately; or (c) *fewer* teachers chose the subject, if the total supply of teachers decreased in 1965 by more than a quarter compared with 1964. The three different situations can be illustrated as follows:

	1964		1965					
	No.	%	(a)		(b)		(c)	
			No,	%	No.	%	No.	%
Mathematics teachers	69	15	92	20	69	20	50	20
All teachers	460	100	460	100	345	100	250	100

Care must also be exercised not to use percentage comparisons too readily when the numbers concerned are very small. To state that examination successes in one year are 200 per cent compared with the previous year, adds little and may even give a wrong impression when the actual numbers involved are 1 and 2.

RATIOS OR RATES OF USE TO THE EDUCATIONAL STATISTICIAN

11.14 In evaluating the stock position, in analysing flows and in forecasting, the educational statistician uses a large number of ratios and rates . The principal ones, which are described further in following paragraphs, include.

Stock (a) Sex ratios
(b) Staffing ratios
(c) Stock of educated persons

(d) Enrolment ratios

Flow (a) Entry rates
(b) Enrolment rates
(c) Promotion rates
(d) Repeater rates
(e) Drop-out rates
(f) Wastage rates
(g) Absentee rates.

The stock ratios are usually simple to calculate; rates of flow may present some difficulty.

SEX RATIOS

11.15 The following information shows enrolment in successive years in standard VII at primary level:

	1960	1961	1962	1963	1964	1965
Boys	25,185	25,286	25,689	25,491	16,948	27,452
Girls	11,598	12,034	12,178	12,642	13,454	14,034

How are the girls progressing compared with the boys? One way of answering this question is to express the number of boys enrolled for every 100 girls. If there is equality in enrolment (and this is what would be expected if all the girls at the appropriate age as well as all the boys at the appropriate age were enrolled, since the number of girls in the population tends to be the same as the number of boys) then the sex ratio equals 100. The sex ratios for the above example are

1960	1961	1962	1963	1964	1965
217	210	211	205	200	196

showing a considerable preponderance of boys that nevertheless fell during this period from just *over* to just *under* twice as many girls.

STAFFING RATIOS

11.16 A useful way of expressing the average work load of teachers, in a particular grade or at a particular level, is to calculate the average number of pupils to each teacher of these grades or in this level. A particular staffing ratio, say, 30:1, could be set up as a desirable standard at which the educational system should aim. It is one of the simplest indicators to provide, and is quite easy to understand when not expressed as a percentage since it suggests the average size of class for the teachers concerned. It is also of use in planning for calculating the demand for teachers when the estimated pupil enrolment is known.

STOCK OF EDUCATED PERSONS

11.17 For purposes of educational and manpower planning the stock of educated persons (see paragraph 8.21 above) is usefully measured as the number of persons per 10,000 population.

INDEX NUMBERS

11.18 A useful employment of percentages is to express a series of values as a percentage of one particular value, usually as a time series with a particular year as base (that is to say, equals 100). Thus the enrolment statistics in paragraph 11.15 would appear, with 1960 = 100, as

	1961	1962	1963	1964	1965
Boys	100	102	103	107	109
Girls	102	105	109	116	121

The greater proportional increase in the enrolment of girls is clearly shown.

11.19 This series of Index Numbers[1] makes possible comparisons between one year and another without the use of plus and minus signs. If two series are calculated as Index Numbers, for example, school buildings completed and teacher supply, it is also possible to make the comparison independent of the unit concerned, or, should the quantities in the two series vary considerably in size, as in the example, to show annual changes rather more clearly. The base year in the following series is 1960 = 100

I.

	1960	1961	1962	1963	1964	1965
Teachers	100	105	106	107	109	110
Buildings	100	96	97	100	106	107

The statistician must be aware of the importance of his choice of base year. If, instead of 1960, 1961 is used as the base year in the above series the Index Numbers will appear to give a quite different impression:

II.

	1960	1961	1962	1963	1964	1965
Teachers	95	100	101	102	104	105
Buildings	104	100	100	104	110	111

The interpretation of the two series is

I. since 1960, teacher supply has increased more than school supply;
II. since 1961, teacher supply has increased less than school supply.

The statistician must be careful to select the base year with an eye to the situation he wishes to illustrate.

1. More strictly of *relatives*. The term Index Number is often limited to the weighted average of relatives, showing the combined effect of the trends in a number of separate items.

Chapter 12

ENROLMENT AND ENTRY RATES

12.1 *Enrolment ratios and rates* measure the extent to which the educational system is meeting the needs of the child population. They can be viewed either as a stock measurement(the enrolment *ratio* shows how much education is being provided at the date to which the enrolment refers) or as a flow measurement (the enrolment *rate* shows what proportion of the available children is flowing into the educational system). In the latter use, it will be found that *entry rates* are even more useful.

GROSS ENROLMENT RATE (OR RATIO)

12.2 The gross enrolment rate is the percentage of all children of all ages enrolled in all kinds of schools and is used as a single general indicator of the amount of education being provided. One figure for all levels of education has in fact little meaning ; to say, for example, that 28 per cent of all children are enrolled in schools when in fact this figure is made up of 60 per cent of the appropriate ages enrolled in primary schools, 5 per cent in secondary schools and 2 per cent in higher education (which could produce 28 per cent of all ages) is much less informative than giving the percentage at each level.

GROSS ENROLMENT RATE BY LEVEL OF EDUCATION

12.3 To calculate gross enrolment rates by level it is necessary to have statistics of enrolment by age, to define the *appropriate age* for the particular level, and to have statistics of the general population at those ages. In developed countries where primary education is legally compulsory at fixed ages, say 6 to 12, there is no problem ; the gross enrolment rate at 100 per cent, or very nearly so, and this has little value as a measure. It is different in developing countries. Where education may not be compulsory, and where, due to repeating or other reasons, there is a wide age spread, the gross enrolment rate by level has some meaning. The position is similar with secondary education where it is not compulsory, and where a qualification in addition to age is required ; and in all higher education. In all these cases the problem is to find the appropriate age group against which to measure the recorded enrolment, a problem that is best appreciated by first considering age specific enrolment rates.

AGE SPECIFIC ENROLMENT RATES

12.4 The table opposite, Table D, gives an analysis of enrolment by age and grade. Enrolment for each age, N^1, is expressed as a percentage of the total numbers in the same age group, P, to give the enrolment rate, n, specific to each age. If these were represented in a histogram it could amount to the more sophisticated form of the educational pyramid (see above paragraph 10.11).

12.5 The crude calculation of the gross enrolment rate is to divide the enrolment at all ages by the population at these ages:

$$\frac{355}{1098} = 32\%$$

It is nevertheless seen from the Table that the four extreme rates (for ages 5, 13, 14 and 15) are all below 10 per cent and thus depress the gross enrolment rate although they together account for only 5.6 per cent of the total enrolment (see percentage composition row in the Table). It is evident that the age specific enrolment rates (the educational pyramid) provide the better description of the stock of education.

1. A proposed standard set of symbols for use in educational statistics is given in the Appendix.

TABLE D

ENROLMENT BY AGE AND GRADE

	Age 5	6	7	8	9	10	11	12	13	14	15	Total	Average Age years
Grade I	10	60	8	3	1	-	-	-	-	-	-	82	6.0
II	-	5	50	8	4	1	1	-	-	-	-	69	7.3
III	-	-	5	40	9	6	1	-	-	-	-	61	8.3
IV	-	-	-	2	35	8	5	1	-	-	-	51	9.4
V	-	-	-	-	1	28	7	1	-	-	-	37	10.2
VI	-	-	-	-	-	1	25	3	1	1	-	31	11.2
VII	-	-	-	-	-	-	1	15	4	2	2	24	12.5
Total N	10	65	63	53	50	44	40	20	5	3	2	355	8.5
% Composition	2.8	18.4	17.7	14.9	14.1	12.4	11.3	5.6	1.4	0.8	0.6	100.0	
Total P	109	106	103	101	100	99	98	97	96	95	94	1098	
$N\%_{P}$ I	9.2	61.3	61.2	52.5	50.0	44.4	40.8	20.6	5.2	3.2	2.1		
$Ny\%_{Py}$ II	-	56.6	48.5	39.6	35.0	28.3	25.5	15.5	-	-	-		

ALTERNATIVES TO THE GROSS ENROLMENT RATE

12.6 If a single figure to indicate the extent of enrolment is nevertheless required, a number of alternatives to the crude calculation of a gross enrolment rate can be considered:
(a) to neglect the extreme values ;
(b) an *average school age* enrolment rate ;
(c) a *standard school age* enrolment rate.

12.7 By neglecting the enrolment of those aged 5, 13, 14 and 15 in the example, the average of the rest may be considered to be more representative[1]. Since this has the same effect in this particular example, as the third alternative, reference should be made to the resulting enrolment rate shown in paragraph 12.9, that is, 47,3 per cent.

12.8 Neglecting the enrolment of some pupils may not be serious where those included represent the substantial majority of the enrolment. Otherwise, a gross enrolment rate should be considered that allows for every pupil. This is the purpose of the *average school age enrolment rate*. The age span taken against which to measure total enrolment is that between the average age in Grade I and the average in Grade VII. From the end column in the table, this age span is seen to be 6 to 12 and the resulting gross enrolment rate:

$$\frac{355}{704} = 50\%$$

12.9 The third alternative is to examine the position of a *standard* age group. A suitable group could be that which the government has in mind eventually for primary education. On this basis the *standard school age enrolment rate* can be calculated to show how far the government's objectives are being met. It is also helpful to give the proportion of all enrolment represented by those in the standard school age group. To give an example, if the objective of government policy is primary education for all aged 6 to 12, the information in the table shows:
(a) those enrolled aged 6 - 12 to be $\frac{335}{355}$ or 94 *per cent* of all pupils enrolled ; and
(b) their standard school-age enrolment rate (the average of the age specific rates) to be

$$\frac{330.8}{7} = 47.3\%$$

12.10 A related measure is to show how far the policy for each pupil of successive years in successive grades is being achieved: the number of 6-year olds, in the example, that are in Grade I, 7-year olds in Grade II and so on. These are the numbers within the diagonal lines in the Table and their age specific enrolment rates are shown as $\frac{Ny}{Py}$ in the Table. They account for $\frac{255}{355}$ or 71 per cent of all pupils and their gross enrolment rate is 35.6 per cent.

ESTIMATING A GROSS ENROLMENT RATE

12.11 In the absence of satisfactory information on ages, the following calculations will provide an approximate rate. The average age of each grade would be assessed, either directly by the teacher or headmaster, or from general knowledge - for example by assuming that Grade I has an average of 6, Grade II of 7, and so on. The age of the most numerous grade is then selected, and the total age span also noted. The estimated gross enrolment rate is then

$$\frac{N}{Pa} \times \frac{100}{A}$$

Where N = total enrolment, a = most numerous age, Pa = the total population at this age[2], and A the age span. On the assumption that successive grades in the Table have successive average ages, the use of this formula gives the following results, which may be compared with the actual figures above:

for an 11-year span 30.%
for a 7-year span 48%

12.12 Gross enrolment rates should be shown as rounded whole numbers where they are only approximate and close comparisons, for example between one year and another, should not be pressed.

ENTRY RATES

12.13 Of greater interest than the total enrolment at any particular time, is the movement *into* the educational system and the movement *within* it. The following chapter deals with the movement *within* each level, that is between grades. The movement *into* the educational system is measured by entry rates.

12.14 Entry rates measure the *flow* into each level of education, at the primary level from children arriving at school age, and at higher levels from successful leavers at the preceding level. They are defined as the initial enrolment, or enrolment in the first grade in primary or secondary schools, expressed as a percentage of those available for entry. As a measure of the extent to which effective provision is being made for education, particularly at second and third levels, entry rates are of considerable value. They are also basic information for the purposes of forecasting.

ENTRY RATE FOR FIRST-LEVEL EDUCATION

12.15 Where education is compulsory after a certain age (say 6), the entry rate is the same as the

1. Compare paragraph 11.2 above. By neglecting the extreme values the age specific enrolment rates at these extreme ages are in effect given a weight = 0; see the concept of a *weighted average* in the textbooks.
2. This may need to be estimated by the demographer if single age group figures are not available from the census, or other demographic sources.

age specific enrolment rate for the six-year olds, since those entering are all aged 6 and the available population are all those aged 6. In both instances the rates = 100 per cent. Where those who enter are of mixed ages, and where there is also repeating, the two rates diverge. Whereas the enrolment rate shows all those of a particular age who are enrolled in whatever grade, the entry rate shows all those enrolled in the first grade, at whatever age, as a percentage of all those available, at whatever age, for entry. Defining "those available" in this connexion leads to difficulty in a developing country.

12.16 The entry rate can be considered as the average of the age specific enrolment rates of those in Grade I. Using the same figures as in the table, we have the following:

Age	5	6	7	8	9	Total
Enrolment in Grade I (E)	10	60	8	3	1	82
P	109	106	103	101	100	
$\frac{E}{P}$ %	9.2	56.6	7.8	3.0	1.0	77.6

$$\text{Average} = \frac{77.6}{5} \times \frac{100}{1} = \underline{15.5\%}$$

Using the *short method* (paragraph 12.11 above), the most numerous age is 6 to give

$$\frac{82}{106} \times \frac{100}{5} = \underline{15.5\%}$$

12.17 In this calculation weight has been given to extreme values. Since the major entry is at age 6, the calculation could be limited to the enrolment at this age to give an entry rate of 57 per cent, on the part of 73 per cent of all entrants.

12.18 Neither approach is completely satisfactory. The second will probably be found to be more useful. As government policy is realized this particular entry rate will come to be that of a growing proportion of all new entrants, so that the two percentages will give a good indication of trends.

ENTRY RATE FOR SECOND-LEVEL EDUCATION

12.19 More satisfactory rates can be calculated for the flow into education at this stage, a point of extreme interest to the educator, especially in developing countries. On the flow into secondary education depends the future of the educational system itself (the supply of teachers) as well as the manning of the economy generally. Entry rates at the primary stage are largely a matter of the provision of places. At the second level, entry is limited by the considerable cost of the provision of places on the one hand and, on the other, the *quality* of those available: that is, the numbers in the previous school year of "successful leavers" from primary education.

12.20 Satisfactory entry rates can be calculated since, on this occasion, mixed ages raise no problem. The number of successful leavers is known from examination or other records, and the numbers subsequently enrolling in the secondary schools can be expressed as a percentage of the successful leavers. It is assumed that there is no delay in leaving one school year and entering the secondary school at the next school year. If regional entry rates are calculated, adjustments will have to be made for pupils transferring to or from another region.

12.21 As with other flow rates, entry rates are often more informative when set against others. Entry into a secondary school results from the working of a number of factors and the flow can be considered at a number of points during the period of change from one level to another. From among those enrolled in the final primary grade, where success at examinations determines the next stage, some will be candidates for these examinations of whom only a proportion will be successful. Thus a number of rates emerge:

(a) percentage of those enrolled in the final year who complete the course;
(b) percentage of those completing the course who take the examination;
(c) the percentage of those taking the examination who are successful; and
(d) the percentage of those successful in the examination who enrol in secondary schools, which is the *entry rate* for second-level education.

Where (a) approaches 100 per cent, it is possible to proceed by first calculating the percentage of those enrolled in the final year who take the examination. For some purposes, the "successful leavers" may be expressed as a percentage of those enrolled, the rate of successful candidates to all taking the examination being used separately in discussing the examination results as such.

ENTRY RATE FOR THIRD-LEVEL EDUCATION

12.22 At this level, the number available for entry are those successful leavers who have passed leaving examinations at the minimum level required by the institutions of higher education. Since these qualifications may be obtained after the pupil has left the secondary school, and since some successful leavers may delay their entry into higher education for one or more years, the number available in any one year will consist of:

(a) those qualified at the end of the school year,
(b) *minus* those who postponed applying for higher education for one, two, three years, etc.,
(c) *plus* those from previous scholastic years who postponed applying one, two, three, etc., years ago,
(d) *plus* those who have qualified since leaving school.

Items (b) and (c) balance off against each other to some extent. If the assumption is made, where there

is no detailed information about intentions for example of successful leavers, that similar numbers decide to defer their entry each year, these items balance more or less completely out. It then remains to obtain (d). This information is given by the examination results of institutions of further education, and similar assumptions may be made about the deferment of actual applications by those successful at these examinations.

12.23 Additional rates which will be found of interest (compare paragraph 12.21 above) are:

(a) *The application rate:* the proportion of school leavers at the appropriate level of qualification to apply for higher education ;

(b) *Degree of competition:* the proportion of each group of applicants admitted.

12.24 The numbers of those *entering* third-level education may be considered separately as initial entrants to (a) teacher-training colleges, (b) to further education and (c) to universities. For describing third-level education as a whole, these separate totals can be aggregated after making allowances for *double counting*. There is a danger of double counting where those entering, say, a particular university may include some who have already entered higher education elsewhere. Thus a graduate from, or some one who has broken his course at, another university may be transferring to the university in question. Or, the more usual case, there may be teachers entering a university after having already qualified at a Teacher-Training College. On the other hand, some enter further education in order to study for *second-level* examinations. To minimize these errors:

(a) only those enrolled in teacher-training colleges or in further education for examinations *beyond* the second-level examinations should be counted ;

(b) all those proceeding to university from teacher-training colleges should be omitted.

Estimates of (a) will be obtained from enrolment statistics from this type of course. For the purpose of (b) it will be necessary to have this information collected when the student enrols.

Chapter 13

WASTAGE AND OTHER RATES

13.1 Entry rates measure the rates of flow into levels of education; other rates are required to measure the flow between grades. As noted above (paragraph 10.15) this is the problem of *wastage*.

CRUDE PROMOTION RATES

13.2 Without repeating and wastage of any kind, the numbers enrolled in a particular year in a particular grade (N_t^k) will be the same as those enrolled in the following grade in the following year (N_{t+1}^{k+1}). If the number promoted at the end of the first year is represented by S, then

$$S_t^k = N_t^k = N_{t+1}^{k+1}$$

and the crude promotion rate (s) defined as the number promoted as a percentage of the number enrolled:

$$\text{crude } s_t^k = \frac{N_{t+1}^{k+1}}{N_t^k} = 100\%$$

In fact in developing countries these rates, based on the straight comparison of successive enrolments, show a position similar to the following. The figures in circles are the percentage comparisons between the enrolment figures linked by the arrows; they are the crude promotion rates for successive grades in successive years. The diagonals thus represent the different cohorts of pupils (Table 1).

Table 1

GRADE	1962		1963		1964		1965		1966
I	50	%	54	%	58	%	61	%	63
		76		78		75		81	
II	34		38		42		46		49
		79		80		81		83	
III	24		27		30		34		38
		88		89		90		91	
IV	18		21		24		27		31
		95		95		95		95	
V	15		17		20		23		26

CRUDE WASTAGE RATES

13.3 The number of those who fail to be promoted provides a crude measure of the amount of wastage. The crude wastage rate is thus the residual of the crude promotion rate, that is 100 - s per cent. Distinction can be made between the grade-to-grade wastage rate and the cohort or gross wastage rate.

The *gross wastage* rate refers to the loss occurring between the first and final grades as a cohort passes through a particular level of education. In the example in the preceding paragraph, and using the symbols set out in the note to this chapter, enrolment in Grade V in 1966 (N_{66}^5) is 26, and in Grade I in 1962 (N_{62}^1) is 50, so that the crude gross wastage rate for this cohort is the difference expressed as a percentage of the initial enrolment or

$$\frac{N_{62}^1 - N_{66}^5}{N_{62}^1} \times \frac{100}{1} = \frac{24}{50} \times \frac{100}{1} = 48\%$$

A series of such rates gives a rough idea of the extent to which wastage is diminishing. It is a crude measure since no allowance is made for the extent of repeating; if this is large, the crude wastage rate can be very misleading. In this event *drop-out* must be distinguished from repeating.

13.4 Sometimes gross wastage can be usefully looked at from the angle of the average years of study required to produce a successful leaver; if there were no wastage and all candidates were successful at examinations, this average number of years would be the length of the course. The extent to which this number is exceeded in practice measures the general wastage. A cohort of children passing through the course is taken and the number enrolled in each successive year added to obtain the total number of years spent by *all* pupils in the cohort during the course. If this figure is compared with the total number of those who successfully complete the course (G), either by passing an examination or being promoted to a further grade, an indicator is obtained in the form of the average number of school years required for that cohort to achieve a single successful leaver:

$$\text{average} = \frac{N_0^1 + N_1^2 + N_2^3 + \ldots \text{etc.}}{G}$$

If the calculation is made for successive cohorts a series such as the following is obtained:

Average number of years per successful leaver

Cohort 1957	Cohort 1958	Cohort 1959	Cohort 1960
5.1	4.8	4.6	4.2

This suggests increasing efficiency of the educational system and is useful for planning.

REPEATER RATE

13.5 As a first approximation, the repeater rate can be defined as the number who repeat a grade (R^k) in the succeeding year (t+1), as a percentage of the original enrolment (N_t^k):

$$r_{t+1}^k = \frac{R_{t+1}^k}{N_t^k} \times \frac{100}{1}$$

DROP-OUT RATE

13.6 If the number promoted and the number who repeat are known, the number dropping out (D) can also be known,

$$\text{since } N_t^k = R_{t+1}^k + S_t^k + D_t^k$$

$$\text{and } D_t^k = N_t^k - R_{t+1}^k - S_t^k$$

If the annual questionnaire provides only enrolment for each grade and the number repeating, the number promoted (S_t^k) can be derived from the fact that the initial enrolment in any grade consists of those promoted from the previous grade plus those repeating the same grade. Thus:

$$N_{t+1}^{k+1} = S_t^k + R_{t+1}^{k+1}$$

$$\text{or} \quad S_t^k = N_{t+1}^{k+1} - R_{t+1}^{k+1}$$

So that the number dropping out in the previous grade can by found by

$$D_t^k = N_t^k - R_{t+1}^k - (N_{t+1}^{k+1} - R_{t+1}^{k+1})$$

which is better expressed as

$$D_t^k = N_t^k - N_{t+1}^{k+1} - R_{t+1}^k + R_{t+1}^{k+1}$$

The *drop-out rate* between one grade and the next is given by the drop-out as a percentage of the initial enrolment

$$d_t^k = \frac{D_t^k}{N_t^k} \times \frac{100}{1}$$

Where drop-outs = 0 the rate is 0 per cent. A high drop-out means a high percentage.

13.7 An *adjustment for transfers* between one school and another is further necessary where drop-out rates for individual schools or for regions are being calculated. In the national rate, transfers from one school to another balance out, but an individual school or region may receive more scholars than it loses, or lose more than it receives, giving it a net balance or net loss of transfers (Q). Transfer balances must be deducted or transfer losses added to initial enrolment before the drop-out is calculated. The drop-out is then given by:

$$D_t^k = N_t^k - N_{t+1}^{k+1} - R_{t+1}^k + R_{t+1}^{k+1} \pm Q_t^k$$

13.8 Strictly speaking *an adjustment for deaths* is also necessary, the number (M_t^k) being also deducted from enrolment before drop-out is calculated. The omission of this adjustement is not very serious since the effect may be small compared with the factors concerned and calculation of a drop-out unadjusted for deaths should not be held up if mortality statistics are not forthcoming.

TIMING AND THE CALCULATION OF DROP-OUT

13.9 Ideally, the calculation should take place on the first day of the school year, taking into account all transfers (and deaths) occurring during the previous twelve months. In practice, the enrolment is not recorded for the statistician until the date of the annual questionnaire, and the figure will as a result already have allowed for transfers and deaths since the beginning of the new school year. The enrolment figure for the previous year will have also been distorted for the same reason. The simplest course, when comparing the two enrolment figures to calculate the drop-out, is to assume that the distortion is proportionately the same each year

and to neglect it. The alternative would be either to adjust all enrolment figures back to the first day of the school year, or to use a transfer (and mortality) figure related strictly to the twelve months preceding the date of the annual questionnaire. This could be troublesome; and the result would include as drop-outs pupils who may be temporarily absent at the beginning of the school year

PROMOTION RATE FURTHER CONSIDERED

13.10 With information on repeating it is possible to move away from the crude promotion rate, in view of the fact that the number promoted from:

$$N_t^k \text{ is } N_{t+1}^{k+1} - R_{t+1}^{k+1}$$

A better version of the promotion rate is thus:

$$S_t^k = \frac{N_{t+1}^{k+1} - R_{t+1}^{k+1}}{N_t^k}$$

13.11 Although this rate could be used for most purposes, it could be refined further, particularly for use in forecasting. Thus, as it stands, for a particular school or region, it assumes that any net loss by way of transfers will be reckoned as pupils who are not promoted, which is not necessarily true. To remedy this, enrolment could first be adjusted by transfers and, where possible, deaths.

13.12 It may also be considered that drop-out is a kind of mortality: pupils are lost, in this way, to the school population. If the initial enrolment in a grade can be considered as a population that loses (or gains) by way of transfers, deaths and drop-out during its life of one school year, at the end a *number available for promotion* will remain. These will either be promoted or repeat, and a strict definition of promotion rate (and equally of repeater rate) would be the number promoted (or repeating) as a percentage of those available for promotion, that is, in individual schools or regions,

$$s_t^k = \frac{S_t^k}{N_t^k \pm Q_t^k - M_t^k - D_t^k - R_{t+1}^k}$$

ABSENTEEISM AND ATTENDANCE STATISTICS

13.13 The drop-out rate shows, in effect, absenteeism in its extreme form. A measure of general absenteeism is also necessary if the evaluation of the educational system, especially in regard to regional differences, is to be complete. This measure is derived from attendance statistics. The drop-out rate is measured by reference to a particular date. Attendance has to be measured as an activity extending through the school year.

13.14 The monthly return (see paragraph 8.2 above) shows the number attending each session, with weekly and monthly totals, and the number of pupils enrolled. From this information certain rates can be calculated:

(a) the *sessional attendance rate*: the average monthly attendance of all pupils at each session gives a general idea of the extent to which class facilities are being used;
(b) *pupil attendance rate*: the average monthly attendance by each pupil as a percentage of the total possible to give a general idea of how much education pupils are receiving;
(c) *absenteeism rates* are the reciprocal of pupil attendance rates; in averaging pupil absences they indicate directly the extent of this problem.

All these rates, when presented as a monthly or even a weekly time series, can be very illuminating.

13.15 A more exhaustive examination of the problem of absenteeism requires an analysis of the dispersion of pupil attendance rates around the average and this would entail grouping these rates into a frequency distribution for subsequent calculation of the inter-quartile range and other measures. This detailed work would probably have to be limited to a selected area or range of pupils or a special inquiry. If this were a sample inquiry, which also investigated pupils' home backgrounds, information about the *causes of absenteeism* might be gathered that could be important for educational planning. It would be necessary to carry out the survey for a sufficient length of time to cover the seasonal as well as the monthly or daily variations in attendance.

MEASURE OF ACCOMMODATION

13.16 The *number* of schools is a poor measure of the extent of school accommodation available. Some idea of school size is also necessary and the first crude measure is that of the number of places which the registration application from independent schools, or the section of the Ministry of Education responsible for building, record as planned for a particular school. This measure fails to show what ancillary physical facilities are available. Moreover, in developing countries, and in times of pressure, places are made available either by converting ancillary rooms into classrooms or crowding the existing ones. It is thus difficult to measure the extent to which accommodation is in fact being utilized and, as a result, gain a working idea of the extent to which demand is unsatisfied . Where a classroom can be suitably defined (such as a room given over permanently for the purposes of teaching a group of pupils) a rate of utilization in the form of x feet per

pupil can be calculated. If, further, a standard of "overcrowding" can be introduced, say 8 square feet per pupil, it would be possible to see where the physical provision of additional places is most urgently required. The educational statistician must use such indications with discretion since, for example, some of these concepts are not realistic when applied to primitive schools. For measuring the level of *ancillary* facilities in the schools selected indicators might be considered such as the existence of a school library and the number of volumes in it or the availability of specific modern teaching aids and the number of pupils having access to them. Such additional information would be obtained from the local officers.

NOTE TO CHAPTER 13

A standard system of notation for use in educational statistics.

Number in age-group	P	Death numbers	M
Enrolment numbers	N	Death rate	m
Enrolment rate	n	Drop-out numbers	D
Entry numbers	E	Drop-out rate	d
Entry rate	e	Number promoted	S
Successful leavers	G	Promotion rate	s
Repeating numbers	R	Grade	k superscript
Repeating rate	r	Year	t subscript
Net transfers	Q		

Chapter 14

FORECASTING

REQUIREMENTS OF THE PLANNERS

14.1 Educational planning is concerned to establish certain targets for schools, enrolment, teacher supply and other educational facilities over periods 5, 10 or 20 years ahead. It does so in the light of the economic and manpower resources available to supply these facilities; the political decisions as to desirable rates of growth (on the advice and guidance of the economic planners); and the probable course of the future demand for education. The processes involved are complex and Ministries of Education often set up an Educational Planning Unit for the purpose.[1]

14.2 It falls upon the educational statistician to forecast the *demand and supply of places* in the educational system, year by year during the period under plan. From this demand can be inferred the requisite *demand for teachers*, raising questions of their likely future *supply*; and also the *cost*, in financial terms, of meeting the demand for places. Although satisfactory analyses can only be provided by trained statisticians, the elements of the problem can be simply indicated.

FACTORS DETERMINING FUTURE DEMAND FOR EDUCATION

14.3 The future demand for places is affected first by the *natural increase in the population* that manifests itself in the increasing number of children arriving at the age at which it is considered appropriate for them to enter schools. This is the *demographic* basis of forecasting. In this field the educational statistician relies upon the population projections of the demographic statistician.

14.4 Future demand will also be affected by *political decisions:*

(a) lowering the *age for entry* into primary education or making the entry compulsory increases the demand for primary school places;

(b) improving the *efficiency* of primary and secondary education in the way of better schools, better equipment, more qualified teachers, lower pupil/teacher ratios, and so on, will increase the proportion of students passing through the different courses who are qualified to move to a higher level. This increases the demand for places at this higher level.

(c) raising the *school leaving age* has a double effect, It increases the demand for places by lengthening the duration of the course. It also increases the number of those qualified to proceed to higher courses;

(d) future demand will also be affected by the extent to which *financial assistance to students* is available, since there will be a tendency for parents and pupils to plan for longer education in the knowledge that a greater supply of places at the higher level will be available.

14.5 *Domestic factors* influencing the future demand are principally the *education of the parents* and the *material resources of the family*. The higher the level of education of parents the greater the tendency for them to keep their children longer at school. Any marked improvement in their financial standing has a similar effect.

14.6 *Social factors* of importance are the *employment prospects* for successful leavers at different levels of education and the *attitude to marriage and careers* on the part of women.

14.7 In an expanding educational sytem there is finally an overall constraint on future demand set by the so-called *"pool of ability"* or the number of those with the ability to qualify at the various levels of education. It is in practice difficult to distinguish the effect of such innate ability from domestic, economic, or local circumstances of the persons concerned. Moreover, in developing countries, the reserves of untapped ability are so considerable that this constraint can be disregarded.

1. See note to this Chapter.

14.8 Basically forecasting the demand for places consists in projecting forward recent trends in promotion and other rates and applying these to the demographic forecasts of the numbers entering the educational system at the first level for each of the years concerned. The result is the estimated demand for places on the assumption that current trends will continue. The reliability of such forecasts will depend upon:

(a) the extent to which current trends are adequately analysed; and
(b) the extent to which the effect of other factors described in the preceding paragraphs is adequately estimated.

The following paragraphs deal principally with the simple approach to (a).

EXTRAPOLATION AND LINEAR DEVELOPMENT

14.9 A simple method for determining current trends and projecting these trends into the future is the use of graphs as in the process of interpolation (paragraph 10.20 above). If the trend produced in the graph is extended into future years, estimates of future values can be read off against the vertical or horizontal scales. This process is sometimes called *extrapolation.*

14.10 The estimate of the future trend rests upon the assumption of *linear development.*[1] Thus if the entry rates into primary education for successive years in the past are marked on a graph it is assumed that the points when joined will form a straight line; this extended into future years will give the projected estimate. Where in fact the recorded proportions do not lie very close to a straight line the line may still be drawn in free hand, ensuring that the distances between the line and the dots above the line are kept generally about the same as the distance between the line and dots below. This technique is *not suited* to the situation where the proportion entering the level of education is approaching 100 per cent, since at that level it is difficult to make a sensible projection as to the timing and the amount of the next minute advance. In such a case there is the likelihood that the government is on the point of making entry compulsory so that projection is not necessary. Further, if an immediate and rapid expansion of school accommodation (or of teachers) is in prospect a forecast based solely on the linear trend in past enrolment may not be realistic where, as often happens in a developing country, this enrolment has been limited by lack of accommodation (or teachers) as well as by unwillingness to enrol. In these circumstances a forecast based also on the proposed increase in the number of school places (or teachers) may be more useful. These examples illustrate the importance of background information, and the need for experienced practitioners, when forecasting. Normally the period of the forecast is for five or ten years ahead. Over longer periods the forecasts can have a large margin of error and should therefore be presented in a suitably rounded and tentative form.

ESTIMATING TRENDS FOR FORECASTING ENROLMENT: CRUDE PROMOTION RATES

14.11 If the percentages in circles in the figures given in paragraph 13.2 above could be forecast for future years, the figures of enrolment for 1966 could be projected forward by applying the estimated rates to the enrolment in successive grades for successive years.

14.12 Three simple methods for providing estimates of these rates for this purpose are:

(a) assuming the rates found by comparing the enrolment figures in successive grades during the *last two years* for which information is available to be constant during the period for which forecasts are being made;
(b) using, in a similar way, the promotion rates provided by the *last complete cohort* for which statistics are available;
(c) after computing the promotion rates for each of a number of recent years, projecting forward the trends so discovered *for each grade.*

14.13 The *first method* has the advantages that only the most recent information is used, and that good statistics for two years only are required, a consideration which may be of weight when past statistics are of a dubious character and their quality has only recently been improved. The results shown by this method in the illustrative Table 2 are as follows with estimated entry in brackets.

14.14 The disadvantages of this method are first, that the rates refer to the *experience of different cohorts,* the promotion rate from Grade I to Grade II in the example reflecting the experience of those who entered in 1966, the rate from Grade II to Grade III reflecting the experience of those who entered in 1965 and so on backwards through the years. Secondly, there is the assumption, which is also shared by the second method, that promotion rates will not improve during the period under forecast. Where enrolment is fairly stable, for example, where primary education is compulsory, it is unlikely that the cohorts will vary much in composition or the promotion rates vary considerably in the short run. But in the rapidly developing societies and where the educational system is expanding at a high rate, the age composition, for example, of succeeding cohorts may vary considerably and one cohort's experience may not be precisely substituted for that of another.

1. See textbooks for explanations and methods..

Table 2

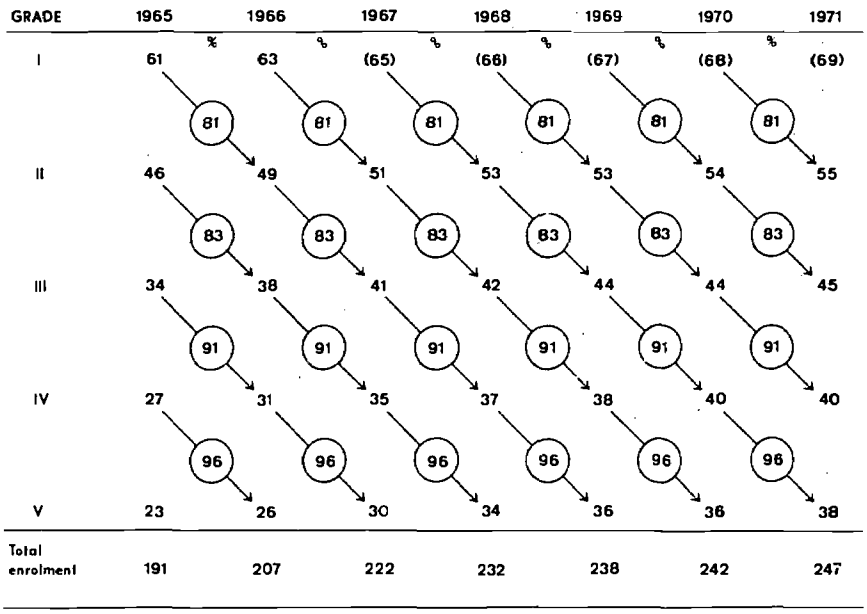


Table 3

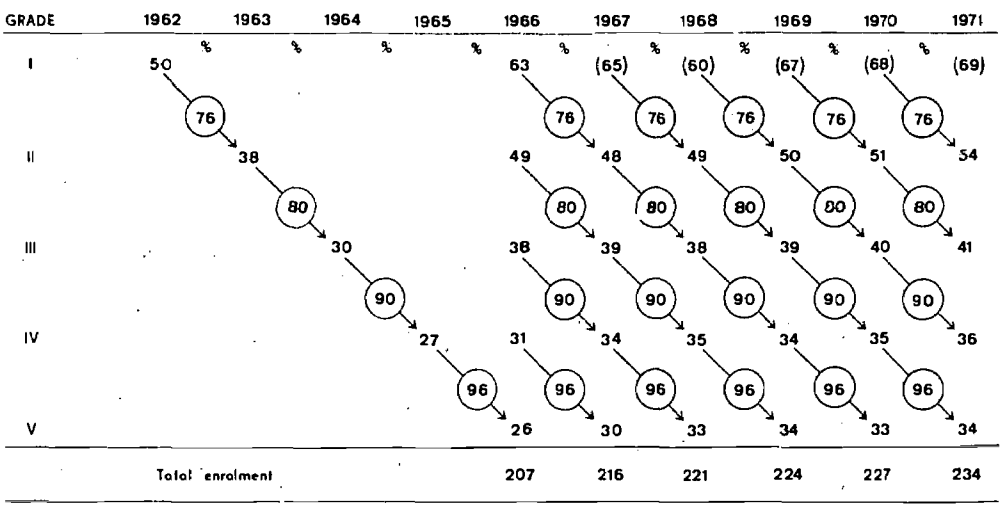
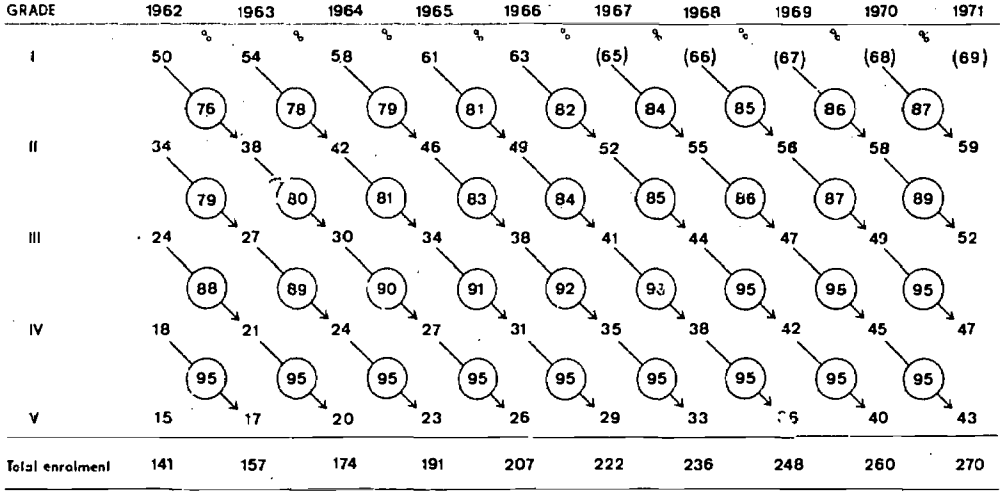


Table 4



14.15 The *second method* attempts greater consistency by drawing upon the promotion rates of a single cohort, to give the following results in the example in Table 3.

14.16 The disadvantages of this method are first, that it draws upon statistical data that are up to five years old and, secondly, that it does not allow for any possible improvement in promotion rates, both important weaknesses in the method when applied to a rapidly expanding educational system.

14.17 The *third method* seeks to remedy these weaknesses. Where reliable statistics are available, making possible the calculation of promotion rates for at least three years – but preferably for at least five years – the rates for each grade, so calculated, can be plotted on a graph and, by means of a straight line projection, the estimated values of these rates found for the ensuing five years. The results given by this method are shown in the example in Table 4.

14.18 It is interesting to compare the total enrolment forecast in each case for 1971. Care has to be exercised in making forecasts of the third kind, particularly where the recorded promotion rates are high since the closer the promotion rates are to 100 per cent the less a straight line describes the trend. Thus a straight line projection of the three rates 94 per cent, 95 per cent, 96 per cent would show rates above 100 per cent in four years' and five years' time and this is absurd. It is probably wise to stabilize the trend at 95 per cent, or at the last recorded level above 90, whichever is the higher.

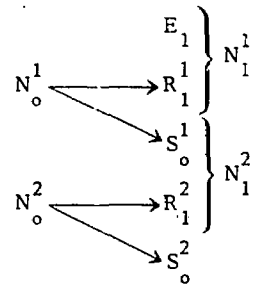
FORECASTING ENROLMENT: DROP-OUT AND REPEATING

14.19 The more useful analysis of promotion is through drop-out and repeating (see paragraph 13.3 above). More precise forecasts of enrolment can also be made by giving separate treatment to them. In developing countries, *repeating* is expected to diminish in the future. *Drop-out* will also diminish, but it cannot be assumed that they will both decline at the same rate. It is therefore important to adjust the forecast separately for each. From the trend shown in drop-out and repeater rates, obtained by one of the three methods discussed above, it is possible to forecast the numbers of drop-outs and repeaters in the future.

14.20 The number promoted from Grade I in year 0 to Grade II in year 1 is the enrolment in grade I less drop-out and repeating, assuming that national estimates are being made (so that transfers cancel out except for those entering or leaving the country) and that mortality is neglected, i.e.

$$S_o^1 = N_o^1 - R_1^1 - D_o^1$$

But enrolment in Grade II in year 1 is composed of both those promoted (S_o^1) and those repeating (R_1^2). The forecasting model is thus



etc.

where E_1 is the number entering in the year concerned (see paragraphs 14.22 and following below).

14.21 The number promoted is found by applying to enrolment (N) the estimated promotion rate (s):

$$S_o^1 = s_o^1 N_o^1;$$

to this must be added the number repeating obtained by applying to the appropriate enrolment the estimated repeater rate (r):

$$R_1^2 = r_1^2 N_o^2;$$

to give

$$N_1^2 = s_o^1 N_o^1 + r_1^2 N_o^2$$

The refined promotion and repeater rates could be used (paragraph 13.10 above). The rates would then be expressed on the basis of those available for promotion ($N_o - D_o$), using the drop-out rate (d) expresed as a proportion of unity, for the purpose:

$$N_o - D_o = N_o\left(1 - \frac{Do}{N_o}\right) = (1 - d_o)N_o$$

so that $$S_o^1 = s_o^1(1 - d_o) N_o^1$$

and $$R_1^2 = r_1^2(1 - d_o^2) N_o^2$$

FORECASTING ENTRY RATES

14.22 The problem is different for first-level, seconf-level and third-level education.

PRIMARY ENTRY RATE

14.23 There is clearly no problem where all the entrants are of a compulsory school age. The entry will then be equal to the numbers at that age forecast by the demographer. If entry is usual at a single age, but not compulsory, the trend of the proportion enrolled at that age can be discovered and applied to the future estimates of the demographer. Where there is also an *age span* in Grade 1, there is a

difficulty which could be met as follows:

(a) a *crude projection* can be derived from the trend shown by the annual increases in N^1;
(b) where there is information to calculate age specific enrolment rates, and also future estimates of age composition of the population, the age specific rates can be applied to the future P and the results aggregated on the assumption that the age span will remain constant;
(c) examination of the trend in the age composition of N^1 (the percentage composition) in recent years would make it possible to project a more precise age composition of future grades to which to apply the age specific enrolment rates.

In both (b) and (c) it is possible to use the short method decribed above (paragraph 12.11).

14.24 In all these calculations regard should be paid to political decisions that may be imminent. One useful exercise in projection is to estimate the demand for places that would result from the introduction of compulsory attendance at a particular age. It should be noted that until the compulsory cohort reaches the final grade, it will still be necessary to predict the enrolment of those in the higher grades. Further, the assumptions about repeating and drop-out must be clearly stated and the calculations based upon them.

SECOND AND THIRD LEVEL ENTRY RATES

14.25 This is a matter of estimating the proportion that enrolment in grade 1 at the second or entry at the third level bears to the number of successful leavers from the primary or secondary schools. Where an examination is also required, a graduation rate is necessary. Quite simply this can be reckoned as the proportion of successful examination candidates to total enrolment in the final grade. Nevertheless, *as a rule, and where the information is available, it is best to project separately each component in the situation*: the appropriate age in the population that could qualify for second level or third level entry; their enrolment rates in the final grade of primary education; the rate of those who sit the examination; and the rate of those who succeed. These different components could well be changing at different rates.

14.26 At this point, and at higher points in the educational system, it must be kept in mind that the entry rate in the past may have been restricted by limited supply of school or university places or teachers, and that an increase in the supply of these must be taken into account if the forecast is to be realistic.

THE DEMAND FOR PLACES

14.27 To derive the demand for places in *primary* and *secondary* schools requires simply the aggregating of the estimated enrolment for all the grades. This is possible since the courses are of known length and are organized in grades. At the *third level*, for estimating the number of places needed for a given series of entrants it is necessary to find a means of estimating the average length of study, a problem complicated by the fact that there are students who drop out of a course and others who spend more than the normal time completing it; moreover, some students take more than one course, for example, by proceeding to post-graduate study. Finally, in most institutions there are courses of varying lengths.

14.28 Once the present average length of study is known, this can first be predicted as a constant. In countries where wastage is high and courses long, the number of places at any one time then equals

100 per cent of this year's entrants
plus last year's entrants reduced by x per cent
plus the number of those entering the year before reduced by y per cent, etc.

Where wastage is low and the courses normally short very similar results to those obtained by this method are given by calculating the *average length of study* in the following manner:

If in 1966 there were 125,000 places and if there were 50,000 entrants in 1964, 55,000 in 1965 and 60,000 in 1966. The total number of places reduced by as many complete annual groups of entries as is possible, that is 125,000 less 60,000 less 55,000 gives a residual of 10,000. The *average duration of study* is thus the number of complete entries plus the remaining fraction,

$$2 + \frac{10,000}{50,000} = 2.2 \text{ years}$$

FORECASTING TEACHER SUPPLY

14.29 The supply of teachers, say, in 1970 will be determined by the current stock in 1965 *increased* by the annual additions for each of the succeeding five years and *diminished* by the wastage that occurs in each of these five years. The gross annual additions consist of:

(a) the output of teacher training colleges;
(b) the proportion of the output of the universities who take on teaching;
(c) those turning to teaching as their second or subsequent job;
(d) those returning to teaching, particularly married women.

The annual wastage results from:

(a) death;
(b) retirement;
(c) resignations and transfers to other employment.

14.30 Because the effect of different causes of

wastage varies according to age and sex, it is necessary to take into account the existing sex and age composition of the stock of teachers and, if feasible, to make some estimated adjustments for any marked changes that may be expected to take place in the age and sex composition of new entries during the succeeding five years: if it is known, for example, that the age of those graduating is likely to be falling; or if there are reasons why a large number of married women are likely to be withdrawing from teaching or re-entering teaching.

14.31 Although the current stock figures should be analysed on the basis of sex and individual years of age to show qualification, previous employment, and the major causes of wastage or loss in the past, for forecasting purposes it is possible to simplify by dealing with certain age groups: ages 21 to 30; 31 to 45; 46 to 50; 51 to 55; 56 to 60; 61 to 65; and 65. The smaller age groups are suggested at those ages where specific wastage rates may be more important.

14.32 The entry from teacher training colleges is the forecast output of successful leavers from these colleges and that from the universities the forecast of graduates reduced by the proportion shown as a trend in recent years of graduates who enter the teaching profession. Estimates of other entrants will be obtained from the trend shown in the employing bodies' returns. These are gross totals of entry for each age group and will need to be reduced by the proportion of loss shown by the trend during recent years due to the various causes noted above. By aggregating the results for each year in each age group the stock of teachers by sex and age group for 1970 will be obtained.

NOTE TO CHAPTER 14: FURTHER PROBLEMS OF EDUCATIONAL PLANNING

1. Simple projections of the demand for places, given certain conditions or targets, require principally the careful application of a set of rates based upon satisfactory basic information. *Manpower budgeting* or *investment planning* (see paragraphs 2.11 and 2.12 above) draw to a considerable extent upon these rates, the required techniques, with the exceptions noted below, consisting largely in the manner of manipulating these simple rates in order to document the total flow from entry at the first level to the final educational output at all levels. Thus the ideas behind manpower budgeting have been formalized in econometric models, relating for example[1] manpower supply factors to the country's volume of production.

2. To this extent all planning rests basically upon the routine work of the educational statistician. At the same time, there are also intricate problems of statistics and of methodology yet to be solved before this wider planning can be successfully achieved. For this reason, the work calls for specialized skill and further research in the field of educational statistics (as well as in the field of demography, labour statistics and national accounting) usually beyond the capacity of the educational statistician in developing countries and experts are called in to assist and Planning Units set up in the Ministry of Education. *They do not nevertheless replace or even absorb the work of the educational statistician; they are supplementary to it*, since the basic work of the educational statistician is more than ever necessary.

3. There are a number of topics in planning where these special skills and further research are required. They can be illustrated by three of importance:

(a) labour coefficients
(b) the economics of education
(c) individualized data.

4. *Labour coefficients* expressing economic skills in terms of the education required to produce them, are crucial to all manpower planning. By " labour coefficient " is meant the number of skilled persons of different types needed for each £1 of output in the particular sector. Once such calculations are made, it is necessary to translate these into educational policy and this requires forecasting the amounts and types of education required to produce the number of skilled persons. But can it be assumed that persons at different levels of educational attainment will continue to choose in the future the same kind of occupations as in the past? Clearly not. On the other hand, information on the intentions of leavers (see paragraph 8.8 above) can only give a crude indication. In particular, the estimates of the supply of skilled office and manual workers are likely to be far less precise than those of professionally or technically qualified persons, if only because persons with primary education and on-the-job training provide substitutes for those having a secondary education.

5. The *economics of education* is a subject covering many complex topics. There is the initial problem of obtaining the necessary statistics, on financial resources and expenditure and some of the difficulties in using them have been noted above (paragraphs 8.18

1. See the example in Tinbergen and Bos: *A Planning Model for the Educational Requirements of Economic Growth.*

and following): Little has as yet been formulated about such general matters as the impact of education as such upon productivity (as distinct from the output of particular skills) and the evaluation of *quantity* of education as compared with its *quality*, are further problems.

6. *Individualized data* are required if the relationship between pupil and teacher backgrounds and their educational histories are to be examined. This information is necessary for the more complex models of investment planning. The I.D.S. (paragraph 7.2 above) is considered to be the ultimate need, working with annual inquiries and less frequent sample inquiries. As an interim measure, much can be done for example if information could be collected by those enrolling pupils at different levels and at examinations, if the pupils are asked where they spent the previous school year and other background information. Since the necessary questionnaire would be complex, most developing countries may still find themselves with insufficient resources, at this stage, to meet even this requirement.

Chapter 15

PUBLISHING: INTERNATIONAL DIGEST OF STATISTICS

INTERNATIONAL COMPARISONS

15.1 When presenting educational statistics for use outside Government, as part of the necessary documentation of the Government's activities, the statistician is concerned to provide information in *sufficient detail* for the various uses to which it will be put, and in a *sufficiently useful form*. In the latter regard, one of the chief uses will be that of comparing the educational systems of different countries.

15.2 This latter use is not confined to the private research worker or to such international bodies as Unesco. One approach to the many problems in educational planning (for example, that of labour coefficient: see paragraph 4 of the Note to Chapter 14) is to attempt to find relationships between certain factors by examining the experience of other similar countries, or even of the more developed countries, despite the fact that such comparisons are fraught with technical difficulties particularly of interpretation.

15.3 In any event, comparability in the statistical evaluation of education is necessary where beginnings are being made towards regional discussions and, possibly, regional planning of education, as for example in the Outline of a Plan for African Educational Development that arose from a Conference in Addis Ababa in May 1961.

15.4 For these purposes, Unesco, arranges for a set of *International* Recommendations[1] aiming to standardize the amount and form of educational statistics published by governments and, through a system of annual questionnaires, regularly collects basic materials in an agreed form. An incidental but highly important effect of these activities is the effort involved in checking national definitions and coverage. This may reveal where the gaps and ambiguities exist and even if an International Recommendation may not be wholly applicable to the country concerned, its consideration leads to clearer thinking about the national statistics. A useful introduction to many of the problems of measuring education that are raised in earlier chapters is thus provided by the International Recommendations; nevertheless, since the aim of the International Recommendations is to reflect and not mould national practice, the task of the educational statistician is to keep in mind the national needs first and foremost[2].

COMPARABILITY PROBLEMS: GENERAL

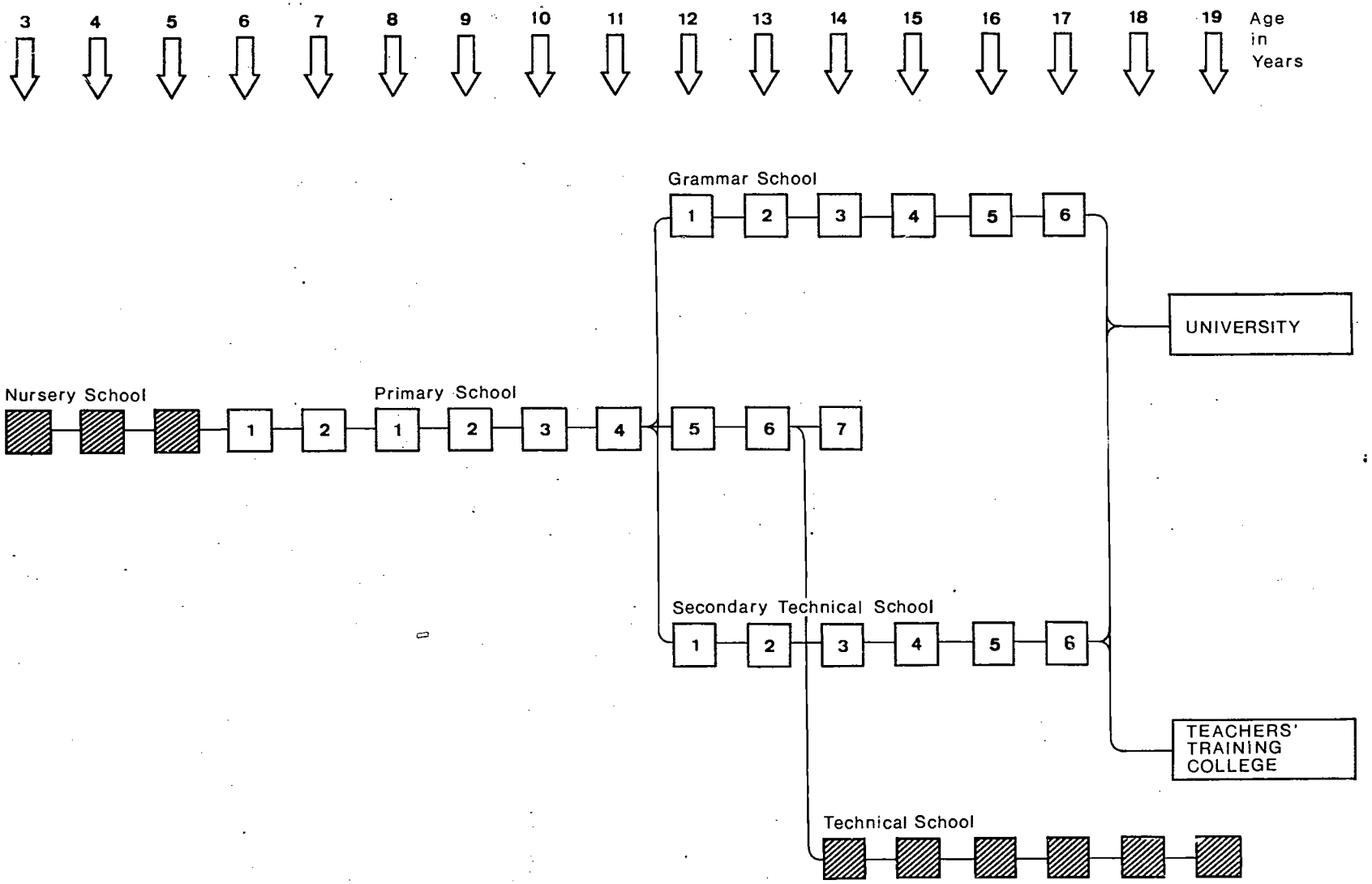
15.5 In developed as in undeveloped countries international comparisons in educational statistics are more difficult to achieve than in many other fields. This is due to the fact that educational systems possess strong national peculiarities arising out of the history and the policies of the countries concerned. In the result, even the simplest forms of comparisons throw up difficult technical problems[3].

15.6 Background information is thus essential whenever educational statistics are published and their use for international comparisons is envisaged. Structural differences are so important that the basic features of the national system should be made clear on all appropriate occasions. A helpful way of doing this is the presentation of an *organigram*. An example of such organigrams is shown opposite, Diagram XI. Where there is a wide age spread in the classes, the organigram should be based either on the average age in each grade or the structure which Government has laid down as its objective. The former is probably more useful. In either case, the basis of the diagram should be clearly noted.

15.7 Comparability problems are aggravated further in developing countries by the special conditions obtaining in these areas described in Chapter 4 above. In particular there is a lack of qualified statisticians with the opportunity to consider these problems and make the necessary operational decisions. These decisions are required because of the

1. Set out in the Unesco *Manual of Educational Statistics*.
2. The present Recommendations were adopted in 1958 and are currently being re-considered in the light of subsequent experience.
3. See A.H. Halsey (Ed.) *Ability and Educational Opportunity*. Chapter 7. OECD December 1961.

Diagram XI. ORGANIZATION OF THE SCHOOL SYSTEM



uneven and rapidly changing character of the educational system. This results in make-shift arrangements which are not easy to classify and fundamental changes, often from one year to another as when, for example, junior secondary may be re-named senior primary.

15.8 Simple international comparisons are attempted on the basis of

(a) the numbers enrolled at different levels ; by subject at the third level ;
(b) enrolment ratios ;
(c) educational finance ; and
(d) teacher supply.

COMPARISONS OF ENROLMENT

15.9 The main problem lies in the *definition of second level.* In the International Recommendations, second level instruction is that lying between basic instruction and the successful completion of a course that qualifies, as a minimum, for entry into third level education. Usually third level institutions can be defined in practice to be those where the courses aim at professional or degree examinations, and the number enrolled is known. Decision will have to be made nevertheless on marginal cases, for example, the teacher-training courses, as in Africa, that may run parallel to secondary courses but extend beyond them. A standard definition of second level as distinct from first level is more complex because of the variation in country practice in the age at which " second " level commences: some preferring for example to have a considerable amount of education beyond the basic instructions carried out in " primary " schools.

15.10 If the description of the course (" primary " or " teacher training ") can be misleading in this way[1], some prior analysis of the enrolment statistics is necessary in order to isolate the relevant components: the " basic " component in primary (for example the first four or five years of primary education) and the " second level " component in teacher training.

COMPARISON OF ENROLMENT RATIOS

15.11 Although the comparison of enrolment ratios is best seen by using age specific enrolment ratios, either as such or depicted in an educational pyramid (see paragraph 12.4 above), a simpler summary is also required to make such statements as that x per cent of the population of one country are receiving education compared with y per cent in another country. A single gross enrolment ratio for all levels is nevertheless unsatisfactory (paragraph 12.2 above), and the attempt to find suitable ratios by level, through the use of a *standard population* to which to relate enrolments, has not been wholly successful.

15.12 The first approach to this problem of a standard school age population was to relate all primary enrolment as defined by the country concerned, to the age group 5 to 14 in the general population and all secondary enrolment to the age group 15 to 19. The comparisons based on these populations are clearly very crude and, for example, the primary school enrolment in Africa, which normally begins at 6 years of age, would be underestimated as a result. A more realistic approach is to use an adjusted formula: the ratios are adjusted by the proportion that the duration of the primary course in the country concerned bears to the standard school age population of 5 to 14. Thus the enrolment of a 7-year primary course would be compared not with the population age 5 to 14 but with 7/10 of that population. This is still not fully satisfactory in developing countries. In most, the absence of detailed demographic information makes it necessary to use rough estimates of the numbers in particular age groups. Further, pupils up to as high an age as 19 may be found in primary schools so that the age range of the pupils enrolled may be substantially wider than the population used in the adjusted formula[2]. Possible ways of dealing with the age span problem have been described above (paragraphs 12.6 and following), but there is still the fundamental difficulty that the comparisons relate to populations of different sizes, as these are determined by different national definitions of what is primary (compare paragraph 15.10 above).

COMPARISONS OF EDUCATIONAL FINANCE

15.13 Until satisfactory financial statistics are available and methods of analysis have been developed (paragraphs 8.18 and following above), comparisons of the cost of education will continue to be very limited. For the moment these are mainly limited to the comparison of public expenditure on formal education. This in aggregate may be expressed as a broad percentage of all public expenditure (a comparison that may have initially to be limited further to the percentage in the national budget of central government expenditure on education), and an estimate may be hazarded of the relative magnitude of public and private expenditure. National expenditure on formal education also lends itself to detailed comparison by level and purpose.

COMPARISONS OF TEACHER SUPPLY

15.14 The number of teachers may in some ways be a better overall indicator of a nation's educational

1. The lack of standardized definitions hampered the assessment of regional targets in the Addis Ababa African Plan of 1961.
2. Moreover, the national ratio may not reflect considerable regional variations.

effort than either the number of pupils or the amount of expenditure on education ; the effort is measured not in money but in numbers of highly qualified manpower devoted to this purpose. It is important for this purpose and others that the quality of the teachers be measured. National practices regarding teacher qualifications are so diverse that this presents a problem of special difficulty which has yet to be adequately resolved.

COMPLETING INTERNATIONAL QUESTIONNAIRES

15.15 With a systematic and progressive set of statistical records, a realistic work programme which provides for this operation, and an appropriate sense of discretion, these questionnaires should not present difficulty if certain rules are also observed.

15.16 First. *The questionnaires should not be farmed out to other departments* but should be completed by the educational statistician. The information required should be available, to the extent that this is possible in the country concerned, in the Statistical Unit or easily on tap from other departments. Further, the decision as to what to include and not to include should lie with the statistician, since he knows best the purpose of the questionnaire.

15.17 Second. *It is better to return the questionnaire promptly with limited information* than to hold it up awaiting final details. If the information is not readily available, it should be stated in the reply. Where discretion is used in deciding how, if at all, to supply the material required, the decision should be that of the educational statistician himself and not a clerk.

15.18 Third. *As much descriptive material as possible should be included* in the questionnaire or in a covering note, explaining any special features of the institutions dealt with, or the coverage of such terms as "primary", "secondary", having in view the purposes of the questionnaire, *No doubt should remain in the reader's mind as to the definitions and coverage of the statistics presented.*

A STATISTICAL DIGEST

15.19 The statistical unit of the Ministry of Education should be responsible for handling all educational statistics and thus responsible for publishing these statistics. Selected tables might appear, suitably edited, in the Statistical Digest of the Central Statistical Office of Government and this is to be expected as normal practice ; but the chief document is the department's own Educational Digest of Statistics, which may or may not appear as part of an annual report of the department itself. The purpose of this publication is:

(a) to provide a full account of the activities of the Ministry of Education and allied bodies for reference within the Ministry of Education itself and other government departments interested in educational policy, and by the public at large ;
(b) to supplement the information provided direct to international agencies for use in international comparisons ;
(c) to provide information for research workers in this increasingly important field.

GENERAL RULES

15.20 The following general rules are suggested as guidelines:

(a) ample funds and time should be allowed, particularly in lauching the first issue or in undertaking a radical review of existing publications. Timing is important. The publication date should not be so optimistically assessed that adequate care cannot be given to final preparations. Further, the publication date should be at a fixed point each year. Irregularity in publication dates means that the publication loses in respect and usefulness ; it is best to publish a little regularly than a larger quantity, irregularly, that is scrappily presented ;
(b) it will help if the tables to be published are geared into the records maintained by the statistical unit for its own purposes (see paragraph 9.8 and following above) ;
(c) a short description of the educational system and an organigram of the structure (paragraph 15.6 above) should always preface the publication ;
(d) the relationship between the definitions and categories used in the publication, and those recommended for international comparisons, should be carefully described. Where possible tables should be set out in the form of the international recommendations ; this would increase the value of such a digest considerably ;
(e) the comments regarding tabulation (see paragraph 9.10 above) should be applied with particular rigour in such publications to ensure that the tables are easy to read and are self-sufficient. A document in roneoed form may be unavoidable in early days, and has its use as a pilot publication, but consideration should be given to producing a printed document at the earliest possible moment because of the greater durability and ease of reference of statistics in this form ;
(f) the aim should be to include as long a time series of statistics as possible since the trend in education is as important as the stock position at any particular date.

COVERAGE OF A STATISTICAL DIGEST

15.21 The following items are suggested as a basic check list. Not all the information will be provided by the educational statistician but the comprehensive information within one set of covers is desirable. There is a great deal of additional information which could be of interest to readers of different types, for example, details of ancillary services in the schools, a number of derived statistics evaluating the educational system and more detailed flow statistics. If the information is available and the resources are such that extra tables can be added, a suitable selection would increase the value of the publication. Priority should nevertheless be given to the main basic tables ; and to publishing these in sufficient regional detail.

15.22 The digest could be helpfully introduced by a number of summary tables of the kind, for example, showing total enrolment by type of school and level of education, with a percentage distribution, and similar tables for teachers. The main tables will then follow:

I. PRIMARY AND SECONDARY EDUCATION

Schools

1. At each level by type: number of schools, of pupils by sex, of teachers full-time and part-time, of pupils per full-time teacher or equivalent; average size of class, and (where appropriate) number of boarders.
2. Similarly for each region.
3. Size of classes by type of school at each level of education.
4. Special schools: number of schools in each category and number of pupils by sex and number of teachers.
5. School buildings: number by type at each level including those approved, completed during the year, and in progress, by number of classrooms and pupils. Value of buildings approved, completed during the year and in progress.

Full-time pupils

6. Projection of population age 0-30 by sex and individual years of age, 5, 10, 15 and 20 years ahead.
7. Number of pupils by age and grade according to sex enrolled in schools of different types at each level of education.
8. Similarly for each region, with repeater rate and drop-out rate for each grade and, where possible absentee rate.
9. Leavers in final grade by age and sex : examination candidates successes in each type of school.

Teachers

10. Number by type of school at each level of education, showing qualification and, at second level, main subjects taught.
11. Number at each level of education showing those continuing in employment, new entrants and departures, and average salaries.

II. FURTHER EDUCATION

12. Number of full-time and part-time students in each type of school by age and sex; number of full-time and part-time teachers by qualification.

III. HIGHER EDUCATION

13. Number of full-time students in, and graduates (distinguishing between first degree and subsequent examinations) from university and equivalent institutions, by age, sex, subject and specialization.

IV. FINANCE

14. Expenditure on education according to source, distinguishing between level of education and type of school.
15. Recurring and capital expenditure by purpose over period of years.

Chapter 16

ORGANIZATION OF A STATISTICAL UNIT

THE CENTRAL STATISTICAL OFFICE AND EDUCATIONAL STATISTICS

16.1 An adequate system of government statistics in developing countries requires a Central Statistical Office (under whatever name) where the qualified statistical skills available to that country are mainly located. While such skills contine to be in acute short supply, it is preferable that the qualified statisticians working in government should be under the management of this office. The type of management will vary from one country to another. The central office may be organized as a single unit serving all the departments directly, or as a headquarters unit with statisticians outposted to the various departments, and thus in daily touch with their problems. Or its control may take the form of ensuring that all statisticians in government service form a pool from which, after consultation with the central office, departments will appoint for their own purpose.

16.2 The question arises whether a separate statistical unit is required in the Ministry of Education for educational statistics. It is evident that to attempt to set up a large, self-sufficient, statistical unit within the Ministry, parallel and possibly in competition with the Central Statistical Office, could be a waste of resources and might even entail delay before educational statistics are put on a sound basis. There would be, in fact, advantages in full responsibility for educational statistics being taken over by the Central Statistical Office.

16.3 These *advantages* are many. The Central Statistical Office is already in existence and it may be easier to expand this organization marginally than to set up an entirely new organization elsewhere. The Central Statistical Office may even have the necessary regional contacts and field staff. Already producing a wide range of statistics, this office is in a good position to understand the problems of educational statistics, and it could bring to bear upon these problems a wider range of specialists, in collecting, computing and calculating, and also in publishing. The office would, as part of its general work programme, be in a position to absorb the irregular pattern of work load inherent in educational statistics and would be well placed to coordinate the educational statistics produced by different sources, to bring together not only the statistics produced by the Ministry of Education's activities but also those of the local authorities, the universities and other private bodies. There will inevitably be trouble about timing, both of dates of reference and of dates when the statistics become available, and the central office with its legal ordinances may be able to ensure consistency in these matters. With its larger staff it can more easily organize training facilities, and provide the time and transport for maintaining personal contact with localities.

16.4 Further, the central office, by its control over a central machine installation for handling government statistics generally, could also provide mechanical sorting for educational statistical data as part of its general work programme. It may well have, in addition, its own printing facilities. Finally, the office, having its own separate budget, can bring pressure to bear at a high level for ensuring adequate financial resources for a statistical work.

16.5 There are nevertheless clear *disadvantages* of such an arrangement. They arise principally from the possible inflexibility of the programme of the Central Statistical Office and the defects of "remote control" over educational statistics. The Central Statistical Office will be committed to producing routine statistics on a large scale and needs to work to a strict time-table, which it may be difficult to adjust to any special needs. Moreover, under pressure of other work, educational statistics may not receive sufficient attention. With a statistical unit located in the Ministry of Education, educational statistics would have the first priority. Finally, the intimate knowledge of the educational system essential to the production of good statistics, may easily

be lacking in the central office. For this office to be in charge of educational statistics can be considered if at all as an interim measure until the introduction of the Education Ministry's own unit.

APPOINTMENT OF AN EDUCATIONAL STATISTICIAN

16.6 Thus even where the Central Statistical Office may undertake the major work of processing the information it is necessary for there to be a statistical unit in the Ministry of Education itself, to ensure proper priority for educational statistics and to be responsible within the Ministry for statistical analysis and briefing the Ministry's planners. It would maintain contact with the Central Statistical Office for these purposes and, within the Ministry of Education, with the headquarters administrative staff and local officers, and with those responsible for planning. Ultimately the unit would in most cases, take over responsibility for all editing (including card punching) even where the actual processing may be undertaken by a central machine installation, since the unit would be in the best position to edit and code the material. Close relations will nevertheless be necessary with the Central Statistical Office both for this purpose and in order to draw, where necessary, upon this office's survey organization and specialist technical skills. (See paragraphs 5.8 and 8.22 above for examples).

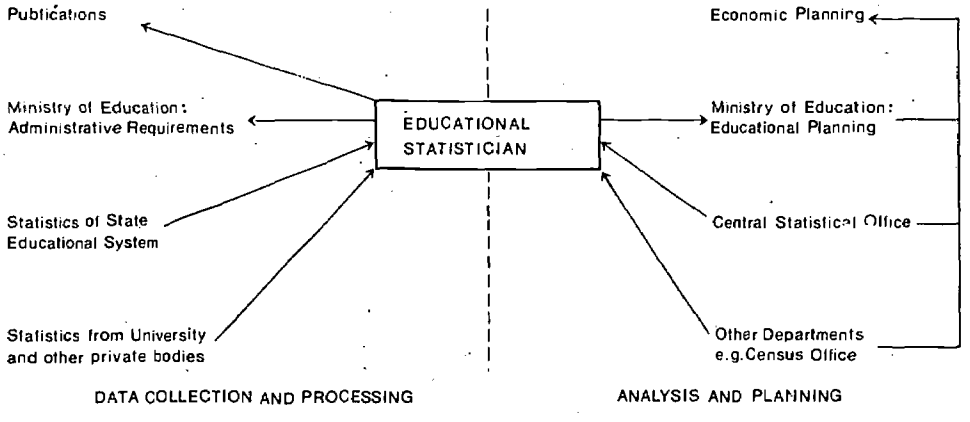
16.7 The existence of planning officers, and possibly a planning unit, within the Ministry of Education itself is recognized as necessary to meet the modern problems set by educational policy and a close link between the provision of statistics and the planning programmer will also be necessary if both planning and the arrangements for collecting statistics are to be realistic. A direct link of this kind between the planning unit and the Central Statistical Office would be too tenuous to be satisfactory and the function falls to the Ministry's statistical unit. To ensure adequate weight in policy-making and skill in analysis (or in calling upon the skills of the Central Statistical Office) this unit should be headed by a qualified statistician and the *appointment of such a person is the essential first step in building up a satisfactory statistical service* in the field of education. Where it is not possible to recruit an academically qualified statistician for the post, urgent consideration should be given to sending a senior executive officer from and possessing wide experience of the work of the Ministry for training. The shortage of such officers at this level, as well as at the professional level, raises the question whether this officer should not be one of the members of the planning unit, and fulfil two functions. Planning officers nevertheless should normally not be responsible for educational statistics; these statistics will be required eventually to check on the adequacies of particular plans and are best provided from an independent source; moreover, the statistical programme should not be solely determined by the requirements of the planners. Nevertheless, if there is a planning committee or board within the Ministry, served by a planning secretariat, it is important that the educational statistician, controlling an independent statistical unit, should be one of its members.

THE WORK OF THE EDUCATIONAL STATISTICIAN:

16.8 The educational statistician must be both statistically qualified and familiar with the work of the educational system, centrally and locally. In addition, he must have the administrative ability required to programme the work of a statistical unit. These qualities are essential: the first to ensure an adequate standard of presentation and analysis; the second to provide a realistic approach to the problems of educational statistics; and the third to minimize delay and the possibility of error in the detailed work of processing and presentation.

16.9 His central position and diverse functions are illustrated in the following diagram XII, showing the flow of educational statistics and other information to the educational statistician and the flow from him into its various uses:

Diagram XII. THE EDUCATIONAL STATISTICIAN AND THE FLOW OF STATISTICS



It will be seen that there are two major functions: (a) data collection and processing; for the purpose (b) analysis and planning.

The first involves organizing a section for data collecting and processing; the second, of applying techniques, and of obtaining additional information and assistance from other departments in government. This suggests a basic twofold organization of the statistical unit, each with different requirements of skills, staff and equipment and each possibly with its separate head reporting to the educational statistician. In the early days of development these may be no more than Statistical Assistants, that is, having middle-level qualifications (see paragraph 16.22 below).

COLLECTING AND PROCESSING DATA

16.10 The fact that much of the basic material is collected by the annual questionnaire at one date in the year, and that the results need to be immediately processed for use, dominates the arrangements. The work involved in processing the information contained in the annual questionnaire should not be spread out throughout the subsequent twelve months since the results would not then be available until as much as eighteen months after the date to which they refer. For these statistics to have their maximum value the processing should be completed within a few months of the date of collecting and subsequent publication in a printed form will take a further two to three months. There are thus two major problems of management: that of the *peak workload period;* and that of *suitable activities for the rest of the year.* So far as the peak period is concerned it is a question first of minimizing delay and secondly of staffing. The two problems are interrelated.

DISTRIBUTING AND CHECKING THE ANNUAL RETURN

16.11 The printing and dispatch of the forms must be planned sufficiently well ahead to ensure that copies are received by the informants two weeks before the date to which the information refers, with full allowance for possible delays in distribution; information on possible delays should be obtained by spot checks on the distribution procedure each year, and by subsequent reports from those responsible for distribution. The responsibility of the educational statistician does *not* finish at the moment the forms are dispatched.

16.12 The forms should be returned within two or three weeks of the date to which the statistics refer. Within a further week, inquiries should immediately be put in hand where a return has not been received. At this stage every effort should be made to ensure a complete return and a clerk full-time on this work, under close supervision, may be necessary. This waiting period must be strictly limited. It is unlikely that the more substantial sources of information will fail to make a return and it is preferable to continue with the processing rather than await the eventual arrival of marginal information. The gaps must, nevertheless, be carefully noted both for purposes of presentation and for further inquiry if necessary after the peak period. Should a marginal return be received during the process, it is normally better to include the information as an amendment when the *following* year's statistics are presented rather than delay current processing.

16.13 General rules for editing and checking have been indicated above in paragraph 9.3 and following paragraphs.

A WORK PROGRAMME

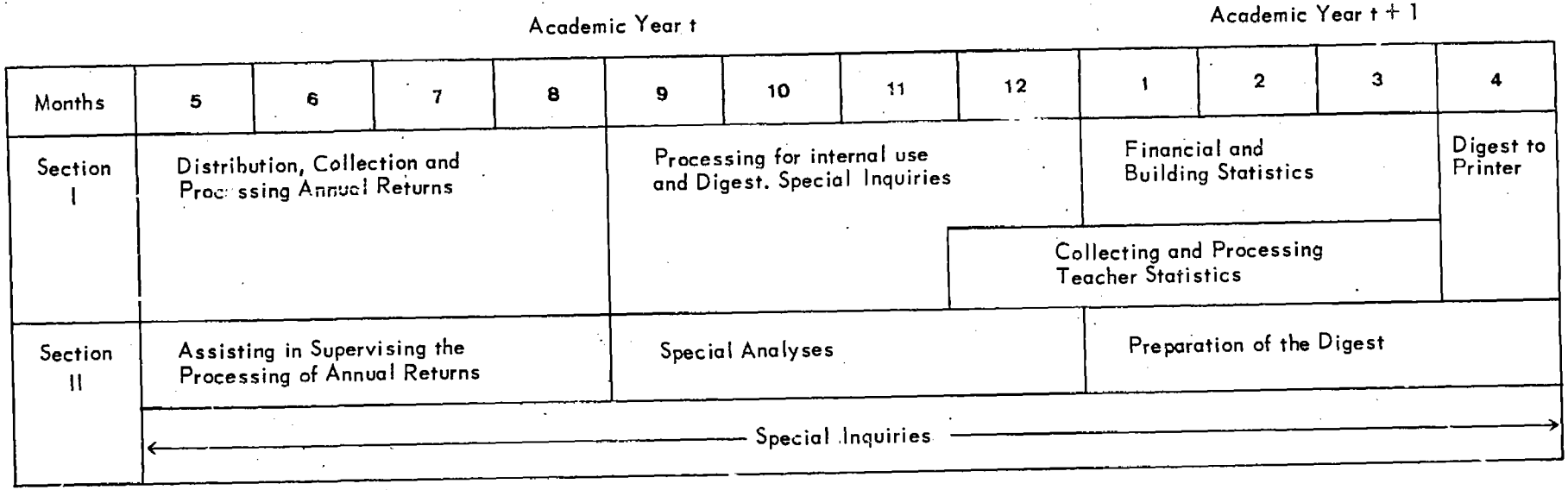
16.14 Subject to the possible use of casual labour at the time of the peak work load, which will occur in the middle of the academic year, the educational statistician, with his two assistants, and supporting clerical staff, would have continuous work during the year, geared to the two sections, which would necessarily work in close collaboration. Diagram XIII illustrates the type of work schedule that is possible with good management.

16.15 There must be flexibility in adjusting the work programme to local conditions and resources, but target dates for each part of the work should be fixed to reflect the rhythm of the work: the annual return, its processing and the publication of the results. Once these targets are established, the necessary clerical staff should be determined (and their supply made a condition of providing the statistical service) and other work adjusted to it. It will be necessary to control the work by progress reports for each job, on a monthly or preferably a fortnightly basis.

MECHANICAL AIDS

16.16 Mechanical aids in office routine and statistical procedures economize in the use of labour and increase the efficiency with which the material is handled, in particular by reducing the possibility of error. Both results are of special applicability to developing countries. It is a waste of the time of a qualified statistician to have to compute manually or to be hampered by lack of typing and duplicating facilities; and it is also wasteful to have manual *computing* at the clerical level; manual *sorting* may be another matter. Once it has been decided what form the statistical unit should take the question of

Diagram XIII. WORK PROGRAMME IN EDUCATIONAL STATISTICS



suitable equipment can be easily solved, *given expert advice*[1], and its provision should be given the highest priority. As compared with the difficulty of increasing qualified skills in the office that of equipment is largely a matter of financial resources and thus may be particularly suited to assistance through aid programmes (see paragraph 16.30 below).

16.17 The chief mechanical aids are calculating machines, duplicating machines and sorting machines. Modern electrically operated automatic multiplying and dividing machines are desirable for analysis work and there should be one or two available for use by senior staff, supplemented by a number of manually operated calculating machines. Further, one adding machine, preferably electrically operated, should be provided for every two clerks concerned with processing. Typewriters with suitably long carriages for tabulating work should be available and also mechanical means of duplicating, in a clear and expeditious fashion, questionnaires and other circular forms that may be required in large numbers: to await the government printer for this service can entail unnecessary delay.

16.18 Tabulating, as a first stage in analysis, entails classifying and for this purpose the original information has to be sorted and re-sorted to assist in these operations. There are a number of simple sorting devices for such purposes, usually in the form of punched cards that are arranged manually and sorted by needles or by a vibrating mechanism. Where large quantities of materials are concerned it is economic in time and labour to use both mechanical punching machines and machines that sort and re-sort mechanically, and a number of governments have installed these machines to deal with payroll, trade, census and other statistics. It is not always the case, nevertheless, that the use of these machines is always the best solution. Sorting is a simple process and the machines are costly ; especially where the flow of work is irregular, and they may stand idle for long periods. In some operations it may be more practica' to use manual sorting, recruiting labour for the operation. Where resources are meagre this may also be the best way of dealing with the peak load of educational statistics.

AUTOMATIC DATA PROCESSING (A.D.P.)

16.19 The latest development in this field is the electronically operated computer, constructed first with mathematical and scientific applications in mind and later introduced into the fields of business and of statistics. A.D.P. is now being installed in government departments throughout the world. It saves labour[2], but the major return to such investment is that of greater efficiency of the organizations concerned. A computer, by coding numbers into varying pulses of electric currents, not only achieves a very high speed of work but also makes possible complex calculations even though its basic operations are extremely simple. With the normal punched card installation repeated sorting of a large number of cards throws up the required totals. This is a time-consuming process and limits the nature of the statistical analysis which is possible. The computer, if it has a large enough store, can theoretically produce full tabulations from a single run-through of the cards without any repeated sorting. In fact it is often the case that the store is not big enough to give a complete analysis from one run-through of the data and some pre-sorting would then be necessary. Without expensive magnetic tape inputs and outputs an A.D.P. machine is not a sorting device so that ancillary punch-card machines may also be required and a computer with its ancillary equipment may thus cost a considerable sum[3]. Further, to staff a small or medium installation might require two or three machine operators, a resident engineer and, once established, three or four programmers. This would be in addition to operators required for punching and operating any ancillary punch-card machine. A.D.P. in consequence raises problems of cost in cash and manpower. At the same time its advantages could be considerable where facilities can be arranged and the future possibilities are vast. In some developed countries they are already being used for storing centrally information about individual teachers or individual schools for use in subsequent tabulation. Its possible use in connexion with I.D.S. has been noted in paragraph 7.2 above.

TRAINING

16.20 It must be a major objective of the educational statistician to ensure training for his staff. Since the supply of suitably trained persons for this work is the chief technical obstacle in the way of producing adequate educational statistics in developing countries, some sacrifice of their time to this end must be faced. This sacrifice can be minimized by a balanced use of the various facilities available:
(a) in-service training ;
(b) middle-level training centres in the region ;
(c) professional training in the region ;
(d) training in developed countries.

1. The advice of experts is essential, not only of those selling machines of all kinds, but also of those with experience of organizing an office. Instances are not rare in developing countries of offices with the wrong kind or amounts of mechanical aids. Merely to order a quantity of machines is not an answer in itself to the problem of organization.
2. It has been estimated that on an average for every £ 1,000 invested one person will be released for other duties.
3. New designs are nevertheless continually coming on to the market, many being cheaper, more compact and less dependent upon anciliary machines than former models.

IN-SERVICE TRAINING

16.21 A few hours' lectures given in the office every week to selected clerks has the clear advantage of providing training without severe interruption in the work of the persons concerned. On the other hand, the amount of skills that can be imparted in this way is limited, so that the *lectures should be rigorously practical* and not theoretical. Principles of rounding, simple tabulation and simple calculation rules, are suitable for such courses; although a few lecturers to the senior officers on less elementary topics would be valuable. In some cases it may be found practicable for this work to be undertaken in conjunction with the Central Statistical Office, possibly wholly arranged by that office.

REGIONAL MIDDLE-LEVEL TRAINING CENTRES

16.22 More systematic training is required for the less junior officers. In particular, statistical units depend in a large measure upon middle-level officers (Statistical Assistants) for the greater part of their processing work. Those officers who have successfully studied mathematics at the second-level are candidates for this work, much of which can be learnt in the office itself. Some short-term (about 9 months) training is also essential, the course covering mathematics (a refresher course), elementary statistical methods, statistical organizations and procedure, and applied statistics. The course must be highly practical, directly related to the special field work and other problems of the region, and should give the student both a general training in statistics and experience of the applications in particular fields. Officers from the educational statistical unit will receive special training in the practical problems of education statistics.

16.23 Few developing countries can afford to provide such middle-level training facilities themselves, although where Statistics Departments have been introduced into the local university, courses have been successfully arranged. On the other hand, both because of costs and the importance of basing the training on local experience, training outside the region cannot normally be considered. This activity is particularly appropriate to the regional bodies of the United Nations and the Specialized Agencies. For example, the Economic Commission for Africa has set up a number of training centres in co-operation with host governments. The United Nations makes provision for the appointment of Directors of the Centres, for equipment and for granting fellowships. FAO, ILO and WHO arrange for lectures in their fields, and the host governments meet the physical requirements.

REGIONAL PROFESSIONAL TRAINING

16.24 The objective is to provide, as a minimum, three professionally qualified statisticians in the statistical unit of the Ministry of Education (paragraph above). It is not essential for all to have obtained a degree in statistics since good professional qualifications can be provided for Junior Statisticians as at the Rabat Institute in Africa (Morocco), which offers a two-year course.

16.25 Degree courses required for statisticians intended for the senior posts are only just being instituted in the universities in developing countries and on the increasing co-operation between these bodies and government will depend, in the main, the future of statistical training in the regions.

TRAINING OUTSIDE THE REGION

16.26 The greater amount of professional training in statistics continues to be provided outside the region, often under Aid Programmes (see following paragraphs), both at the university level, for degrees, and for such professional examinations as those of the United Kingdom Institute of Statisticians, a body which also provides a useful year's training for Registered Statistical Assistants.

AID FROM DEVELOPED COUNTRIES

16.27 The main developed countries have programmes of aid on which the educational statistician can draw for building up and improving his statistical service. This aid is channelled to the developing countries either as *bilateral aid*, direct from donor to recipient; or as *multilateral aid*, dispensed through an international agency.

16.28 Bilateral aid takes two forms, financial aid and technical assistance. *Financial aid* makes available a flow of funds to the recipient country either as loans (on terms that vary from loans free of interest to those at market rates) or as grants. This financial assistance can be directed to specific projects or given for such general expenditure as budgetary aid. Appropriate projects of interest to the educational statistician would be the provision of equipment (paragraph 21.5 above) or the provision of a reference library essential to the adequate working of a statistical unit. The select bibliography in the Annex could form the basis of such a reference library.

16.29 *Technical assistance* makes available to developing countries, bilaterally and multilaterally, the skills of the developed countries, either by the provision of experts to work in the developing

countries or of training facilities within the developed countries. The experts may be advisers to government, on short or long-term missions, or, as with the U.K. Overseas Service Aid Scheme or the United Nations Opex posts, they may fill operational posts, usually for longer-term assignments. Technical assistance could provide the means for getting a statistical unit off the ground ; it is *not* a long-term substitute for a statistical unit. Nationals from the country concerned must be trained as counterparts eventually to take over the unit, and a proper emphasis given to training the necessary supporting staff.

16.30 In addition to helping a statistical unit come into being, technical assistance can make a special contribution to improving the work of the educational statistician in a number of ways, such as the following

(a) providing lecturers for training centres ;
(b) providing experience in the statistics unit of a Ministry of Education in a developed country ; this is only applicable to experienced and senior candidates who are well versed in the problems that arise ; younger persons are best trained in their own country ;
(c) advice on the design particularly of the annual return and its processing ;
(d) advice on the organization of the statistical unit, including the use of mechanical aids ;
(e) advice on suitable analyses for planning purposes.

16.31 To make full use of technical assistance it is helpful to specify the type of advice required in some detail rather than to apply generally for an " educational statistician " as such. Academically qualified statisticians are in short supply and if the advice required is rather that of a suitable expert in organization and methods, or of someone with a special knowledge of the administration of educational statistics as distinct from a theoretical knowledge of the statistical problems involved, this should be clearly stated.

Chapter 17

FURTHER PERSPECTIVES

RESEARCH IN TECHNIQUES

17.1 As interest in educational statistics is increasing, new and more suitable techniques are being explored to meet the growing demands of the planners. For this reason, the educational statistician cannot simply use an inherited body of rules; he must also be experimenting with new methods. This is particularly the case in developing countries where special and novel conditions (see paragraph 1.7 above) obtain.

17.2 While grappling with the initial task of introducing a good basic service, the statistician in these countries may have little time for further research. Nevertheless there are a number of important technical problems that remain to be solved before this basic can be considered to operate satisfactorily. While it is always important *not to discard an existing method until the new one has been amply proved*[1], and innovation for its own sake is to be avoided, fresh thinking is urgently required on the part of those who are familiar with the special problems of the developing countries.

REGIONAL MEETINGS OF EDUCATIONAL STATISTICIANS

17.3 Many of the technical problems involved are common to the countries in each region. Opportunities for the statisticians concerned to meet to discuss these problems would in consequence be valuable in a number of ways. It would be possible on these occasions to exchange experiences of particular methods, hear about new work in countries of similar structures, obtain, as a group, expert guidance on questions of special difficulty, and study problems that require the regional approach, problems such as training of educational statisticians, regional standardization and regional planning. Such meetings could also help in raising the status of the educational statistician in the eyes of governments and others. As a start, the exchange of official statistical publications could be arranged.

TOPICS FOR FURTHER RESEARCH

17.4 Some indication has been given in this Introduction of the topics which require further examination in order that a satisfactory statistical service can be provided. The major items can be listed for convenience.

(a) Financial statistics in general (paragraphs 8.18 and following).
(b) Forecasting techniques (paragraph 14.2).
(c) Training: middle level training (paragraph 16.23); regional professional training (paragraph 16.24); courses for statisticians in demography (paragraph 5.6), sampling (paragraph 5.8) and planning (paragraphs 2.13 and 14.1, and Note to Chapter 14).
(d) Special problems of measurement: extra-curricular activities (paragraph 3.5 (a)); adult education (paragraph 3.5 (e)); pupil background statistics (paragraphs 8.5 and following); school equipment (paragraph 8.16); accommodation (paragraphs 8.17 and 13.16) and literacy (paragraphs 8.27 and 8.28).
(e) Special problems of definition and recording: the listing of schools (paragraphs 3.5 and 6.3 and following); age (paragraphs 4.9, 6,20 and following); pupil coding (paragraphs 6.24 and following); and international comparisons (paragraphs 15.1 and following).
(f) Use of mechanical aids (paragraphs 16.16 and following).

1. This may mean testing the new method parallel with the existing method; the efficiency of the new method can then be observed and a link will be provided between the results shown by the old method and those shown by the new (if it is adopted) when recording a time series (see paragraph 10.1 above).

Annex

SELECT BIBLIOGRAPHY

I. EDUCATIONAL PLANNING

International Institute for Educational Planning: Educational Planning: a Bibliography, Paris, 1964.

Griffiths V.L. Educational Planning, London, 1962.

Harbison F. and Myers C.A. Education, Manpower and Economic Growth, U.S.A. 1964.

Harbison F. Manpower, Education.

Hunter Guy, Education and Manpower, London, 1962.

Education for a Developing Region, London, 1963.

Lewis W. Arthur, The Meaning of Economic Growth, London, 1955.

Development Planning, London, 1966.

Unesco: Economic and Social Aspects of Educational Planning, Paris, 1963.

Unesco: Elements of Educational Planning. Educational Studies and Documents. No. 45, Paris, 1965.

Unesco: Educational Planning Practice in the Developing Countries, Paris, 1965.

Vaizey John, The Costs of Education, London, 1958.

II. EDUCATIONAL STATISTICS

Economic Commission for Europe: Statistics of the Educational Characteristics of the Population.

Conference of European Statisticians. Working Group on Statistics of Education, Geneva, 1965.

Edding Fredrick: Methods of Analysing Educational Outlay, Unesco, 1966.

Goldstone L., A School Cohort Coding System. Conference of European Statisticians: Working Group or Statistics of Education, Geneva 1965.

Idenburg Philip J., Statistics in the Service of Comparative Education: International Review of Education, Vol. II, No. 4, 1965.

Stockwell Edward G. and Nam Charles B. Organization for Economic Co-operation and Development: Methods and Statistical Needs for Educational Planning. Paris 1967. Illustrative Tables of School Life. Journal of the American Statistical Association, Vol. 58, No. 304, December 1963.

Unesco: Economic and Social Aspects of Educational Planning. Ch. X (Statistics needed for Educational Planning: K.G. Brolin) and Bibliography, Paris, 1963.

Unesco: Manual of Educational Statistics Paris, 1961.

Unesco: Recommendations concerning the International Standardization of Educational Statistics, Paris, 1958.

Unesco: Statistical Yearbook, annual.

Unesco: Statistics of Illiteracy, Paris, 1965.

Wallberg K., Statistics of the Educational System and of the Educational Level of the Population; Needs and Possibilities.

Conference of European Statisticians. Working Group on Statistics of Education, Geneva, 1965.

III. GENERAL STATISTICS

Allen, R. G. D., Statistics for Economists, London, 1960

Barclay George W., Techniques of Population Analysis, London, 1958.

Blanc Robert. Manuel de recherche démographique en pays sous-développé - C.C.T.A. 1959.

Conway F., Descriptive Statistics, Leicester, 1963.

Croxton Frederick E. and Cowden Dudley J., Applied General Statistics, London, 1950.

Guilford J.P., Psychometric Methods, New York, 1936.

Fundamental Statistics in Psychology of Education, New York, 1956.

Ilersic A.R., Statistics, London, 1964.

Kendall Maurice G. and Buckland William R., A Dictionary of Statistical Terms, London, 1957.

Tippett L. C. H., Statistics, London, 1956.
United Nations Statistical Office: Demographic Yearbook, annual.
Yates, F., Sampling Methods for Censuses and Surveys, London, 1960.
Wallis, W.A. and Roberts, H.V., Statistics, A New Approach, London, 1957.

IV. DATA PROCESSING

United Nations and FAO: Studies in Data Processing Methods: Scope and Principal Methods of Data Processing, Rome, 1957 (Provisional edition).
Studies in Data Processing Methods: Manual Methods and Tools for Data Processing, Rome, 1957 (Provisional edition).
Studies in Data Processing Methods: Questionnaire Design. Processing Aspects, Rome, 1959 (Provisional edition).