STUDIES IN EDUCATIONAL COSTS

by

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SUMMARY

Aims

There were three interlinked aims.

1. To devise a multi-functional cost-accounting system which could be used by Scottish Education Authorities.
2. To analyse the costs of primary and secondary schools in sufficient functional detail to establish the costs of individual schools, different kinds of schools, different activities within schools and, where appropriate, different subjects within schools.
3. To establish procedures for projecting and forecasting the costs of primary and secondary schools for five to ten years ahead.

Procedure

A multi-functional cost-accounting system was devised and applied to the accounts of all the schools in a typical Scottish Education Authority for the year 1964/5. Each account was coded according to categories of a) school (including subdivisions into size and kind), b) school subject (for secondary schools), c) class of expense, d) value of expense. The data was stored on punched cards which were processed according to specific programmes to produce an analysis of the costs of education in that Education Authority. A simplified form of the accounting system was used on a sample of 14 schools in another Education Authority for the years 1961/2, 1964/5 and 1967/8. These investigations were complemented by analysis of the total expenditures of all Scottish Education Authorities for the years 1959 - 1968 and for individual Authorities for the years 1962/3 and 1965/6.

Results

1). Expenditures related to teaching staff dominate all other heads of current expenditure. Teachers' Salaries and related costs took up roughly 68% of expenditure allocable to Education Authorities in 1962/3, roughly 80% of expenditure allocable to individual primary and secondary schools in 1964/5 and roughly 90% of expenditure allocable to the 'Teaching function' of individual subject departments in 1964/5. (Chapters 3 and 4)

2). Expenditure per pupil by the Education Authorities rose by 50% in real terms in the years 1959/60 - 1966/67. (Chapter 3)

3). Expenditures per pupil varied by as much as 100% over the 35 Education Authorities and the level of the unit expenditures related closely to the demographic/geographic nature of the Authority. (Chapter 3)

4). Expenditures per pupil, based on one Authority, were shown to be £101 in primary schools and £219 in secondary schools. The ratio of expenditures on teachers in secondary schools to those on teachers in primary schools was rather more than 2:1. The ratio of expenditures on staff teaching years IV-VI of secondary school to those on staff teaching years I-III was roughly 7:4. (Chapter 3)

5). Expenditure on directly educational materials, books, etc., was shown to be only 4.7% - 6% of the level of expenditure on Teacher's Salaries and related costs (Chapters 3 and 4).

6). The expenditures per pupil on individual primary and secondary schools ranged over approximately 250%. (Chapters 3 and 5)

7). Economies of scale were shown to operate in primary schools. For instance, two schools, one of which is eight times the size of the other, will have unit expenditures such that those in the larger will be 57.5% of the level of those in the smaller school (Chapter 5).

8). There is a close association between unit expenditures and pupil/teacher ratios. In primary schools 69% of the variability in unit expenditures can be accounted for by the relationship between unit expenditure and pupil/teacher ratio. In secondary schools the figure is 50% (Chapter 5).

9). Unit expenditures also vary amongst school subjects, and for the same subject amongst schools. Roughly half of the variation in unit expenditures can be ascribed to the relationship between unit expenditures and the average size of class for a subject. (Chapter 4)

10). Teacher distribution between primary and secondary schools was found to be somewhat inelastic in response to change of school rolls over a period of years covering bhe 1960's. (Chapter 6)

11). The estimates of expenditure by Scottish Education Authorities for the year 1974/5 based on 1966/7 prices varied from £200m. to £280m. depending on the method of projection and assumptions concerning the numbers of teachers and the zate of growth of their salaries. (Chapter 6)

Conclusions

Accounting procedures in education should be extended and refined so that they can produce the kind of costing data necessary for management of human, material and financial resources. The impending re-organisation of local government units should give the opportunity for review of both accounting procedures and the collection of pupil and teacher statistics. Expenditures should be allocated to educational programmes and related to human and material inputs in order that the future cost implications of current educational decisions may be evident to administrators.

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CHAPTER 1

WHY STUDY THE COSTS OF EDUCATION?

Introduction

Studies in Educational Costs has its origin in a paper by (Edding,1964), the title of which - Efficiency in Education - must still conjure up an Orwellian nightmare for many an educationist. His hypothesis was that 'efficiency in education is comparatively underdeveloped', and he surveyed the areas in which research might be done to clarify the issues affecting the efficiency of education. Heady stuff indeed at a time when, in the U.K., the expansion of higher education was still a reality, much needed curriculum changes were hitting the secondary schools, and a socialist administration had taken office. Educational programmes and plans might then have been constrained by lack of resources (mainly teachers and buildings) but money problems hardly seemed to enter the scene in the mid sixties. Untouched by the effects of the omnipresent financial squeezes of the past few years, there is a hard inner core of educationists who would be most suspicious of an academic enquiry into the costs of education. Their credo is that educational reforms might well involve increased expenditure but such expenditure will be balanced by proportionate gains in the quality of education. There is often present, in the writings of such educationists, an implication that increases in expenditure will have some effect on education, and therefore, ipso facto, increased expenditure is justified. Who knows? It may be true that additional outlays on, say, school transport have some, as yet unrecognised influence on the "quality" of achievement of those pupils who use the transport system.

It will be a theme of this work that questions about the possible link between educational standard, quality, output - call it what you will - and expenditure on education are of secondary importance at this time. There are more basic questions regarding resources in education.

They are:

a) Is the proportion of public expenditure allocated to education appropriate for our current national goals?

b) How are resources allocated to education used? Are there possibilities of doing more with the present level of resources, or the same amount of things with fewer resources?

In other words, does education have a big enough slice of the national cake, and how well does education slice up its own cake?

Efficiency

There is still doubt as to the validity of questions regarding the efficiency of education. Can we define the term, efficiency, at all meaningfully? Economists use it in connection with the relationship between input (of resources) and output (of product). The apparently intractable problem of measuring the output in education has caused reactions such as:

> "Education has ends in itself. They must be achieved regardless of costs, because these ends are of absolute value. They cannot be measured and be related to exogenous factors. Economic growth, costs of production, or prices of finished goods have no meaning at all for the understanding of educational systems and for their comparison. Efficiency is not a criterion that can be admitted in this field." (Edding,196 5)

Such evasion leads to grossly unequal inputs (of money and resources) to educational institutions being justified on the basis that "different" kinds of education are being provided.

The danger is that, if time is to stand still until philosophers define and educationists have measured the output of education, economies like our own will have 'gone burst' in the effort to finance all the means for attaining the ends which are "of absolute value".

The long term aim of a Department of Education and Science project - D.I.E.C.A.T. - contains an antidote for the efficiency evaders: (DES,1965)

> "The overall object is to assist in the introduction into educational systems of a revolution in efficiency - that is an increase in value received in relation to resources used - as has occurred in industry over the past 200 years."

The parallel is plain. Education must regard itself as an industrial concern: it must interest itself in how it uses its resources. It is with this facet of efficiency in education, namely the allocation and use of resources, that this work is concerned. There is ,however, another facet which bears, at least at first sight, more directly on what is actually done in schools. This is the cost-quality relationship in education. Firman(1964) , in a paper on this topic, illustrates anew an old American neurosis concerning value for money in social services:

> ". .if it is to be shown that there is a cost-quality relationship in education, and if it is to be acknowledged that schools are not universally good or universally bad but that each does some things well and other things poorly, then it must be possible to relate specific items of expenditure to specific measures of performance to establish the relationship"

As a thorough analysis of the costs of education will show, a simple correspondence between expenditure and performance is most improbable. The costs of education are just not built up in a way that the effects of <u>specific</u> items can be traced to <u>specific</u> pupils or classes. Firman falls into the same category as those educationists who imply that increases in expenditure will inevitably have <u>some</u> effect on education. The fundamental misconception of those who would seek an explicit cost-quality relationship and those who imply that increased costs increase quality (which cannot of course be quantified) lies in their lack of understanding of the inputs to education.

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[1] D.I.E.C.A.T. stands for Developments in Educational Cost Analysis Techniques.

Education and Economic Growth

Leaving aside, for the present, the consideration of education as a user of resources, it is fitting to draw attention to the notion that education creates resources, for it is largely this latter idea which has stimulated the expansion of education in all countries in recent years.

In attempts to measure the determinants of the growth of national income there were found large residual components : attention then turned to human capital. Putting that another way, the major part of growth in production, in developed countries anyway, over the past 50 years cannot be ascribed to inputs of physical capital, man hours and natural resources. The major part must be put down to technical progress and human factors among which education plays a prominent part. What is then more intriguing than the results of retrospective analyses of economies is the possibility of controlling, or at least partly determining, the wealth of a nation by varying the total quantity and the quality of education.

At this point, two issues must be raised concerning, in the first place, development, and secondly, the nature of the inputs to education.

The God of most modern societies is development. This has been defined in the U.N. Development Decade report as 'growth plus change; change is social and cultural as well as economic, and qualitative as well as quantitative.' Harbison (1964) observes a more familiar definition given to it by economists who tend to equate development with "economic growth and concern themselves with the process of savings and investment and the increase of national income and productivity." Admitting then that development is, perhaps, something more than economic growth there is still no escape from the goal of increasing wealth or per capita income. The means of reaching this goal - whether by formal education, on-the-job training, or other means - must concern all countries.

Inputs To Education

If the residual factor in economic growth can be ascribed at least partly to education,we are still left with the difficulty of identifying which elements of the total inputs to education work towards increasing economic growth. Renshaw,(1960) sees this problem as partly one of separating out the effects of various forms of education:

> "The correlation existing at the aggregate level between formal education and other kinds of education prevents us from obtaining a reliable measure of the instrumental effect of a change in the amount of formal education on production."

Obviously, the skill of any one worker is the resultant of his background variables - socio-economic class, personality, attitudes, ambition, health etc., - his formal schooling (both general and vocational), his on-the-job training, and his degree of participation in further or adult education. At the moment, we do not know nearly enough about the costs (or benefits) of providing the various forms of education with the result that we are unable to judge whether any substitution of one form of education for another is desirable or whether we could improve our resource utilization. For a start, we can list what should be known about educational expenditures in any country.

a) How much is spent on all forms of education, general and vocational, private, in the armed forces, on-the-job, in industry?

b) How much of the total expenditure on education is health, welfare and social service support?

c) How much is spent per head at the various levels of education?

d) How much do increased costs reflect new modes of organisation within the country and within the schools and how much an increase in the real inputs to education?

e) How much do increased costs in education reflect price increases? Can a price index be constructed which is appropriate and specific to the education sector?

f) /

f) What is the cost of producing "qualfied leavers" from the various types and sizes of schools and other educational institutions?

All of these questions bear upon the nature of the inputs to education. If a relationship exists between the wealth of a nation - measured by its income or G.N.P. per head - and educational expenditures per head, it is unlikely to be a simple one. Since the inputs to education are very heterogeneous, it seems prudent to carry out extensive analysis of the costs of education before embarking on calculations which purport to indicate the extent of the relationship between G.N.P. and expenditures on education.

Consumption or Investment?

In the absence of the necessary analysis of costs, some economists have traced the crude expenditures on education per head over time relative to income per head. Schultz,(1961) calculated this education-income ratio (which ratio relates resources used in education to consumer income) for the U.S.A. for the period 1900 to 1956. He found that the ratios indicated that educational resources rose from 2.9% to 10.3% relative to consumer income. There are two ways to interpret the fact that in half a century resources allocated to education rose by three and a half times relative to consumer income. First, if we regard education expenditures as consumption this estimate "would not be inconsistent with the hypothesis that the income elasticity[2] of the demand for education is highly elastic. A 1% increase in real per capita income was associated with a 3.5% increase in the allocation of resources to education." Secondly, if we look upon the resources entering education as investments based on the behaviour of people seeking investment opportunities, this estimate is not inconsistent with the hypothesis that the rate of return to education was very attractive.

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[2] Income Elasticity: If a 1% increase in educational expenditure were associated with a 1% increase in income, then the income elasticity would be 1%. An income elasticity of more than 1% means that, as per capita income rises, the proportionate share devoted to educational expenditures rises. In short, the income elasticity of educational expenditures is the percentage change in educational expenditure associated with a 1% change in per capita income.

"The returns presumably were larger than those to physical capital to have 'induced' the implied larger rate of growth of this form of capital."

Furthermore, a cross spatial examination of educational outlays, at any point in time, will show that the developing countries spend little of their national wealth on education (1 - 2% of G.N.P.), Mediterranean countries spent 2 - 4% of G.N.P. and advanced economics 4 - 6% of G.N.P. Are these amounts the causes or effects of the economy? Sachs(1967), investigating the effectiveness of income constraints on educational expenditures, reports Edding's view that since the requirements of an industrial society can be assumed to be more or less uniform in countries of a similar stage of growth, these needs may be expected to determine largely the educational plans or goals. Edding's subsequent hypothesis that the total of all efforts taken in the sphere of education remains in remarkably steady relationship to national product receives support from his finding of a highly significant correlation between education expenditures per head and per capita income for 18 countries. However, Sachs reports that Blot and Debauvais made calculations which reveal that education outlays are not uniquely related to income; income is probably the major but not the sole determinant of educational outlays. Like Schultz, they found that the income elasticity of educational expenditures was greater than unity, i.e. as per capita income rises, the proportionate share devoted to educational expenditure rises.

Such investigations may be important for the future planning of economies. All the more reason to examine critically the underlying assumptions made in the calculations. Two major criticisms can be levelled at the above studies which seek some simple relationship between educational expenditures and economic growth. The first concerns the essentially heterogeneous nature of the inputs to education - people's time, buildings, equipment, land - all put on a common denominator of money.[3]

[3] Having said this, there is no other obvious denominator.

Yet, the proportions of the factors of production might be changing, the quality of teaching may be altering, the demographic distribution may be changing. We are surely a long way from separating out those expenditures which are of a consumption-type and those of an investment-type. We know little of the educational effect of the health/welfare expenditures. We cannot tell how much the increased costs of educational services reflects a real increase in the quality or quantity of inputs. The second criticism concerns the supposed returns to education (in the shape of increased wealth) and their obvious time-lag. Generally speaking, there is a long interval of time between the beginning of education [the investment activity] and the reaping of the 'full fruits of the higher capacity to produce'(Benson,1961). Compared with investment in physical plant the returns to education take a long time to accrue. Economists have called education a lumpy investment i.e. it is not subject to manipulation in small pieces or over short intervals. Accordingly, the income per head figure for a nation is not the part-result of that particular year's investment in education, but rather it represents the part returns from expenditures from many previous years. Of course, one could make estimates of the time-lag for particular employments but there would remain the huge unsolved problem of relating per capita income to past educational expenditures. What must be plain is that the crude assumption that expenditures on education can be related to income per head for the same year will not give a true picture of the investment possibilities in human capital.

Returns to Education

But, the returns to education accrue not only to the nation but to individuals as well. The more education we have the more will we earn in our lifetimes. Becker(1959) found that in 1950, males were earning a 14.8% return on what they had privately invested in acquiring their high school, college and university education, measured by their opportunity costs (earnings foregone while being educated) and their direct costs (tuition, books). Renshaw(1960) points out that Becker's estimates were made on <u>mean</u> income differentials and that these obscure the differences in income amongst college graduates.

He suggests that a better estimate would be founded on median income differentials. A more basic criticism of Becker's calculations (and of other similar attempts to estimate the returns to individuals) is the glossing over of the large number of factors which might well correlate with formal education, e.g. socio-economic class, differences in ability, educational opportunity. Vaizey(1962) is sceptical about research into the returns to education:

> "....all the statistics may go to show is that incomes are unequal and that education is unequally distributed; there may be no necessary causal relationship between education and income".

He reiterates his doubts in a paper on the role of education in economic growth where he states that

> "There is no demonstrable connection between education and later earnings which is not as close as the connection between birth and later earnings." (Vaizey,(1963)

The impact of work on returns to education may well be felt ultimately in the methods of the finance of education. Should students receive loans instead of grants? Johnson,(1968) observes that university students like to have public policy consider them as a "subdivision of the deserving poor", whereas in terms of lifetime income prospects they are destined to earn incomes well in excess of the national average. If a rational system of individual-state joint finance of education is adopted it must be based on the actual costs of education.

We have said how education uses resources and we have proposed that cost studies should enable us to allocate these resources between competing uses more rationally. Also, a new branch of economics - the study of investment in returns from human capital - has been shown to be in urgent need of cost data.

Resources In Education

It is to the aspect of education as a user of resources that we must now turn. In a national system of education barely a century old, there must be considerable opportunities to plan for efficient use of real resources, teachers, pupils' time, buildings, equipment etc.

Some of the questions regarding the planning and organisation of education are: How large should a school be? Do unit costs keep on decreasing as a school becomes larger, or do they fall off with increasing size then, after a critical point, start increasing again? In rural communities does the value of having the school as an integrating social institution not outweigh the savings (in money terms) from centralisation of schooling? If the supply of teachers should limit educational provision, what can be done to obtain optimum use of teaching resources? To answer these questions fully, the facts about the use of human and material resources and, the cost implications of alternative resource allocations must be known. Before we can answer questions which concern whether we can afford one system or educational programme or another, we must know a) the expenditures on the alternative systems b) the value of production foregone, for any human resources used in teaching have a "potential" value in the wider economy as well as a use in other parts of the education system.

In situations where skilled labour is scarce we must have reliable and valid instruments for measuring the degree of scarcity. For instance, the present teacher shortage in Scottish secondary schools might be the result of an over optimistic policy regarding the pupil-teacher ratio. There is some evidence that the shortage is in fact confounded by a regional maldistribution and by varying standards of provision between schools within the same region. (S.E.D. 1969). Some educational philistines are asking if the lowering of the pupil-teacher ratio - a policy pursued as a matter of political course - leads to an increasing quality of education at all; even if it does, can we afford it? With a relatively fixed number (in the short run) of skilled people from whom teachers are drawn, what effect does increasing the demand for teachers have on the rest of the labour market and on the economy? We do not, as yet, know the optimum relation of class size to learning but can we afford to allow class sizes to drop indefinitely on the questionable assumption that the quality of education must be improving?

The Swedish government faced just such a dilemma in 1966 when it directed local and regional authorities to arrest the continuous lowering of class size. (O.E.C.D.,1968). Indications are that on present definitions of shortage, the deficit of primary teachers has been wiped out at a national level though there will be regional pockets of shortage for some time. A lowering of the maximum for primary classes would once again increase the demand for teachers, a demand which may outstrip the supply, thereby leading to a situation of shortage. Shortages are very much a creation of our own.

A Technology of Teaching?

The solution to the problem of the shortage of skilled teaching labour in this country and elsewhere, and to the problem of ever-increasing expenditures on education has lately been thought to be in the application of a broad technology of education. By this is meant the systematic and controlled use of T.V., teaching machines, programmes, computers, language laboratories to present quality-tested learning packages which are properly programmed with built-in opportunities for student responses and feedback of results. Vaizey,(1966) asked bluntly, but as yet in vain, if these new teaching techniques will enable us "to improve education without increasing the numbers of teachers at the rate which we have up to now accepted as necessary to get that improvement."

Little progress has been made in the U.K. in the direction of introducing these innovations into education other than in a supplementary capacity. As such, their employment only adds to existing costs and no skilled labour is replaced. For instance, the largest local E.T.V. system in the country, operated by Glasgow Corporation Education Committee at a cost of more than £150,000 per year, relies on each class teacher being present with his or her class when a programme is shown.

All these innovations must be fully costed before their submission to finance committees for approval: that goes without saying. But, and this point has been overlooked, the sponsors - the innovating educator, the hardware entrepreneur - must show how their introduction can be fitted into the on-going educational system.

Without this, innovations in education will be looked upon by teachers as time wasting gimmicks, and by parents and ratepayers as unnecessary paraphernalia. The sponsor of the new teaching system must show that his system can teach - that comes first - and that it does so at least as effectively as conventional instruction, and that it costs say £2 per student-hour for a school year, while conventional instruction costs £2.5 per student-hour for a school year. In arriving at his costs, he must take into account the life expectancy of his system, its storage requirements, its maintenance costs, the likely proportion of time it will be used, the potential audience. In short, he must know a considerable amount about both the innovatory and conventional costs so that he might demonstrate that, with certain organisational changes, his system will save money, not merely increase the overall costs, with at least the same quality of education (as far as it can be appraised).

<u>Educational"Standards"</u>

Just how important the increasing quantities of educational aids are in the total budget is not likely to be revealed without a rather more thorough analysis of expenditure than the conventional accounts system gives. But, the increase of educational hardware is only one part of what might be called the <u>development factor</u> in education. The other side of the development factor consists of the generally rising standards of expectation which society has, with respect to the provision of public education. Modern buildings are more spacious. Compared with pre-war buildings, they have additional facilities such as art/craft rooms, gymnasia, swimming pools, and there is a huge amount of equipment used from lathes to electric sewing machines, from potters' wheels to fridges. In terms of cost per pupil Vaizey,(1967) has observed that new buildings are more expensive to maintain than old buildings. More generous provisions of space per pupil make new buildings somewhat cheaper, in terms of costs per sq.ft., than old ones to maintain.

The capital costs of buildings are relatively easily controlled, but what of maintenance costs? How much do schools of different design cost to run? What use is made of educational facilities in evenings and vacations? Is there duplication in the provision of public buildings? What are the relative costs and benefits of integrated and separate units, say school and community centre, school and health clinic? A more intriquing question for teachers than those referring to resource utilization concerns the impact of these increased standards of amenities on the education of the children. Does a centrally heated school promote learning or induce sleep - or both? An American survey of the school attainments of roughly half a million children - Project Talent - concluded that school achievement was more closely associated with teacher salaries and experience than with school size, class size, or age of buildings (Dailey,1964). A priori, one would not anticipate that the scores on tests should depend on how old a school was or even on the maintenance costs of that building. School inspectors repeatedly tell of good work being done by pupils and teachers in the most primitive educational environments. New buildings and pleasant school environs might, other things being equal, cause an increase in the morale of the staff, which increase _might_ be felt by the pupils: but, that is sheer conjecture.

The gist of what we have been saying is that

a) the inputs to education are very heterogeneous,

b) the implications for learning (or any other educational aim for that matter) of alternative ways of organising the inputs are almost completely unexplored.

Economic Considerations In Education

The discipline of economics exists because of _scarcity_. The intrusion of economics into education is appropriate because education is a user of vast resources. These resources, or most of them, have alternative uses. There is, then, a need to harness our resources in education as efficiently as possible.

This would be so even if we did not have to face the prospect of a) an almost constant, if not actually decreasing, volume of public expenditure; b) a constant proportion of this expenditure being allocated to education. Roughly £2,000m is being spent currently on education in U.K., this sum is of the same order as the defence budget and is roughly 20% of the total public expenditure. At this time of an economic freeze there are many worthwhile educational plans "on-the-stocks", all competing for the resources. Among these are plans for R.S.L.A. [4], comprehensivisation of secondary schools, increasing nursery school provision, aiding deprived areas, expansion of tertiary level education. Politicians and educators are entitled to hold the opinion that society ought to give up, say the idea of R.S.L.A. in order to aid deprived areas, but, unless such opinions are based on a careful evaluation and balancing of the alternative plans, they can have only the status of personal judgement. Detailed cost data are essential in assessing the feasibility of one project against another and of one set of priorities against another.

Planning and decision-making based on cost analysis has been, and still is, hampered by the lack of cost data. However, costs themselves have costs. Johnson(1968) states that an important new development in economics is:

> "the recognition that the information required for the making of choices is not a free good, but has a cost of acquisition that may not be worth paying"

In the days before quantified educational planning, it might have been reasonably argued that the cost of setting up the accounting systems which would have been able to produce cost statistics analysed by school, curriculum, or educational programme, number of pupils etc., would have outstripped the use to which such statistics would have been put at that time. The advent of computer-based accounting systems should lead to a fall in the cost of producing the now much needed information.

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[4] R.S.L.A. Raising of the School Leaving Age.

Decision-making about specific projects has suffered on account of the absence of cost data. So also has the forecasting or projection of educational resource needs. The projection of costs requires knowledge about detailed unit costs, including probable cost implications of educational innovations as well as knowledge of demographic fluctuations, migration and emigration and trends to remain at school beyond the statutory leaving date. Projection is an important part of economic and educational planning because:

1) the long term (say 5 years or more) needs of education for manpower and other resources must be integrated with the overall development planning;

2) educationists must ensure that the share of the G.N.P. going to education at least keeps pace with school population trends (over time most countries will find that there is a shift from the less expensive to the more expensive levels of education);

3) at a regional level, the projection of costs should focus attention on the planning, phasing and siting of schools taking into account possible increases or decreases or shift in population. Such action might lead to schools of the "right" size being in the "right" place at the "right" time.

4) We have a duty to taxpayers to budget for the future and since currently adopted policies have expenditure implications for the future, we must project or **forecast resource needs.**

Much of what has been said about the needs for projection of costs rests on the assumption that education is or will be planned. "Planning is concerned with setting up an effective system for utilizing resources to their best advantage to serve given ends." (UNESCO 1964). Educational planning is the first sub-branch of education[5] to lean heavily on economics as a mother-discipline. This association should stimulate interest in education in the alternative means of attaining desired outcomes. Planning implies a systematic consideration of alternatives in order to produce a range of courses of action. The question is, which system?

[5] That is looking at it from the point of view of one whose first interest is education. Economists may not agree that educational planning has any footing in education but rather they may feel that it is a branch of applied economics.

In many countries there is very little in the way of systematic gathering of demographic, school, financial and costing data. And even among those countries where data sources do exist, the variety of conventions, methods of reporting, and general lack of standardisation of statistics, causes a certain lack of comparability of published statistics. The uses of international planning comparisons are in the setting of targets and in the substitution of data from one country in the plans of another where there is a lack of planning data. Since it is clear that international educational planning comparisons are worthwhile, it is vital to ensure that like is really being compared with like. Towards this end, O.E.C.D. have published a handbook or blue print of statistical needs (O.E.C.D.1967). Eventually, once all countries are collecting data and processing it in a similar way, educational systems of various countries might legitimately be compared quantitatively.

Input - Output

As it has been argued, the input to education, conventionally reported in crude money terms, is heterogeneous and as such it is possible to vary the allocations of resources to various heads of expenditure or to different levels of education. Now, there are areas of education where the same output (or ostensibly the same) is produced by different institutions or by different means. For instance, 'A' level or 'H' grade work can be done in school or F.E. college. How much does it cost to produce each 'A' level, in, say, chemistry in school and in the F.E. college? Are these true alternative means of attaining a given end? Some would argue that the end-products are only superficially the same, and that in fact the 'A' level obtained in the school was a mere by-product of the larger aim of educating "the whole man". Even so, the fact remains that scarce resources - teachers, buildings, equipment - are being combined to produce the same product in different institutions.

It would be wise to compare the alternative costs and resource profiles[6] of a pass on the 'A' level chemistry exam in both types of institution. In some areas, a rational management of education might mean that senior school pupils would be offered the chance to take an 'A' level course in an F.E. college or do without it. Even if no appraisal of the quality of the alternative outputs can be made, the cost and resource implications of the alternative routes to the output are required so that adequate budgeting and planning can be done. If this kind of data were available then decision makers would be able to forecast the cost and resource implications of their choices. One would hope that the exercise of forecasting would influence decision making, and cause it to be more rational.

The notion of educational output is still inescapable. Any systems analysis consists initially of a rigorous analysis of the organisation, culminating in the formulation of objectives expressed in operational terms. For an educational system the pervading educational philosophy should define more specific curricular objectives. The nearest approach to the rigorous assessment of output has come from the field of programmed instruction. The devotees of this method of instruction, by insisting on precisely stated behavioural objectives hold out the greatest hope for realistic cost-effectiveness studies in education. If the same objectives can be shown to be attained by alternative means, say, by a printed programme, or by a teaching machine, or by integrated T.V. and programmed script, or by automatic tape-slide presentation, clearly feasibility can only be discussed when the capital and running costs of each system are known. Such analytical procedures as cost-effectiveness studies are designed to aid in the evaluation of competing alternatives.

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[6] Resource Profiles are the proportions of the various factors of production involved in producing the output.

Summary

The general thesis of this chapter has been the need to cost in education. At no point has it been advocated that costs and costs alone should direct educational policy and planning. The aims of the study of costs in education are limited to creating the methodology whereby it is possible to estimate in advance the financial effect of changes in organisation, methods or curricula in education. The cost data generated might influence decisions to change existing practices in order to obtain optimum use of available resources; or the data might be required for comparative purposes.

Caveat

The classic example of the misuse of cost data in education is provided by the Scientific Management school of education administrators in U.S.A. 1910 - 1930. Callahan(1962) notes that in this unfortunate period the word "efficiency" as applied to education was equivalent to "lowest cost" and excellence was judged by that criterion. The "finest product" was forgotten in the search for per pupil costs. Among measures taken to decrease costs were; a) increasing class sizes, b) increasing teacher loads, c) increasing school size, d) eliminating certain expensive subjects e.g. Greek, e) creation of "platoon" schools where a system of "shifts" of pupils was adopted.

Such educational myopia is not dead. In a paper to the Committee on Educational Finance of the N.E.A. Firman(1963) recalls that the Committee agreed

1. "....it is time to apply all intelligent means to arrest costs not necessary to a sound educational program through the most prudent management of educational affairs"

2. "....savings of $100m. or more annually can be achieved in the cost of public schools and within the foreseeable future a saving between $300m. and $400m. per year is possible".

The stimulus in this paper is clearly the desire to save money. Little attention is given to questions of the factors influencing costs or alternative means of educating the same numbers of children. First and foremost, money must be saved.

In a later paper, (Wohlferd,1968), an administrator with New York State Education Department, oblivious of the large literature on the Scientific Management era in education, asks as if for the first time "Why cannot industrial cost accounting methods be applied to the business of educating children?" His final remarks that only through the establishment of cost-benefit methods can "the citizen be assured his children are receiving the best education for his hard earned tax dollar" is surely aimed at those who would cut education expenditure without considering other non-financial data.

Conclusion

There are always those who doubt State intervention on a large scale in a sector of a capitalist economy. Some of them, like E.G. West, believe that most families would invest in education anyway without the "vast, costly and cumbrous machinery of state administered finance" (West 1965). At these times when private spending is curtailed by heavy direct and indirect taxation, more people grow concerned at what happens to public money. We owe it to them to have ready the answers to questions on educational finance and expenditure.

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CHAPTER 2

THE APPROACH AND METHODS OF RESEARCH

Introduction

This volume has emerged from a Scottish Education Department sponsored enquiry entitled the Scottish Educational Costs Project (S.E.C.P.). In order to understand the research method, it is necessary to discuss the origins of that project or, more exactly, the interests and inclinations of the initiators of it. The long first stage of the enquiry not unexpectedly revealed problems in the research plan, problems which were time consuming to solve. The very detail of the pilot project was most instructive to the writer in so far as it raised so many issues e.g. allocation problems, capital/current expenditure definitions, which in a more global or macro approach would have been lost. Moreover, the sheer volume of hack-work involved at this stage stimulated a search for less weary methods of costs analysis; the result of this search was the follow-up exercise.

Briefly, then, this chapter will describe the method of enquiry, and discuss the problems encountered in cost accounting at the micro level of education i.e. in the schools themselves.

ORIGINS

The S.E.C.P. was the brain child of an educationist, Ian Espie, whose special interest was in educational innovations, and an economist, Emil Rado, who had expertise in the field of manpower planning in developing countries. They were joined at a later date by J. Sleeman, Department of Political Economy and M. Mepham, Department of Accountancy to form an inter-departmental supervising committee. The writer was appointed by Glasgow University, on the advice of this group, as Research Assistant and sole full time worker. The remit was as follows.

> "The investigation will be concerned with the factors governing the total and per capita costs of education at various levels and will explore the effects of various teaching techniques on these costs. It is hoped that a contribution will be made by this enquiry to the long-term projection of educational costs." [1]

[1] (From the Scottish Educational Costs Project - Draft Remit.)

There were seen to be two interdependent stages in tackling the remit. First, an analysis of educational costs at education authority and school levels in order to find out the principles and methods by which educational expenditures were determined and controlled, and the points at which decisions of a financial nature were being taken. Secondly, an analysis of the total and per capita current and capital costs of primary and secondary schools in selected counties, in sufficient functional detail to make possible a careful interpretation of the causes of inter-schools cost differences both within the same county and as between different counties.

A later enquiry was to look at the impact on costs of new teaching methods. But, in effect, this latter part was felt by Espie and Rado to be the real flesh of the project; the initial enquiry being necessary to build up the skeleton. They were anxious that the later enquiry should concentrate on the measurement of the innovatory costs rather than on the educational effects of them. They reasoned that, although new methods are normally introduced for reasons which are educational rather than financial in origin, they have financial and resource implications if and when they pass from the invention or experimental stage to the diffusion or application stage.

What was intended by Espie and Rado was an investigation of the economics of new teaching methods via an enquiry into the costs of conventional education. What actually transpired was a much more detailed probing of the costs of schools without much reference to innovations. Thus, the objective of the project was not attained, mainly because of what Espie and Rado had themselves feared viz the new technology of education had not reached many schools in Scotland, nor where it had reached, had it made any real impact on the organisation of school, say, by altering the method of time-tabling or the size of the classes.

Having outlined the original plan it is fitting to describe the "modified" objectives and methods adopted by the writer.[2]

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[2] Also, the departure of both Espie and Rado to posts in Africa, when the project had run for 7 months, must be taken as another factor which caused the original objectives to be altered by the writer.

The broad aim of Studies In Educational Costs is to set out guide lines for a methodology of cost projection in education. Following from this aim, there is a need to develop a set of accounting procedures in education which would furnish planners with the costs of individual schools, subjects within schools (where this is appropriate), staffing costs for different levels of education, costs of equipment (especially of technology in education), as well as other data necessary for medium and long term planning.[3] The subsidiary second aim must be tackled first. The research might aptly be termed an exercise in cost accounting in education.

The bulk of the work on first sources was devoted to a pilot project in an education authority, which is throughout the volume known as Area A, and a follow-up exercise in another authority, termed Area B. The financial documents and data referring to schools, pupils and teachers were consulted initially in the education authority's offices, then transported to Glasgow where the data analysis was carried out.

The Pilot Project In Area A.

(1) Reasons For Choosing Area A.

Area A is a typical Scottish rural county with roughly 15,000 school children, 100 schools, and, on analysis, average unit expenditures on education compared with other Scottish education authorities. Area A also has a good representation of large and small schools, including a number of one and two teacher primary schools. The education "policy" in so far as it can be judged, is neither ultra-progressive nor too traditional. The system of accounts was thought to be reasonably typical of Scottish education authorities, and accounting records were available for a number of financial years.

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[3] Medium term - 3 to 5 years. Long term - 5 or more years See Chapter 6.

The County Treasurer was motivated to aid the research by his interest in the Rate Support Grant (R.S.G.) and, in particular, in the weightings in the R.S.G. formula given to educational factors.

(2) The Line Of Enquiry In Area A.

A very full analysis of the accounts of Area A was performed for one financial year with the dual aims of a determining (1) the feasibility of a multi-functional classification of expenditure in education, and (2) the problems of a data processed system of accounting in education. b producing some detailed costs of education which were not available at that time for Scotland.

The Coding System

The first practical task was to design an experimental coding system, to be used on the selected items of expenditure incurred under the education budget for the year 1964/65 in Area A. The system allowed for a coding of each expense to a school, to a subject where appropriate, and to a class of expense. It was also thought necessary to include a code which distinguished between

(i) those expenses incurred by another education authority on behalf of the education authority being studied (inter-authority charges),

(ii) those expenses incurred by other local government departments within the authority (intra-authority charges)

(iii) those expenses incurred by the education authority itself (the vast bulk).

As it turned out, this part of the coding could well have been omitted since almost all expenses were of type (iii). In addition, a five digit code giving a unique reference number for each expense was included. Appendices 2/A to 2/D lay out formally the coding system as applied to Area A financial records. The format of the coding system was developed to the point as it appears in Appendices 2/A to 2/D only after considerable consultation with accountants and, after several sample analyses of data had been done. The writer sees these tables as one of the most important of the outputs from the whole work.

Also, the notes 1 to 50 which follow the Appendices 2/A to 2/D set down the reasons for adopting one convention of cost allocation rather than another. These should be consulted, in conjunction with the following sections, by those who wish to appreciate the niceties of cost accounting as applied to individual schools.

The documents analysed in this part of the work were: A) supplies invoices, B) teachers' salaries records, C) the wage and salary records of janitors, cleaners and other non-teaching staff.

A) SUPPLIES INVOICES

Two types of invoices were distinguished: firstly, those dealing with teaching supplies such as apparatus and textbooks; and secondly, those dealing with non-teaching supplies such as coal, electricity and maintenance of fabric. The procedure with each of the former type of invoice was as follows:

1) Determination of the reference number of the expense.
This number was in all cases already stamped upon the document and was unique.

2) Determination of the school.
With reference to the list of schools and their code numbers, each document was coded to a particular school, if this were at all possible. Specific problems incurred here were

   (i) Some invoices did not mention any school or education establishment and were consequently coded "99096" (a schools general code).

   (ii) Some invoices referred to more than one school and accordingly an allocation between schools was made on the basis of the details of the account if this were available, and if not, allocation was made to the schools general code.

   (iii) Confusion arose between schools of similar name, (e.g. invoices marked Hutton School and Hutton Hall) and from schools having several "names".

3) Determination of the school subjects.

With the minor exception in primary schools of modern languages, the determination of school subject applied only in the case of secondary schools. In the minority of cases, the subject department was stated on the invoice and through reference to the appropriate appendix, the document was coded to the school subject. However, in the majority of cases, no such indication of subject was available. For primary schools this made no difference, and the majority of invoices were coded subject "91", primary school general expenses, while those few referring to modern languages in primary were coded "32". The problem of coding text-books, apparatus, equipment, clothing to secondary schools subjects was tackled in the following way. Each invoice was examined and the number of subjects noted by observation of the items listed on the invoice. Where it was not possible to code an item of expense unambiguously to one subject, the general secondary school subject code, "92", was used. On occasion, where invoices concerning textbooks were concerned, up to a dozen or so separate entries had to be created to take care of the various subjects mentioned in the invoice. A slightly different procedure was adopted with science equipment. Here, splitting between the branches of science was done only if the equipment could be used only in that branch, for example, potometers and microscopes are most likely to be used in biology and not in chemistry and physics. In all other cases the general science code, "29", was used. The determination of the subject was not, in fact, a complex process though it was lengthy and tedious, involving as it did the allocation of relatively small sums of money between several categories.

4) Determination of the class of expense.

As far as teaching supplies invoices go, the main trouble encountered was the difficulty of deciding whether an item was stationery or equipment, a functional division required by the coding system. To get over this, a reference checklist of items, which were considered as stationery, was built up and this was used for doubtful items. Bulk quantities of stationery were, as a rule, put down to school administration rather than to a subject, and were thus coded 230 (school administration stationery.)

5) Determination of the amount of the expense.
Difficulties arose when an invoice contained items coded to different subjects or items coded to different classes of expense. In these cases, an allocation between subjects or between classes of expense had to be performed by counting the value of each item on the invoice. An additional complication was encountered when a discount was allowed on certain items in the invoice but only deducted from the final total. Procedure adopted was once again to go back to the separate items of the invoice and discount the appropriate percentage from the individual items.

SUPPLIES INVOICES (II) - Non-teaching supplies and repairs to fabric

Reference number and school were treated in the same way as detailed above for teaching supplies. Almost no invoices could be allocated to any school subject, and invoices were, therefore, coded 99 (unallocable to subject code.) Rather more difficulty arose than with teaching supplies when trying to allocate to a particular school, mainly because many invoices included expenses incurred by more than one school. In some cases upwards of twenty schools were mentioned on one invoice, thereby necessitating an allocation of the total account between each of twenty schools. The expense code created some difficulty initially, and checklists of items, to be included under heads such as repair and maintenance of heating, lighting and ventilating systems, were drawn up. The determination of the actual amount of the expense was somewhat more straightforward than in teaching supplies, since no discounts on items appeared.

B) TEACHERS' SALARIES

The problem of cost allocation of teachers' salaries was the major one faced in the Area A study. The procedure adopted was as follows:

1) Each of the nearly 1000 teachers employed in roughly 700 teaching posts, was given a unique code, the first number indicating the salary scale on which the teacher was paid, and the remaining four indicating an accession number related to the accession order of the salary record card. The cards were stored alphabetically by teacher. The code zero in column 1 indicated that the teacher was uncertificated.

2) In order to determine the "cost" to the education authority of a particular teacher, the sum of the net gross pay and the authority's contributions to superannuation, national insurance and graduated pensions, was found for the fiscal year 1964/65 i.e. April 1st.1964 to March 31st.1965. The net gross pay and the national insurance for the year had to be obtained by addition of the various entries, one per month as a rule, on the salary card for each teacher. The superannuation and graduated pension, where incurred were normally totalled on each card already.

3) Since it had been decided to separate responsibility payments or allowances(R.A.)from the total salary for those teachers who had responsibility allowances a further two way analysis was made up of the total salary as follows.

(i) Responsibility Allowance (R.A.) was subtracted from Net Gross Pay to give the "teaching element" of salary.

(ii) The superannuation was divided between the R.A. and "teaching element" in the ratio of R.A. to the "teaching element".

(iii) The National Insurance was then added to the "teaching element" on the principle that insurance must be incurred whether an R.A. is given or not.

(iv) The separate totals were named the Gross Teaching Element and Gross R.A.

(v) Overtime allowances for F.E. and A.E. were abstracted and subsequently coded to further education.

4) The teacher's school was in most cases written on the salary card, and, with reference to the Appendix 2. G showing schools and their code numbers, the expense was coded to that school. In a number of cases where no school was available on the sheet, a decision was postponed until the authority was consulted. The major difficulties arose with uncertificated and visiting teachers, some of whom taught in a large number of schools (up to 10) over the course of the year. An allocation to each school on the basis of time worked in a particular week or in a particular month was made.

5) At this stage the coding procedure for primary schools was complete since the teacher code, school code, the subject code, codes 91 for salary, and 99 for responsibility element and the expense code (100 for full time teachers, 101 for part time teachers, and 202 for responsibility allowances) were already determined. It was with the salaries of secondary school teachers that most time was taken up. Since it was required to allocate to a particular school, and within that school to a particular subject, and within that subject to the lower school, namely Years I - III, and upper school, namely Years IV - VI, the timetable form S.8 - an official S.E.D. return made on the 21st September, 1964, had to be used. This form shows referenced to each subject the teachers name and each class with the number of pupils and the number of periods, as illustrated in the following example Fig.2.1:

Fig 2.1 Fig 2.1

EXAMPLE OF THE OFFICIAL TIMETABLE RETURN

PART OF S.8 Subject English

NAME	Qualification	Classes Year	No. of Pupils	Periods in which instruction in the subject is given. Mon.	Tues.	Wed.	Thurs.	Fri.
Mr.I. Anderson	Chap. V	1A	31	2	2,5	6	2	1,5
		1D	30		3		1	
		11C	33	1	4	7,8	6	2
		IV5	27	7	6	5	4,5,8	4
		V1	27	4,5,8	1	4	3	8
		VQ	21		7,8			

Fig.2.3 shows how it is possible to calculate the proportion of time devoted to the teaching of years I - III and to years IV - VI. Fig 2.2 shows that by counting the number of pupils, and the number of pupil-periods, the basic data for a later stage of unit cost calculation were prepared. The allocation as between subjects was done by determining the proportion of the teacher's time spent on each subject (if more than one subject were taught), and then allocating within each subject the time between Years I - III and IV - VI. The analysing of timetables and the coding of teachers' salaries took an estimated 500 man hours.

Fig 2.2 Fig 2.2

CALCULATION MADE ON THE BASIS OF THE S.8 ENTRY

	Years I-III	Years IV-VI
Number of Pupils	94	75
Number of Pupil-periods [4]	468	420

Fig 2.3 Fig 2.3

COST ALLOCATION WITHIN ONE SUBJECT BETWEEN LOWER AND UPPER SCHOOL

Expense Code	Teacher-Periods [5]	Proportion	Salary (Gross Teacher Element)	Cost Allocation
102(Years I-III)	15	15/31 = 0.48	£1886. 0.10	£905. 6. 0
103(Years IV-VI)	16	16/31 = 0.52	£1886. 0.10	£980.14. 10

[4] Pupil-periods: one pupil-period is one pupil receiving 1 period of instruction per week. The total number of pupil-periods taught by a teacher in one week is the sum of the products for each class of the number of pupils and the number of periods of instruction.

[5] Teacher-periods: the number of periods in which a teacher has class contact. In figure 2.3, out of 40 possible periods the teacher has 31 teacher-periods. The remaining 9 for the purposes of this costing exercise are considered to have no cost attached to them. [See also Appendix 4/A]

C) NON-TEACHING SALARIES

These involved the determination and allocation of the salaries of janitors, cleaners, auxiliary personnel (mainly secretarial assistants) and school crossing patrol personnel, school meals staff, and staff employed at the education offices, including the Director of Education. Two types of records were used to arrive at the allocation of these wages and salaries.

1) For those being paid weekly, the backing sheet to the weekly payroll was used. The entries for each school occurred on fifty two separate sheets. As for teachers, the sum of the wage/ salary, the authority's contribution to superannuation and/or graduated pension, and national insurance was found in order to calculate the cost to the authority of the particular group of employees in the particular school.

2) The data for the staff of the education authority offices was available on record cards, one for each employee. Each card was totalled for the period of a year and the sum of salary, national insurance, superannuation, graduated pensions was found. A number of "weekly" staff employed in small schools are paid on a "monthly" basis because the number of hours for which they are employed and therefore their weekly wage is so low. The data for this group was also available on cards one for each employee. The data was treated in the same way as for the other monthly paid staff.

The only problem of allocation involved with non-teaching salaries occurred when employees did cleaningand dining room work.The system of grant in operation at the time, 1964 - 65, required the isolation of the costs of the school meals service, for which there was a 100% specific grant. Because of the advantages to the authority of allocating all that could be legitimately allocated to provision of meals, there existed, on each record card, information regarding the number of hours spent on the separate functions of a) cleaning and b) dining room work.

The work involved in coding the non-teaching salaries was of a repetitive, mechanical type, requiring the addition of figures and their transcription from worksheets to the coding document. The time involved in dealing with this section took about 260 man-hours.

THE CODING OF DOCUMENTS

Each expense was coded on to a specially constructed coding document which had 32 columns available. Columns 1 - 5 were used for the reference number, column 6 was blank, columns 7 - 11 were the school code, column 12 was blank, columns 13 and 14 the school subject, column 15 was blank, columns 16 - 18 the class of expense, column 19 was blank, column 20 indicated whether the item was an inter ('2'), or intra ('3') education authority item, or neither ('1'), column 21 was blank, columns 22 - 30 indicated the value of the expense in pounds, shillings and pence. Column 31 was blank, column 32 indicated if the entry was a debit('1') or credit ('9'). Some credits were found, those being mainly in the supplies invoices.

PUNCHING AND PROCESSING OF DATA

The cost data, now on some 500 sheets (35 separate entries or lines on each) was transferred to 80 columns punched cards at a punching bureau. The 18,000 cards(the store of data) were then sorted and processed according to the seven "jobs" or analyses, the results of which appear in the final parts of Chapter 3 and 4. Although the design of each job was detailed by the writer, the actual computer programme necessary to process the cards was written by a bureau programmer.

THE ACCURACY OF THE DATA

1) When considering the total amount of expenditure analysed in the pilot project details in Chapter 3, it must be made clear that the figures are not strictly comparable with those published in the Accountant's Report 1964/65. For instance, the data available from the research project on teachers' salaries covers the fiscal year, 1st April 1964 to 31st March 1965, whereas all other expenditure (and that published in the Accountant's Report) is taken on the Local Authority Year, namely 16th May 1964 to 15th May 1965.

The local Director of Education and the County Treasurer both considered that, in view of the fact that there had been no salary award in the critical period covered, the two 'years' should be approximately comparable with respect to outlay on teachers' salaries.

2) In calculating unit costs, total expenditure incurred over the 'year' was divided by a number of units (pupils) counted on one day. The school session 1964/65 runs from roughly 25th August, 1964 until the following July. During this period, head counts are required by S.E.D. e.g. on form F.2 (September 21st,1964), and by the authority on at least one other occasion. The frequency and dates of the head counts varies from Authority to Authority and even from year to year. Therefore, in choosing a date for 'counting heads', the following factors must be kept in mind:

(i) the date should be firmly in the school session 1964 - 1965 and not in 1963/64, i.e. it should be after 20th August, 1965. This decision can be justified by drawing attention to the fact that total expenditure in the Local Authority Year covers about $\frac{3}{4}$ of school session 1964/65, should be mainly related to activities in the year 1964/65 e.g. storm damage, per pupil quota levels[6] new intakes of pupils, and more important, new output of teachers from colleges.

(ii) The date should be prior to the Christmas or Easter leaving dates (whichever applies) i.e. the number of pupils should include those who attain their fifteenth birthdays after the start of the 1964/65 session but who will not complete their third year in secondary school.

[6] While it would be rational to assume that the sum incurred in one year, under the heading 'educational supplies, text-books etc.,' would be partly a function of the roll in that year, it was found that in Area B, quotas for each school were calculated on the basis of the product of the per capita quota for one year (e.g. 1964/65) and the school roll of the previous year (1963/64).

> This limitation can be justified on the grounds that educational plans, made at the beginning of the session in order to accommodate those pupils who will leave at the first opportunity, presumably 'stretch' resources to their limit. In so doing, it is explicitly assumed that educational plans have financial implications e.g. by requiring extra staff or accommodation at the beginning of the session which is not fully used later on. [7]

The actual date chosen for the head count in Area A was the 21st September, 1964 for secondary schools because, in addition to satisfying the above conditions, the details of timetables were available for that day and for all schools, roll returns are made for the capitation allowance calculation on the first Monday in October. Costs for secondary subjects are based on S.8 rolls, all other unit costs on October rolls. It could be argued than that the unit costs quoted are <u>not</u> strictly average costs (to obtain an average cost, the average number of units over the 'year' would have had to be calculated). The unit costs quoted in succeeding chapters mean that if the number of units counted on say September 21st 1964 had remained throughout the period, the unit cost would have been £x per pupil. In fact, averaged over the 100 odd schools the roll changes would not have a very marked influence on overall unit costs. Only in small primaries (one and two teacher schools) would an alteration of say 5 pupils make a marked difference in unit costs. In the analysis of costs referenced to size of schools (Chapter 5) it is shown that there is a measurable error in predicting unit cost from size of school due to the qualifications/the mix of teachers. This error is probably greater than that incurred by the assumption that the roll in October is constant throughout the year.

[7] Some Authorities have 2 intake dates so that the exodus of 15 + pupils is compensated for by an intake of 12 + pupils in mid-year.

CAPITAL AND RECURRENT EXPENDITURE

As stated in note 31 in Appendices to this chapter, the division between capital items and the rest was made on the basis of an expected durability of two years or more and a cost of more than £25. These 'arbitrary' criteria require justification. It may be possible, in theory, to propose a figure for capital expenditure (we are deliberately leaving out expenditure on capital account for which permission to borrow must be sought) by considering the total number of 'durable' goods for a particular school within wide limits - say 3d. to £300-and then ascertaining what percentage of durable goods remains if we omit all those below say £25, £10, £5 etc. The work involved in performing this analysis (assuming an acceptable working definition of durable could be found) hardly justifies the anticipated benefits of doing the task. Basically, what we should like to know is, at what level of accuracy are we working when we choose the lower limit as £25 and not £50? In a trial run of coding invoices many clearly 'durable' type items e.g. radio, record player, microscopes were being omitted because of the £50 limit. For this reason the lower limit of £25 was selected.

THE FOLLOW-UP PROJECT IN AREA B.

1) Reasons For Choosing Area B.

Area B is a mixed industrial/rural area having an interesting mix of well staffed and rather more poorly staffed schools, town schools and small rural schools, old buildings and new buildings. The education policy is reputed to be progressive compared to the rest of Scotland; auxiliary helpers and a large peripatetic music staff are employed. Anaylsis showed also that the county, like Area A, had roughly average unit expenditures on education compared with other education authorities.

2) The Sampling Procedure

Nine primary schools and five secondary schools were chosen to represent a range of size, age of building and type. For primary schools, this latter distinction was based on what the District H.M.I. called the progressive - traditional scale of primary teaching methods.

The five secondary schools ranged from a large senior secondary (equivalent of a grammar school), through a smallish comprehensive, to a four-year secondary in an economically declining area of the county. A simplified coding system for classifying 'expenses' for these 14 schools appears in Appendix 2/E.

3) The Form of Salary Records and Requisitions

There was rather easier accessibility to the salary records, school supplies, and heating/lighting bills in Area B because here, unlike Area A, all these records were filed by school.A sample exercise in Area A would have necessitated going through all salary records (1000 in all) to isolate the cards for each school. This process would have been tedious and not foolproof, since cards with no school name would have been omitted from the calculations. Also, the task of hunting through 11,000 invoices to find all those pertaining to one school was too daunting.

A) Salary Records 1) Permanent staff (teaching and non-teaching [8]) filed by school, hence the cards for the 14 schools were readily abstracted.

2) Peripatetic, temporary, uncertificated staff; their cards were filed alphabetically, necessitating a complete search of all cards for those belonging to the 14 sample schools.

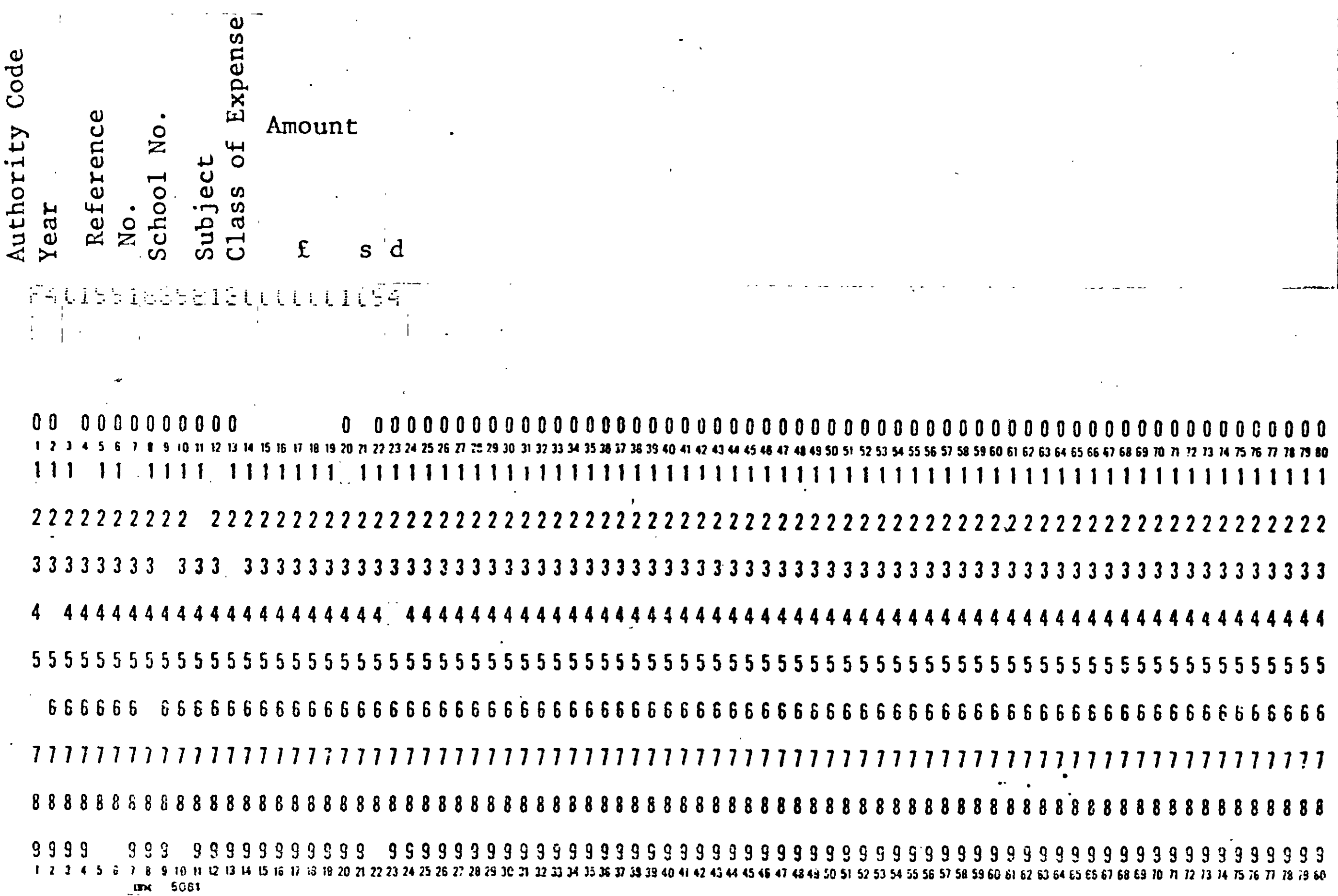
B) School Supplies Records These were filed by school(though in a building some 16 miles away from the salary records). The County Supplies department kept very full records, pricing each original school requisition form from the appropriate invoice. It was these priced requisitions which were coded by the writer and not the accounts.

C) Heating/Lighting Records Payment of coal, electricity, gas and oil bills were marked against each school on record cards. This made the obtaining of these costs very straightforward.

[8] Records of clerical staff were kept, oddly enough, in the County Clerk's department.

4) The Coding - Alterations to Pilot Stage

The major change in the coding was the abolition of the classification of secondary teachers' salaries by subject and by upper school/lower school. Teachers' salaries were allocated directly to school (as explained in Chapter 4 an alternative method of allocating these school costs to subjects was developed). No separate heads for "Teaching Element" and "Responsibility Element" of salary were maintained; all of salary was allocated to the function of teaching. The entries from this document were transferred to punched cards, an example of which is shown below, which were sorted and processed according to the jobs, the results of which are set out in Chapter 3, Summary of Findings Area B and Appendices 3/F.



Appendices 2/G and 2/H contain the lists of schools used in the project in Areas A and B respectively, together with the relevant code numbers.

LONGITUDINAL STUDY

To gain information on the movement of costs over time the "salaries" part of the above exercise in Area B was repeated for years 1961/62 and 1967/68. The gross salary, and employee's contributions to superannuation and G.P. were added mechanically for each school. The data was used for Chapter 6 - Part III.

OTHER SOURCES OF INFORMATION

Two other authorities supplied first source data on the costs of secondary schools. 1) Area D; Mixed industrial/rural type - supplied original teachers' salary record cards for 5 secondary schools covering year 1964/65. Total unit costs were calculated for each school and the material used in the study of economies of scale in secondary schools (see Chapter 5).

2) Area F; Mixed industrial/rural type, total costs for two secondary schools were supplied direct by the County Treasurer.

CAPITATION ALLOWANCES

The Education Authorities designated Area A, Area B, Area D, together with Area C (industrial type) and Area E (rural type), all supplied figures and notes on the capitation allowances schemes for a number of years. These were used in Chapter 3 - see Appendix 3/F.

The official publications Education in Scotland, The Report by the Accountant and Scottish Educational Statistics, all published annually [9], contain valuable statistics which can be reworked in many ways. The first two parts of Chapter 3 rest on reworkings of figures from these publications.

[9] Scottish Educational Statistics available only from 1966 onwards.

POST SCRIPTUM

The initial stage of the work involving an analysis (multi-functional) of the education accounts for one year for one authority was set in motion in June 1966 when contact was made with the Treasurer of Area A and arrangements made to have the accounting data collected. The first draft of the coding and classification system detailed in the Appendices 2/A to 2/E(H) was compiled in January 1967. The aim of the devised accounting system was to allocate expenditures to functional categories (e.g. "Teaching"), individual schools and, where appropriate, subjects. It was felt that the traditional line item or object of expenditure budget, although adequate for fiscal accountability, was severely limiting for appraising the continuous rise in educational costs and for determining future implications of current policy decisions.

In May 1969, there came to the attention of the writer two educational administration texts advocating a system of programme budgeting, many of the features of which had been incorporated into the costs coding documents prepared for the study of Area A. (Hartley, 1968; OECD 1968).

P.P.B.S. (planning, programming, budgeting systems) is a comprehensive planning process which incorporates a programme budget as its major item. After successful use of the P.P.B.S. by the U.S.A. Department of Defense, President Johnson in 1965 directed 21 departments to go over to this system of budgeting and planning for the year 1968.

In traditional object-of-expenditure budgets, allocation is made to heads such as Salaries, Repairs, Fixed Charges; whereas in a programmebudget emphasis is on programme classification. A curricular-based programme structure involves direct and indirect costs being apportioned by subject areas and by year of study. A programme in its widest sense in "a group of inter-dependent, closely related services or activities possessing, or contributing to, a common objective or set of allied objectives; a package of subprogrammes, elements, components, tasks and activities". (Hartley,1968 p256)

There is some degree of similarity in the formats of the multi-functional cost accounting system devised for Area A and that of the programme budget. The writer however, would not, claim that the Scottish system relates output or performance to the resources used, which claim is made for programme budgeting. In the final chapters some use is made of the programme budgeting concepts.

REFERENCES

Hartley. H., (1968) Educational Planning - Programming - Budgeting: A Systems Approach. New Jersey Prentice Hall.

(O.E.C.D.,1968) Budgeting, Programme Analysis and Cost Effectiveness in Educational Planning (1968) Paris: OECD

CHAPTER 3

ANALYSIS OF THE COSTS OF EDUCATION

Introduction

Business and industry employ cost-accounting extensively. Expenditures are accurately allocated to each unit of output, and the cost of manufactured products is monitored for management from raw material to completion. Each change in the method of production is costed and together with quality tests, the value of the change can be discussed within a solid quantified framework.

Perhaps it is the seemingly intractable problem of measuring the raw material, never mind the output, of the educational processes which has held back cost accounting in education. Whatever the reason, cost accounting in schools and other educational establishments is almost non-existent. Even at a national level, the collection, processing and publishing of educational finance statistics is just developing. These statistical services began to improve following the impact of The Costs of Education (Vaizey, 1958). Nevertheless, most educationists and economists would still be somewhat at a loss if asked a relatively simple-minded question, such as how much more expensive is it, in real terms, to educate our secondary school children now compared with ten years ago. They would be quite unable to quantify precisely the factors which have increased costs; nor could they justify the increases with attested increases in "quality". More will be said on the subject of educational quality in Chapter 7. What this chapter attempts to do is to examine total and unit costs over time (cross-temporal analysis), over space (inter-regional analysis) and at the various levels of education, particularly schools. The material presented draws on a study of published educational finance statistics, and on the results of the analysis of unpublished accounts of two Scottish educational authorities.

PART I

A Cross-temporal Analysis of Scottish Educational Costs [1]

The data presented in Part I and Part II of this chapter was obtained by the writer by 'marrying' statistics of expenditure (some published and some made available through the Finance Division of the S.E.D.), and statistics relating to pupils.

The figures shown in Fig. 3.1 relate to approximately 80% of the total public educational expenditure on education in Scotland, the remainder being devoted mainly to Universities, Central Institutions, Colleges of Education, Grant-Aided Schools. In other words, the figures represent expenditure by the thirty-five Scottish Education Authorities.

Fig.3.1 Analysis by Year of Total Outlays of Scottish Education Authorities Fig.3.1

Year	Index at Current Prices	Index at Constant Prices
1959/60	100	100
1960/61	108	107
1961/62	125	120
1962/63	133	123
1963/64	148	134
1964/65	159	141
1965/66	173	146
1966/67	196	159

Source: Appendix 3/A for derivation and note on indices.

[1] Edding, 1966, has attempted to appease the purist-minded economist by differentiating between cost and outlay. The former covers expenditure on education plus income forgone by pupils/students and an imputed rent in respect of schools and other educational premises. For the purpose of this chapter (and the others), however, the term outlay, denoting expenditure or money spent, is used synonomously with costs.

In the eight-year period covered, outlays increased by some 96% at current prices or 59% at constant prices, the sharpest rises occuring between 1960/61 and 1961/62 and between 1965/66 and 1966/67. Even allowing for the rough-and-ready price index adopted, there appears to be a 60% increase in inputs to education. Ideally [2], one would want this additional input analysed into two components 1) education expenditure, 2) non-education expenditure. The latter component might be classified as social and welfare expenditure. It includes meals, milk, health, youth service, boarding. There are both conceptual and practical difficulties in making this kind of division. Basically, the conceptual problem comes down to defining education. Peacock(1967) has observed the tendency in national and international official documents to adopt a fairly narrow definition which covers only public and private institutions offering formal instruction. Does this definition exclude "educational activities" not carried on in the institution? (Mother's care, on-the-job training and home study may be substitutes for kindergarten, vocational training and higher education). Another problem, which is more practical than conceptual, is that, if education is defined as the activities of establishments offering formal instruction and if these establishments perform certain other services e.g. the school health, the recreational, the civic services, then the problem of the allocation of joint costs is encountered.

The aim of such a breakdown of inputs into education and non-education expenditure over a period of years is to assess (rapidly) whether the increased outlays are bound for increasing quantity or quality of teachers, or apparatus, or for the host of ancillary social and welfare services.

[2] It is of more than academic interest whether expenditures in the education budget are destined for educational rather than other social or welfare purposes. The future level of education spending could well be increased if some of the "non-education" expenditure were transferred to other budgets. e.g. Social Security or Department of Employment and Productivity.

Putting that another way, does the increase in outlays reflect a higher status for school teaching - through higher salaries - or simply bigger, healthier children through added inputs in terms of school meals, milk, health and recreational facilities? This is not a trivial point, especially at a time when public expenditure and, in particular, education expenditure is being scrutinised so closely. A case might be made for the transfer of all social and welfare expenditure hidden in the education budget to some budget other than education. Such a policy would free money for more directly educational activities. It would also cause an increase in public expenditure or, were that undesirable or impossible, a decrease in some other budgets e.g. Health or Defence.

Briefly, the close analysis of inputs over a period of time can be justified on the grounds of more informed control over public expenditure. Peacock et al (1968) have shown, however, that such a detailed breakdown for the U.K. is fouled up by both conceptual and practical (statistical) problems.

The data of figure 3.2 falls short of being as rigorous as the ideal breakdown touched on above, but it goes as far as published figures will take us at the moment. It traces the variation in the proportions of the main heads of education authority expenditure in Scotland for an eight-year period. We observe that:

(a) Teachers' Salaries in schools are the largest single item of expenditure;

(b) The trend in the Teachers' Salaries over the eight years - as a proportion of total expenditure - is certainly down, the variation in proportions during the intervening years being due, to a large extent, to pay rises being made in January 1960 July 1961, April 1963, April 1966;

(c) Whereas Maintenance of Schools has improved its share of the total slightly for schools (17.3% in 1959/60, 18.8%in 1966/67), the corresponding head for F.E. has risen proportionally almost two-and-a-half times its 1959/60 level (see Head 5);

(d) The steady expansion of authority provision of further education is also evident in the increased share of Salaries of Educational Staff in F.E. - steady increase from 2.7% to 4.6% in eight years;

(e) /

(e) The expansion of teacher training (following Robbins) is reflected in Head 16 which had risen in 1966/67 proportionally two-and-a-half times its 1959/60 level;

(f) The change in arrangements for student allowances (see Appendix 3/A) from 1961/62 has caused head 9, Bursaries, to fall to a quarter of its 1960 proportion;

(g) Loan Charges have crept up steadily in the period and stand at over half the Maintenance of Schools proportion now;

(h) Apart from Loan Charges, expenditure on administrative, social and welfare items (see Heads 1,11,13,14,15,20) has remained reasonably constant compared with the variation in proportions taken up by more directly "educational" heads.

From this commentary on Fig.3.2 it will be gathered that heads of expenditure are given capital letters e.g. Loan Charges. This procedure is adopted throughout the report. Also, it should be pointed out that the head, Teachers' Salaries, is the expenditure by the education authority on teachers, i.e. it includes salary and the authority's contributions to superannuation, national insurance and graduated pension. In the first two parts of this chapter Teachers' Salaries also includes travelling expenses of staff - a minor item. In Part III this latter item is included under another head - Transport and Accommodation.

Fig.3.2

Analysis of Main Heads of Expenditure as Proportions of Total Expenditure on Education by Education Authorities - Scotland 1959/60 - 1966/67

Fig.3.2

HEAD		1959/60	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67
1	Administration (4)	2.2%	2.1%	2.1%	2.2%	2.1%	2.1%	2.1%	2.1%
Primary & Secondary Education									
2	(a) Salaries etc of education staff	47.0	46.3	48.0	47.1	47.6	44.7	42.4	43.4
3	(b) Maintenance of schools	17.3	16.7	18.0	18.9	18.2	18.7	19.5	18.8
Formal Further Education									
4	(a) Salaries etc of education staff	2.7	3.0	3.1	3.3	3.5	3.9	4.2	4.6
5	(b) Maintenance of Centres	1.0	1.2	1.3	1.4	1.6	2.0	2.3	2.4
6	Social & Recreational Education (2)	0.6	0.1	0.1	0.7	0.7	0.7	0.8	0.8
Aid to Pupils and Students									
7	(a) Transport and Accommodation		1.8	1.8	1.9	1.8	1.8	1.9	1.8
8	(b) Board & Lodging		0.7	0.6	0.7	0.7	0.7	0.7	0.6
9	(c) Education in Hospitals etc.,	7.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10	(d) Bursaries		4.4	1.1	1.1	1.2	1.1	1.0	0.9

Fig 3.2 Continued

HEAD		1959/60	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67
11	School mid-day meals	7.2	7.3	7.2	7.3	7.3	7.3	7.5	7.2
12	School milk	2.0	1.8	1.7	1.7	1.5	1.5	1.5	1.4
13	School health	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4
14	County Library	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9
15	Contributions to other E.A.	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2
16	Contributions for teachers training	0.4	0.5	0.5	0.6	0.6	1.1	1.0	1.0
17	Loan Charges	7.0 (3)	7.2	7.6	8.2	8.4	9.5	10.1	10.1
Revenue Contributions Towards Capital Expenditure									
18	(a) School mid-day meals	1.1	1.0	1.0	1.1	1.1	1.1	1.0	1.3
19	(b) Others	-	1.5	1.5	0.6	0.4	0.4	0.5	0.4
20	Youth Employment Services	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2
21	Other Expenditure	0.5	0.6	0.7	0.4	0.4	0.5	0.7	0.6
22	Total Expenditure (1)	100%	100%	100%	100%	100%	100%	100%	100%

Source: see Appendix 3/B

(1) Proportions do not add to 100 for years 1959/60,1960/61,1961/62 because of rounding off.
(2) In the figures for Years 1960/61,1961/62 some expenditure under head 6 has been allocated under head 21
(3) This is the sum of heads 17 and 19 for 1959/60 only.
(4) Administration refers to the expenditure on Education Authority administrative staff and buildings and not to administration at the S.E.D.

UNIT COSTS

This last observation tends to suggest that these non-education expenditures are more constrained than the directly education expenditures. The latter, it might be thought, should vary with pupil numbers. How much, if any, of an increase in input per pupil does the total increase shown in Fig.3.1 represent? To answer this we must look at unit costs over the period [3]

Fig.3.3

Fig 3.3

Unit Costs of Education in Scotland over an Eight Year Period in Current and Constant 1959/60 Prices

YEAR	Total Expenditure per pupil at Current Prices	Total Expenditure per pupil at Constant Prices	Expenditure on Teachers'Salaries per pupil at Current Prices	Expenditure on Teachers'Salaries per pupil at Constant Prices	Expenditure on School Maintenance per pupil at Current Prices	Expenditure on School Maintenance per pupil at Constant Prices
Cols.	1	2	3	4	5	6
1959/60	86.5	86.5	43.8	43.8	16.1	16.1
1960/61	92.5	91.5	47.0	46.4	17.0	16.8
1961/62	106.5	102.1	54.2	53.1	20.3	19.5
1962/63	114.0	105.6	56.4	52.2	22.5	20.8
1963/64	124.6	113.2	62.5	56.8	23.9	21.7
1964/65	132.3	117.0	63.0	55.7	26.3	23.3
1965/66	144.1	122.1	65.6	55.5	30.1	25.5
1966/67	158.6	129.1	73.8	60.0	32.2	26.2

Source: Appendix 3/C All the above figures are in £.

The unit cost of educating pupils in Scottish education authority schools has risen by 83% in current terms, £86.5 to £158.6 or 49% in constant terms. These increases in input compare with 96% (current) and 58% (constant 1959 money) for total expenditure.

[3] Unit Costs: a full explanatory note on this term appears in Appendix 4/A. The unit costs calculated above are the ratio of total expenditure (over each financial year) to the number of pupils present at the school census day in January of each year e.g. Financial Data for 1959/60 with pupil numbers at January 1960.

Although comparison of columns 1 and 3 reveals just how much unit costs are dominated by the level of remuneration of teachers, it is in column 4 (unit expenditure on Teachers' Salaries) that the influence of salary awards to teachers is most obvious. Following the pay award in July 1961, unit expenditure (in constant terms) fell slightly over the two year period when no awards were made, £53.1 in 1961/62 to £52.2 in 1962/63. The award in April of 1963 raised expenditures to £56.8 per pupil in 1963/64. In the subsequent two years, unit expenditures decreased slightly because,

1) the numbers of pupils increased for the years 1963/64 to 1964/65 (871.1 thousand to 874.2 thousand),

2) general price inflation was greater in the period 1964/65, 1965/66, although the number of pupils dropped slightly.

The award of April 1966 caused unit expenditures to rise to £60 (in 1959 prices) or roughly 37% above their 1959/60 level.

Unit expenditures on School Maintenance have risen steadily over the period and show none of the fluctuations observed in the case of Teachers' Salaries. School Maintenance expenditures per pupil rose from £16.1 to £32.2, 100% in current terms, and by 63% (16.1 to £26.2) at constant (1959) prices. These trends in unit expenditures at constant prices are summarised diagrammatically in Fig. 3.4

In short, the inputs to education in Scottish public schools have increased, whether one considers total or unit expenditures. The most directly educational inputs, Teachers' Salaries and School Maintenance (as distinct from total expenditure which includes items of social and welfare outlay) have risen by 37% and 63% per pupil in real terms, respectively. It is immediately obvious that the rapid increase of the head School Maintenance in per pupil terms requires further analysis. Have the inputs in terms of textbooks, apparatus etc., been mushrooming, or have the schools been costing more (in per pupil terms) to heat and clean or has there been a significant advance in the employment of non-teaching personnel, e.g. clerical and technical assistants,auxiliaries? These are some of the questions which will be taken up now.

SCHOOL MAINTENANCE COSTS

Fig.3.5 shows that although the overall unit outlay on School Maintenance has roughly doubled in eight years, the component sub-heads have expanded at varying rates. The steepest rise has been in expenditure on Rent, Rates and Taxes which has increased by 212% from £2.25 per pupil in 1959/60 to £7.03 per pupil in 1966/67 in current prices. The first two subheads, which together represent the direct educational expenditure have both failed to increase as much as the overall unit outlay. Unit expenditure on "Books, Apparatus" has gone up by 82% and that on "Furniture, Equipment" by 50% in current terms. However, taking both these sub heads together, unit outlay, on educational items has decreased as a proportion of overall outlay on School Maintenance from 21.6% in 1959/60 to 19.0% in 1966/67. In current prices, there was an increase of 79% in the unit expenditures on Fuel, Light and Cleaning, a rise comparable to that on Books andApparatus

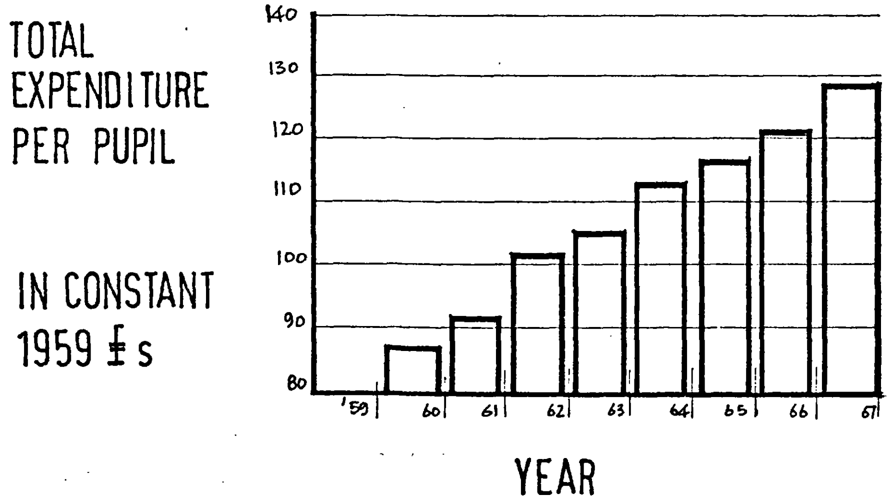
Fig.3.5 Analysis of School Maintenance into Sub-heads in terms of unit outlays at current prices for years 1959/60 and 1966/67, Scotland Fig.3.5

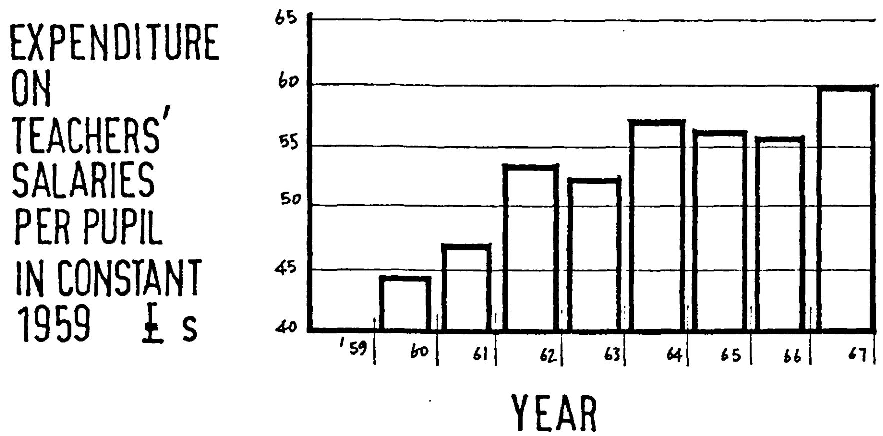
SUB-HEAD	1959/60 £	1966/67 £
a) Books, Apparatus	2.59	4.72
b) Furniture,Equipment	0.81	1.21
c) Rent, Rates, Taxes	2.25	7.03
d) Repairs, Maintenance	2.70	4.58
e) Fuel, Light, Cleaning	6.66	11.94
f) Clerical Assistance	0.40	0.83
g) Other Expenditure	0.36	0.86
TOTALS	£15.76	£31.16

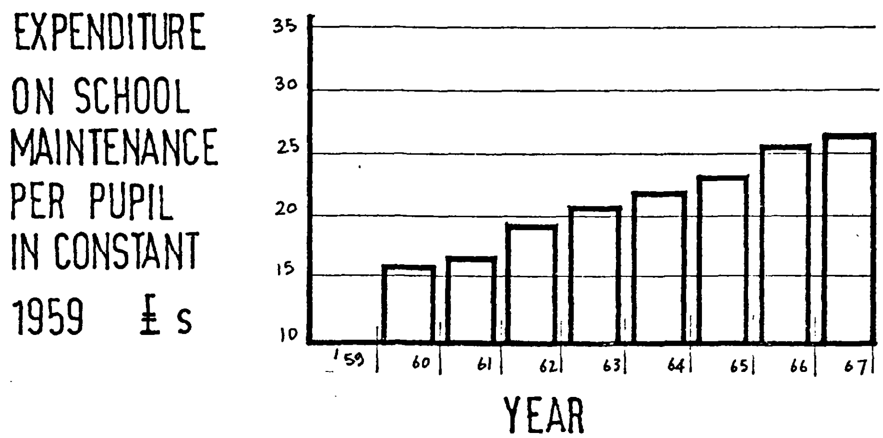
Source: Appendix 3/D

What we cannot tell from these figures is by how much, if at all, unit outlays, in real terms, exceeded (in 1966/67) those in our base year 1959/60. Information regarding the quantities of consumable items and stocks carried (especially with reference to the educational items) in the first and last years of the period would be most interesting.

Fig. 3.4 Trend In Unit Expenditures At Constant Prices - Histogram Form







Those who can look back over these eight years and longer, observe the improved quality of textbooks, the increase in equipment and apparatus used in most subjects. Some critics of modern methods of teaching (particularly with reference to primary schools) claim that money is being wasted on frills. Statements by a few local politicians and members of the public give the impression of lavish, if not luxurious, school buildings, bulging with the paraphernalia of contemporary progressive education. In view of the very modest, increases in both Books, Apparatus (about 80% and only just keeping pace with the costs of heating and cleaning schools) and Furniture, Equipment (about 50% in current prices), together with evidence which will be presented below on education authority capitation allowances, the fear that expenditures on educational equipment is running out of control seems ill-founded [4]. Yet, both these heads - Books, Apparatus and Furniture, Equipment - are, what might be termed policy-controlled items of expenditure.

POLICY AND CONSTRAINTS

The notions of, on the one hand, constrained expenditure and, on the other, unconstrained (or policy-controlled) expenditure will be frequently encountered in this and later Chapters; an explanation of these terms will be interposed here. Statutory regulations require that, in Scotland, education should be provided according to the age, aptitude and ability of pupils. Given that requirement education authorities must incur certain expenditures. In other words, there is a certain/

[4] Although separate price indices for School Maintenance and Educational supplies, apparatus etc., could have been calculated, they were not. Instead the crude index of Final Goods and Services Sold on the Home Market was used to deflate the 1966/67 prices to 1959/60 prices. There is some support for this according to Vaizey and Sheehan (1968) At constant prices, the increase in unit outlays on School Maintenance over the eight year period was 61% at constant prices. The increase in unit outlays on the first two sub-heads (a) and b)) was roughly 42%.

certain minimum level of expenditure below which an education authority cannot fall, for, by so doing, it would be unable to provide education for all pupils according to age, aptitude and ability. The expenditures incurred in providing education depend on such factors as the numbers of pupils, the dispersion of the population, communication patterns. In the short term, little can be done to change these factors so that, in a sense, these expenditures are constrained. There are also other fields in which education authorities have room to manoeuvre as far as the level of expenditure allocated to these fields is concerned. This other kind of expenditure is policy-controlled, in so far as locally or nationally adopted policies can, in the short term, control expenditure. The field of the employment of auxiliaries in the class-room might well be regarded as one where the expenditure is policy-controlled, at present. One further, vital point must be made. What constitutes a policy-controlled expenditure today, might become a constrained expenditure tomorrow, because society increasingly raises its expectations regarding the acceptable minimum level of provision. While classes of 100 children and rooms heated by small coal fires were standard and acceptable at one time they are no longer so. Sights are being constantly raised; the minimum is forever increasing.

CAPITATION ALLOWANCES

One example of a policy decision determining costs is the field of capitation allowances for books, apparatus, clothing for sport etc. The level of allowance is set, at a local level, by the education committee, on advice from the Director of Education and Authority Treasurer. Increases occur to take account of increased prices of items such as books[5] and also to allow development of curricula within the schools as well as rising standards of provision.

[5] Authorities receive advice from bodies such as educational publishers on price increases. There is a joint committee of publishers and L.E.A. representatives in England which publishes recommended per capita allowances.

Fig 3.6 shows the per capita allowances (or estimates thereof made from actual expenditures and rolls) for five Scottish education authorities during the sixties.

Fig 3.6 Capitation Allowances in Primary Schools for Fig 3.6
Five Scottish Education Authorities

Authority	1961/2	1962/3	1963/4	1964/5	1965/6	1966/7	1967/8	1968/9
'A'	20/-	26/6	29/-	30/-	31/6	40/-	40/-	-
'B'	-	-	35/-	40/-	42/6	45/-	45/-	-
'C'	30/-	30/-	32/-	32/-	32/-	35/-	38/-	38/-
'D'	34/-	34/-	40/-	40/-	50/-	70/-	80/-	-
'E'	-	29/6	29/6	32/-	33/-	36/6	45/-	50/-

Source: Appendix 3/E

(1) Similar tables showing the capitation allowances in Secondary Schools are shown on Appendix 3/F.

(2) - Denotes not available.

Authority 'A' did not reach the level of expenditure attained in 1963/4 by authority 'D' until 1966/7, and what is more, maintained the same level the following year by which time its allowances for primary pupils were only half those in authority 'D'. Here is some evidence of differing policies of education committees and/or Directors of Education for we know that books, apparatus etc., are priced the same in both areas. The observed differences need to be treated with some caution however, since capitation allowances do not include all items of expenditure. They are normally meant to cover textbooks, stationery, apparatus and generally low-priced, consumable or short-life items. Larger items, such as audio-visual aids, lathes, domestic science heavy equipment are normally allocated from a separate budget. In other words, the capitation allowance is available or under the control of the headmaster to disburse among his class teachers or subject departments; whereas the budget for larger equipment is under the thumb of the Director of Education.

Returning to the discussion of constrained and unconstrained expenditure with respect to the position of capitation allowances, it is evident that although these expenditures are policy-controlled or unconstrained (by legislation at least), there is little opportunity for either individual schools or Directors of Education to be spendthrift. In view of the low level of the allowances, the modest increases over the period studied, and the fact that, although prices rose each year, for two or three years some authorities did not raise their allowances.

Data Gaps

Having gone as far as possible, at this national level, with the trend of unit expenditures on Books, Apparatus and Furniture, Equipment something ought to be said about the other less directly educational items in Fig.3.5. What is most obviously missing is detailed manpower and expenditure statistics relating to second-line educational staff - clerical helpers, technical or laboratory assistants, auxiliary teaching staff. The 100% increase in unit outlay on Clerical Assistance is in some part due to increasing man-hours worked and in some part due to better salaries (notwithstanding the inflationary rise). The other categories of helpers do not enter into the figures explicitly. For the purposes of projection of costs in education, both manpower and expenditure figures are vital. In addition, should any cost-effectiveness study of manpower deployment in schools be initiated this information would be a basic requirement. The deficiency in manpower data should be partly covered in the future since the S.E.D. are now requesting more information on manpower from authorities.

Nothing further will be said about the other sub-heads Fig 3.5 at this stage. Reference to costs of heating and cleaning schools will be made below when individual schools are investigated.

PART II

INTER-REGIONAL ANALYSIS OF UNIT COSTS IN SCOTLAND

It was hypothesised that some educational expenditure would be constrained or controlled by such factors as statutory requirements, pupil numbers and geography. While the difficulties of making a comparison of educational expenditure between countries are notorious, the high degree of comparability of expenditure statistics which exists between the thirty-five Scottish education authorities should enable such a hypothesis and others to be put to the test. A country such as Scotland with its variety of geography and wide variation in population density should display variation in unit costs in its regions. It might also be anticipated that policy decisions of an authority might upset the imposed or constrained level of expenditure.

Fig 3.7 Fig 3.7

OUTLAY PER PUPIL IN
THE SCOTTISH EDUCATION AUTHORITIES FOR 2 YEARS At Current Prices

Authority	Outlay £ per pupil 1962/3	1965/6	Authority	Outlay £ per pupil 1962/3	1965/6
Moray & Nairn	93.2	123	Dumfries	113	152
Renfrew	96.2	127	Clackmannan	115	160
Ayr	96.3	128	Perth & Kinross	115	153
West Lothian	96.9	133	Aberdeenshire	120	164
Lanark	101	130	Caithness	121	160
Angus	101	132	Aberdeen City	124	163
Dundee	102	128	Roxburgh	124	148
East Lothian	104	134	Argyll	131	177
Dunbarton	107	140	Inverness	131	168
Stirling	107	140	Bute	137	183
Edinburgh	107	140	Kirkcudbright	142	178
Kincardine	110	144	Peebles	145	176
Fife	111	146	Berwick	149	189
Midlothian	111	151	Orkney	150	204
Glasgow	112	150	Ross & Cromaty	154	200
Wigtown	112	160	Zetland	175	242
Selkirk	113	163	Sutherland	224	293
Banff	113	144			

Source: The Report by the Accountant,1962-3 Edinburgh HMSO; Scottish Educational Statistics,(1966) Edinburgh HMSO Education in Scotland in 1963 Edinburgh HMSO

The unit outlays in Fig.3.7 for the year 1962/63, were calculated by finding the ratio of the total gross outlay on pupils in the public and grant-aided schools [6] in Scotland in each education authority to the number of pupils; for 1965/66 the ratio is the total outlay on pupils in public schools in each education authority to the number of pupils in these schools. The different methods of calculation were necessary because the accounts of the grant-aided schools for 1965/66 were unavailable when the work was done. In any case, there are no grant-aided schools in twenty-five authorities; a significant number of pupils attend such schools only in Edinburgh, Glasgow and Clackmannan-shire. Even at sight there is a remarkable agreement in rank order between the unit outlays for the two years. [The rank order correlation co-efficient turns out to be 0.96]. This consistent pattern of unit costs suggests that some cost determining factors are indigenous to the authorities. Whether these factors are wholly geographic and/or demographic, i.e. constrained, or partly constrained and partly policy-controlled, only a closer analysis may show. Sleeman (1965), amongst others, has noted that per pupil outlays tend to be lowest in industrial areas, slightly higher in cities and 'mixed' industrial/rural areas, and to rise more steeply as the population becomes sparser. Indeed, the claim that the unit outlays increase in proportion to the distance from Sauchiehall Street is not altogether fanciful, as a cursory glance at Fig.3.8 will show.

[6] As far as possible, expenditure on F.E. was abstracted from the authorities' total expenditure. In terms of the heads shown in Fig.3.2, this meant omitting 4(a) and 5(b). The writer realises that further restriction of the heads of expenditure e.g. subtraction of heads 6,10,14,16,20 from the total might also have been justified since these heads do not refer specifically to expenditure on the school population. The relative position or rank position of one authority to another would not have been altered by such a change.

Fig 3.8

Fig 3.8

OUTLAY PER PUPIL IN THE SCOTTISH EDUCATION AUTHORITIES IN RELATION TO GEOGRAPHICAL CHARACTERISTICS FOR 1965/6

Authority	Outlay in £ per pupil	Type
Aberdeen City	163	City
Dundee	128	City
Edinburgh	140	City
Glasgow	150	City
Weighted Mean*	147	
Dunbarton	140	Industrial
Lanark	131	Industrial
Renfrew	127	Industrial
Weighted Mean	131	
Ayr	128	Mixed
Clackmannan	160	Industrial
Fife	146	Agri-
Midlothian	151	cultural
Stirling	140	''
West Lothain	133	''
Weighted Mean	139	
Aberdeenshire	164	Rural
Angus	132	Rural
Banff	144	Rural
Berwick	189	Rural
Bute	183	Rural
Dumfries	152	Rural

Authority	Outlay in £ per pupil	Type
East Lothian	134	Rural
Kincardine	144	Rural
Kirkcudbright	178	Rural
Moray & Nairn	123	Rural
Orkney	204	Rural
Perth & Kinross	153	Rural
Roxburgh	148	Rural
Selkirk	163	Rural
Wigtown	159	Rural
Weighted Mean	152	
Argyll	177	Heath
Caithness	160	and
Inverness	168	Moor
Peebles	176	''
Ross & Cromarty	200	''
Sutherland	293	''
Zetland	242	''
Weighted Mean	187	

S C O T L A N D 144

* All means are weighted for the actual number of pupils in each authority and group of authorities.

Fig 3.8 shows the unit outlays for 1965/6, authorities being grouped according to predominant geographic characteristics. It may be concluded from this Fig. that:

a) a considerable variation in outlays occurs between authorities;

b) this variation is strongly tied to geographical characteristics;

c) even within a more or less homogenous geographical area, unit outlays vary, e.g. it cost £163 per pupil for education in Aberdeen but £128 per pupil in Dundee.

Since the highest cost pupils - those living in areas of Heath and Moor - are only 5.2% of the total school population in Scotland, and those in Rural areas, a further 15%, the effect of these high cost pupils on the total national education outlay is not over significant. The mean cost of educating a pupil in Scotland in 1965/6 turns out to be £144.

Before attempting to link total unit outlays quantitatively with explanatory variables, some attention will be given to the breakdown of unit costs into the various heads. Do the unit costs vary because of Teachers' Salaries, or Maintenance Costs? Or, in those authorities which have higher than average unit costs, are all the sub-heads higher? Answers to these questions may point to possible cost determining factors. What we are looking for is the strength of relationship between total unit outlay - say X_1 - and the main heads of expenditure - Teachers' Salaries (X_2), School Maintenance (X_3), Transport, accommodation, board and lodging of pupils (X_4), Meals and Milk (X_5), and Loan Charges and Revenue Contributions to Capital (X_6). This strength of relationship is best measured by the correlation co-efficient (product moment) Fig. 3.9 shows the array of all possible correlation co-efficients.

Fig 3.9 Fig 3.9

CORRELATION COEFFICIENTS FOR SIX OUTLAY PER PUPIL VARIABLES FOR SCOTTISH EDUCATION AUTHORITIES FOR 1962/3

X_2	0.93**				
X_3	0.70**	0.50**			
X_4	0.92**	0.84**	0.53*		
X_5	0.82**	0.76**	0.35	0.85**	
X_6	0.76**	0.58**	0.68**	0.57**	0.45*
Variable	X_1	X_2	X_3	X_4	X_5

No * : significant at 5% level
* : significant at 1% level
** : Significant at 0.1% level

Source: See Appendix 3/F

Not too much should be read into this set of correlations and particularly into correlations involving X_1. All the first column values contain a large spurious element owing to the fact that X_1 is the sum of the individual elements X_2, X_3, X_4, X_5, X_6 and other minor heads.

The high correlation between total per pupil outlay and that on Teachers' Salaries (0.93) follows from (a) the fact that the salary element is the largest single element in the total per pupil outlay, and variations in it thus swamp the total unit outlay, (b) those factors which make for a high salary bill also affect, in general, the other main heads in the same direction; thus, transport costs are apt to be high in areas where the population is dispersed, and where schools are relatively small giving rise to high Teachers' Salaries. Putting that another way, generally high unit outlays on Teachers' Salaries will be found in rural areas.

But, higher than predicted outlay on this head does occur in Aberdeen where unit outlay on Teachers' Salaries was £66.8 in 1962/3 and that figure was higher than Argyll, Inverness and Banff - all rural areas. The reasons behind this apparent anomaly will be discussed below under the heading of pupil-teacher ratio.

The correlation between Total unit outlay and School Maintenance is 0.70. It has been pointed out already that this latter head is a composite of heterogeneous items. Sleeman (1965) has inferred that the geographical nature of the authority works in the direction of increasing outlays per pupil on the largest sub-head, Fuel, Light, Cleaning, in the more urban areas and lowering them in the more rural areas. Also, the lower level of Rents, Rates, Taxes in rural areas causes the per pupil outlays on that sub-head to be lowest in sparsely populated areas and highest in the cities. There exist less significant differences between groups of authorities in respect of the other sub-heads. These other sub-heads may be rather more policy-controlled than constrained by geography. For instance, although every authority in Scotland has 'some' clerical help in its schools (the criterion of 'some' being that at least one school in the authority has some clerical assistance) the amount varies widely[7]. One rural authority has the policy of giving clerical assistance in a primary school of seven or more teachers, another has adopted the policy of secretarial help in secondaries only. Edinburgh and Glasgow have formulae worked out by a team of O & M experts, relating secretarial and administrative personnel to size and type of secondary school. Thus, in the head School Maintenance there are some policy determined sub-heads - Clerical Assistance, Books and Apparatus, Furniture and Equipment (see above policy and constraints) - as well as some geographically constrained elements i.e. Rent, Rates Taxes and Fuel, Light, Cleaning. It may be argued that

[7] The writer had a 90% response to a simple questionnaire (sent to all 35 Education Authorities) on the topic of auxiliary help in schools.

Repairs, Maintenance as well as Fuel, Light, Cleaning are to some extent a function of the types of buildings. And, in so far as the authority has control over their stocks of buildings, the expenditure on the running costs of these buildings is partly within its own purview. New buildings, with more windows, more fittings, higher standards of heating, lighting than older designed buildings, are known to be more expensive to maintain than old buildings. That is, in per pupil terms, it costs more to maintain new buildings, but with the modern design, costs are lower per sq. ft. because of a more generous allowance of space per pupil.

In short, expenditure in an authority on the composite quantity School Maintenance reflects both geographic-demographic conditions and policy decisions. It is impossible to quantify from the above data just how much of the expenditure is due to the constraining factors and how much is due to policy decisions.

From Fig. 3.9 it will be seen that there is a highly significant correlation (0.68) between School Maintenance (X_3) and Loan Charges and Revenue Contributions Towards Capital (X_6), indicating that investment in new buildings is tied to the running cost of these buildings. The provision of school buildings is to some extent a policy decision, influenced, it is true, by the local demographic and economic situation as well as the state of the existing stock of buildings. However, it is a policy decision of the authority which initiates a building programme, although permission to borrow for such a capital project must be sought from the central government in Scotland, the S.E.D. One crude measure of gauging the investment programme in each authority is to look at Loan Charges and Revenue Contributions Towards Capital for the thirty five authorities. For 1965/66, the minimum per pupil outlay was £8.77 and the maximum £41.4. Such a variation might be due to :

x Correct these figs for FE before publication of book.

a) variation in the provision of new school places,

b) the distorting influence of pupil numbers in the unit outlays in authorities of vastly differing size,

c) a difference in the stage reached in the re-building programme; those authorities which got off their mark immediately after World War II will be investing less - in money terms - than those who waited till the sixties when interest rates were higher.

Factor b) can be taken out of the running by holding pupil numbers constant between authorities. Then, Aberdeen, Dundee, Dunbarton and Stirling - all with comparable pupil numbers-show unit outlays on Loan Charges etc., of £22.7, £15.5, £20.1 and £18.9 respectively. Even when authorities with similar numbers of pupils are compared, it is clear that unit outlays on Loan Charges etc., do vary. It is not possible from the published figures to probe this capital provision question much further.

Buildings and Maintenance Costs

One issue connected with investment in education - the relationship between expenditure on School Maintenance and the number of places provided - can be taken a little further [8]. Ideally, what we should like is a quantitative relationship between the number of places (in terms of 'old' and 'new', say pre-and post-war places) and the unit expenditure on maintenance, at constant prices. Such an equation would predict how unit costs would change as the 'mix' of places changes over a period of time. But, the fact that the 'mix' of places is unknown together with the absence of a suitable, valid, price index for deflating maintenance costs prevent the derivation of this ideal equation. Nevertheless, a crude indication that such a relationship does exist is to be found in Fig.3.10 which shows the relationship of unit maintenance costs in schools to the accumulated number of places from 1960 - 1967. The scatter diagram indicates that in the eight year period, each additional 45,000 or 50,000 places have been accompanied by an increase in unit outlays on School Maintenance of roughly £1 or £2 at constant prices.

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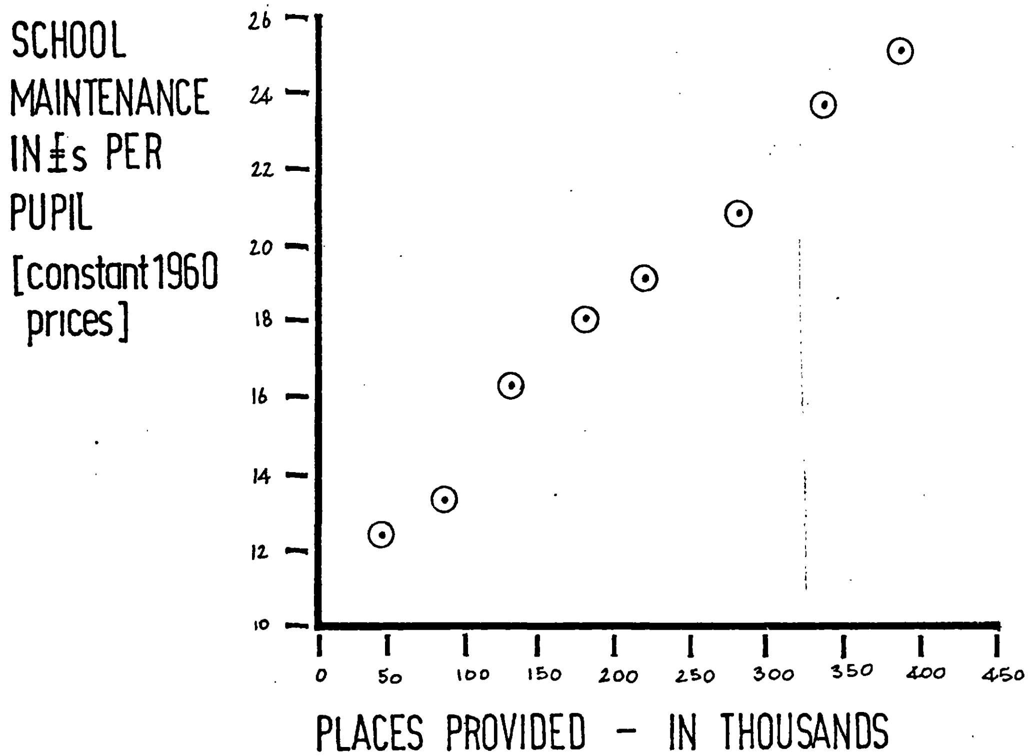
[8] The number of school places exceeds the number of pupils provided for in a school or authority. In secondary schools roughly 1.5 places are provided for each pupil to give flexibility of subject options, class sizes, timetables.

FIG. 3.10 The Relationship Between School Maintenance And The Provision Of New Places 1960-1967



source: appendix 3/G.

The pursuit of the ideal form of the relationship between maintenance costs and school places lies outwith the scope of this work. The slight evidence from the above diagram would suggest such a relationship will play a part in explaining different maintenance costs in Scottish authorities which are, almost certainly, at different points in their re-building programmes. Additionally, such a relationship would be valuable in the projection of costs.

To sum up Fig.3.9 the general pattern is one of high costs in one item of expenditure tending to be associated with the high costs in the other major items.

The results of the above exercise and the observed high correlation between the unit costs of the authorities in two financial years, 1962/63 and 1965/66, suggest that there are certain factors affecting unit costs and these factors are indigenous to the authorities.

School Population and Unit Costs

An obvious unit cost-controlling factor is the size of the school population in an authority. Fig 3.11 shows that within authorities with a small (less than 20,000) school population there is a large range of unit costs. In the larger authorities the range of unit costs is smaller. Very small authorities (less than 5,000) tend to have very large unit costs indeed, (see Zetland and Sutherland). The form of the scatter diagram Fig.3.11 suggests a linear relationship between the log values of the data of the form

$$\log Y = b \log X + a.$$

where X is the school population in pupils,
Y is the unit cost in £

When log values of school population and unit costs were taken, the following regression equation was calculated.

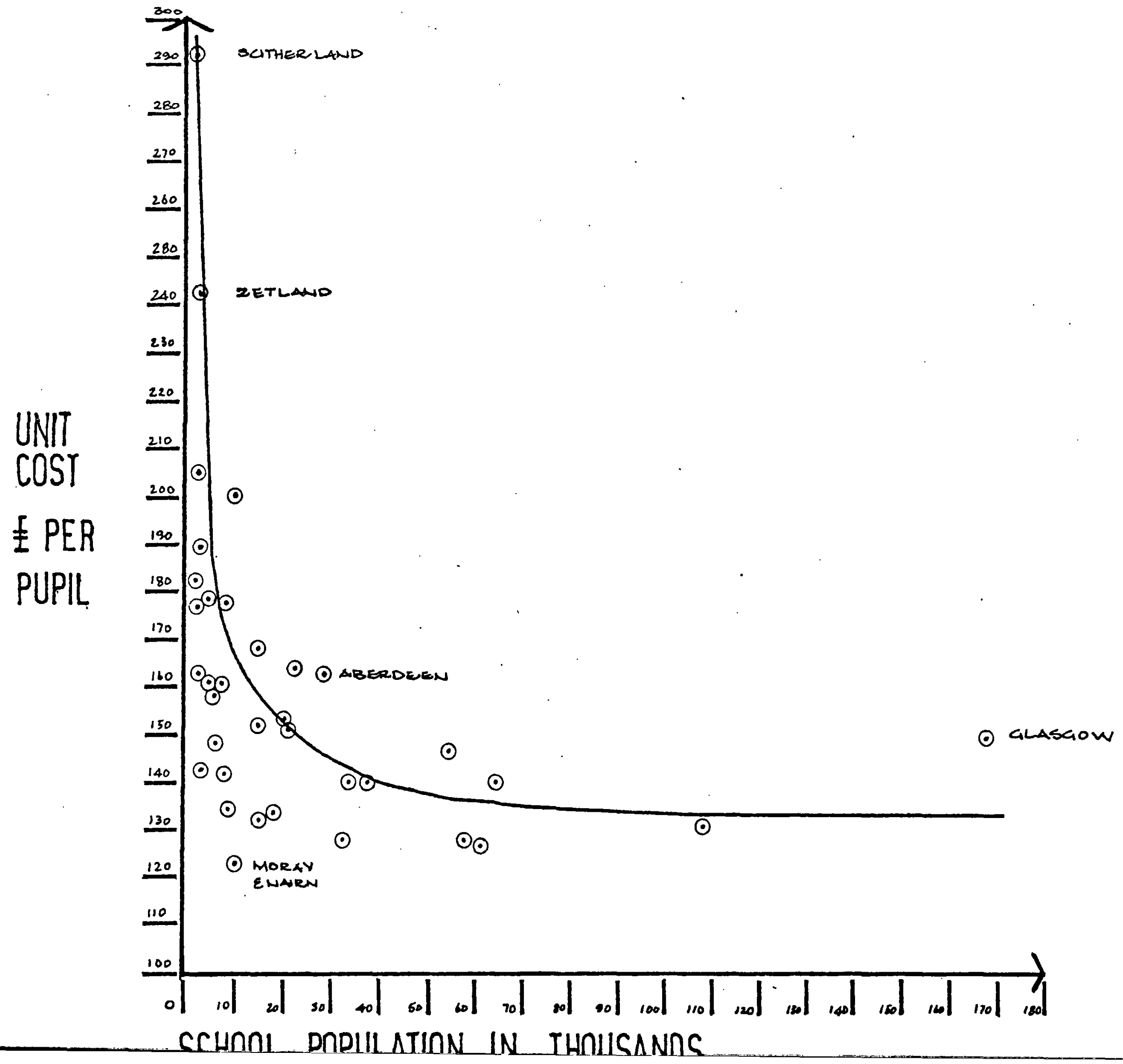
$$\log Y = -\ 0.0991 \log X + 2.6035 \quad (r = -\ 0.6375)$$

The correlation coefficient is significant and indicates that 40% of the variability in log values of unit costs can be accounted for by the relationship between the log value of unit costs and the log value of school population. The regression coefficient (- 0.0991) is significant at the 0.01 level (t = 4.6) and indicates that for an increase of one unit of log X, the log value unit cost decreases by 0.0991. The scatter of points in Fig.3.11 and the relatively low values of both the correlation and regression coefficients indicate that the absolute number of pupils in an area is only one important factor controlling unit costs.

From what has been said regarding the organisation of schools in rural areas it might be expected that the dispersion, or 'density', of school children on the ground, might correlate highly with unit costs. The extremes of population density in Scotland are represented by Sutherland, (one pupil per sq. mile) and Glasgow (2830 pupils per sq, mile).

Fig. 3.11

Diagram Showing Relation Of Unit Cost To School Population
Scottish Education Authorities 1965/6



Conditions of low population density are bound, perhaps even with a rational centralisation plan, to give rise to small schools and small classes. Fig.3.12 shows the values of the rank correlation coefficient for pairs of variables involving population density.

FIG .3.12

FIG.3.12

Four Rank Correlation Coefficients Involving Population Density+

35 Scottish Education Authorities 1962/3

	Unit Cost	P.T.R.++	Transport etc*	%age staying on after 15 years **
Population+ Density	- 0.73	+ 0.76	- 0.95	- 0.43

\+ Population density in pupils per sq. mile

++ P.T.R. : Pupil/teacher ratio = the ratio of the total number of pupils in an authority to the total number of full time equivalent teachers (present on one day in the year).

* This denotes expenditure on Transport, accommodation, board/lodging, education in hospitals, bursaries : For Scotland as a whole, in 1962/63 the first three sub-heads represented 68% of the total - see Fig 3.2 (heads 7-1 0).

** The %age staying on after 15 years is the number of pupils aged 15,16,17 18+ expressed as a %age of the 13 year-old schools age group of respectively 2,3,4 and 5 years previously. The figures are not corrected for migration.

There is a strong negative relationship between unit cost and population density i.e. an authority which is high up in the 'league table' of unit costs, e.g. Orkney, is likely to have a low population density. An obvious exception to this 'rule' is Aberdeen City which has a population density of 1670 pupils per sq. mile but has higher unit costs than Aberdeenshire (11.2 pupils per sq. mile).

A high pupil/teacher ratio is associated with high populatinn density. Towns and industrial areas, then, have fewer teachers per standard quantity of pupils, say 100, than rural areas. Roughly speaking, classes in rural areas should be smaller than those in towns.[9] With Teachers' Salaries taking up such a substantial part of the total outlay on education, small classes in rural areas must play a significant part in accounting for the higher unit costs in those areas.

A highly significant relationship exists between population density and expenditure on transport, accommodation, board etc. The problems of centralisation of schools, including the reduction in the number of one teacher primary schools, and in the number of secondary departments with the aim of forming 'viable' educational units offering a range of courses, are only now being tackled in Scotland. Expenditures on transport and accommodation may be so constrained in rural areas that centralisation will further increase them. [These increased transport/boarding costs should be more than outweighed by reduced unit staffing and maintenance costs of schools]. Fewer schools must result in longer journeys, perhaps too long for secondary children, more of whom may require boarding. There will be more to say (in the chapter on economies of scale) on the centralisation problem.

The significant rank correlation between population density and the numbers at school after the official S.L.A.[10] requires discussion. Those authorities ranked lowest in the population density tend to be ranked high in the proportion of its pupils staying on after 15 years of age.

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[9] The P.T.R. is an educational statistic, the interpretation of which is fraught with problems. For primary schools, where one teacher teaches one class, the P.T.R. indicates roughly the average size of class (notwithstanding visiting art, music,physical education specialists). For secondary schools, a low P.T.R. may indicate small classes or, perhaps, large classes and teachers with a considerable amount of non-teaching time.

[10] S.L.A.: School Leaving Age.

Industrial areas on the whole, tend to have more and better paid jobs (many of them unskilled) for school leavers than rural areas. To put that another way, the opportunity cost of education in the industrial (more densely populated) areas of Scotland is higher than in the rural areas. It costs more to a family - in terms of loss of potential income - to keep a young person at school in Glasgow than in Perthshire. This economic factor is not the only cause. From all that is known about social class and participation in education beyond the period of compulsory attendance, we would anticipate that this social factor would increase the percentage of pupils staying on after fifteen in those authorities which have a larger proportion of middle class families. A third factor influencing the staying-on rate and one which is almost part of the 'conventional wisdom' of the Scottish character is the high regard for, or positive attitude towards, education of many of the Scottish landward people. The quantification of the part each of these three factors plays in the pattern of 'staying-on' in an authority is outwith the scope of this research.

Summing up this section, the evidence is that many rural authorities have educational outlays which are hardly within their control in so far as they are constrained by the size and dispersion of the population. Large areas, small schools and small classes, result in high unit outlays through high salary bills, high transport/ accommodation costs, maintenance and meals and milk charges. Small classes or at least a comparatively 'favourable' pupil-teacher ratio are known in some less rural areas, e.g. Aberdeen City, which had a P.T.R. of 18.2 (compared with the figure of 22.6 for Scotland as a whole in 1962/63)and this fact largely explains why the city has a unit cost mid-way between those of a Rural area and those of an area of Heath and Moor.

CONSTRAINT : TEACHER SHORTAGE

A very real constraint is put upon the costs of those authorities which have an overall teacher-shortage. In the great push forward towards universal secondary education, practically all countries are affected by a shortage of secondary teachers. In some cases the lack is qualitative but in most cases it is both qualitative and quantitative. In Scotland, the present teacher supply position may be summarised as:

1. an overall shortage of teachers;

2. a continuing shortage of secondary teachers while the overall supply of primary teachers is now meeting overall demands;

3. a chronic deployment problem of teachers in both primary and secondary school;

4. serious deficiencies in some secondary subject areas e.g. in maths and science - particularly physics .

It is the third factor - teacher deployment - which most obviously constrains education expenditure in the Scottish authorities. 'Well staffed' areas such as Aberdeen, Edinburgh, Midlothian, reported shortages of 31,108 and 13 teachers respectively at December 1966, while poorly staffed areas such as Glasgow and Lanark reported shortages of 1309 and 547 teachers respectively. Estimating the average cost to the authority of a teacher in 1965/66 at £1400, these shortages in Glasgow and Lanark resulted in 'savings' of £1.8m and £0.77m respectively in salaries alone. In other words, unit costs in these authorities were lower by at least £11 and £7 per pupil respectively than if they had been as well staffed as other authorities.

This is not the place to pursue at length the reasons for the deployment problem nor the place to pose solutions [11] [12]. One could guess that unless there is, in the future, a huge surplus of teachers there will always exist a deployment problem because some parts of the country are more <u>attractive</u> than others to teachers. The attraction may be the social-class composition of the area, the aesthetic nature of the town or countryside, the availability of housing and 'good' schooling. Those areas in the West of Scotland which have, at present, a 10% or more shortage of teachers lie in an area which is heavily industrialised and, compared withthe rest of Scotland, densely populated. The measures to beat the deployment problem suggested in the Robert's report[11] and instituted in 1968 consisted of offering more money to teachers to teach in these areas. That is, a financial attraction has been added to the other features of an area (or more accurately, schools within an area). But does every man have his price?

<u>Conclusion</u>

The observed variations in unit costs in the thirty five Scottish authorities are, in the main, constrained by the geographic and demographic nature of the area and the number of teachers. Education committees have some room to manoeuvre in the provision of school buildings, expenditure on school equipment, textbooks, apparatus etc., more generally in the planning of schools, the policy with regard to the employment of non-teaching personnel and the standard of maintenance of buildings. Only detailed case studies of the provision of schooling/

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[11] The S.E.D. report <u>Measures to Secure a more Equitable Distribution of Teachers in Scotland</u>, 1966 Edinburgh HMSO, deals with possible solutions of the problem. No rigorous analysis of the reasons for such a poor distribution exists to the writer's knowledge.

[12] A later memorandum <u>Staffing of Secondary Schools in Scotland</u> ,1969; Edinburgh:S.E.D. revealed that large differences in staffing standards - measured by the P.T.R. - exist in the education authorities and in the schools within authorities.

in areas would reveal how much conscious planning and decision-taking had contributed to preeent unit cost patterns; for this type of study much has to be known about costs at the micro level. It is to studies of the costs ofindividual schools that we not turn. W

PART III

THE COST OF SCHOOLS

INTRODUCTION

One of the objectives of the Scottish Educational Costs Project was the identification of the costs of particular schools. A pre-requisite for the attainment of that aim was the formulation of a cost-accounting methodology which would be multi-functional in so far as it would allow costs to be allocated to individual schools, to groups of schools, to subjects within schools (where appropriate), and to various cost categories. Some idea of the difficulties which had to be faced in obtaining the costs of individual schools can be gauged from the limited nature of the data demanded on official financial returns to the S.E.D. at the time of beginning the research. The form of returns (F/2) [13] from Scottish education authorities did not require a breakdown into primary and secondary school expenditure so that even the simple analysis produced in England and Wales, see Fig.3.13 could not be obtained for Scotland. [14]

Fig 3.13 Fig 3.13

Unit Costs of Primary and Secondary Education 1965/6

AREA	Cost per Pupil (1) PRIMARY	(2) SECONDARY	RATIO OF (2) : (1)
London Boroughs	£75	£145	1.93 : 1
County Boroughs	£70	£134	1.91 : 1
All Counties	£73	£136	1.86 : 1

Source: Education Statistics, 1966-7, The Institute of Municipal Treasurers and Accountants (London 1968)

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[13] This form was superseded in 1967/8 by form F2/RSG1

[14] Only one Authority up to 1968/9 to the writer's knowledge (as a matter of course) broke costs down to primary and seoondary schools. The tendency among Authorities is to try to give the S.E.D. what it requires, in the format it requires. Since there was no request for breakdown of costs, other than a straight object of expenditure analysis, Authorities would only perform the more detailed analysis if it could use the information.

Fig. 3.13 shows, that in England, the cost of educating a secondary pupil is somewhat less than twice that of educating a primary pupil. How do these figures compare with Scotland? That is one question which we should like to answer. Another is, how does the cost of educating a pupil in the later years of schools, say, the over fifteen year-olds, compare with younger pupils in the secondary schools? In England, the Local Education Authorities Committee on Inter-Authority Payments estimates that secondary pupils aged 16 or over cost twice as much as those under 16. Then, at the micro level we should like to identify a) administrative costs, b) subject costs, c) costs of different sizes of schools, d) costs of different types of secondary school.

What follow are the results of an analysis of the costs of education in all schools in one authority (Area A) for 1964/5, and a cost analysis based on a sample in a contrasting region (Area B) for the same year.

SCHOOL COSTS - AREA A

The total revenue expenditure on education in Authority 'A' for the year 1964/5, as given in the Form F.2, was £2.163m, whereas the total expenditure analysed in the project was £1.432m or 66.2% of the whole. The difference between the two is mainly accounted for by the heads, repayment and interest on loans, rates, taxes, insurance etc., the food and milk used in the school meals and milk service, F.E. maintenance and various minor sub-heads of expenditure. Of the £1.432m analysed, £0.217m could not be allocated to any particular school. This included the expenses incurred in the Education Authority offices, bulk fuel supplies bought for unspecified schools, repairs and maintenance of school teachers' houses and those expenses which it was not possible to code to a sc hool because the school name was not marked on the invoice or salary card. The total allocable to schools was therefore £1.215m or 84.8% of the total analysed.

PRIMARY

The total expenditure on primary schools which had no secondary departments amounted to £0.457m, which is 31.9%of the total analysed and 37.6% of the total allocable to schools expenditure. Allocable expenditure per primary pupil worked out at £60.93, taking the total expenditure as £0.457m and the number of pupils as 7,500.

There was, however, a range of costs from £46 per pupil for a school with 14 teachers and 515 pupils, to £152 per pupil for a school with 2 teachers and 28 pupils. The factor of economy of scale is evident when one considers the overall costs of the 'Small' primaries (£95.86 per pupil), the 'Viable' primaries (£66 per pupil), the 'Two-Stream' primaries (£50.5 per pupil) [15]. The major cause of the large differences in unit costs, and of the obvious economies of scale, is the range in Teachers' Salaries per pupil, which take up about 75% of the total allocable expenditure.

SECONDARY

Of the £1.432m analysed, £0.530m was allocable directly to secondary departments. This £0.530m represents 37.0% of the total £1.432m and 43.5% of the total expenditure of £1.215m allocable to schools. The per pupil allocable expenditure of a secondary pupil is derived as £108.67 per pupil. This amount is an under-estimate because of the overheads included in the joint costs of combined primaries and secondaries is not included nor, of course, are those heads of expense not analysed by the project. If the teaching cost of a secondary pupil is modified by assuming that £23.52 per head can be allocated as the secondary share of the joint costs then the total teaching cost per pupil is £108.67 plus £23.52 or £132.19. This adjustment of £23.52 receives some justification in the following paragraph dealing with two-department schools. No opportunity was available to obtain reliable figures on unit costs of secondary schools in this area as affected by the factor of scale, because of the paucity and variety of secondary schools. A large four-year school with over 1100 pupils had costs of £93.06 per pupil, while a comprehensive school with 800 pupils had costs of £109 per pupil. The only senior secondary in the county, of roughly the same size as the comprehensive showed costs of more than £137 per pupil. In fact, if the additional amount for joint costs were added to the senior secondary costs, the unit costs in that school would be roughly £163.

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[15] 'Small' = one and two teachers
'Viable' = three to seven teachers
'Two-Stream' = eight to fourteen teachers

TWO-DEPARTMENT SCHOOLS

Scotland's two-department schools [16] are notorious for fouling up statistics. The treatment given to them in the project required all costs associated with these schools to be shared between three codes for any one school; namely a code for the primary department, a code for the joint costs and a code to represent the size and type of the secondary department. Of the £1.432m. analysed, £0.517m. was allocable to these combined or two-department schools. This represented 36.1% of the total expenditure analysed or 42.5% of the total allocable expenditure. With a school population in these combined schools of 5151 pupils, the costs turn out to be about £100 per pupil. The method of allocation of joint costs in combined schools is not established. The method adopted by the writer was the crude one of dividing the total joint costs for a particular school by the total number of pupils on the roll of the school (both primary and secondary pupils). Since all except one of the primary departments attached to such schools is a 'Viable' Primary, we would anticipate costsfor these primary departments to be around £66 per head (see above Primary). In fact, the average cost per pupil in the 11 primary departments was £39.57 and the overheads for the combined schools £23.52 per pupil. Addition of these per pupil figures gives an estimated cost for a primary pupil in a combined school as £63 per head, which matches very well with the £66 proposed as being rational.

Fig. 3.14 is an attempt to clarify the main data on which the last five paragraphs were based. Fig 3.15 shows some of the figutes on which the calculations of unit costs were based as well as some figures which were not used in the above commentary.

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[16] Primary and Secondary in one administrative unit.

Fig. 3.14 Schematic Representation of Expenditure Analysed in Area A

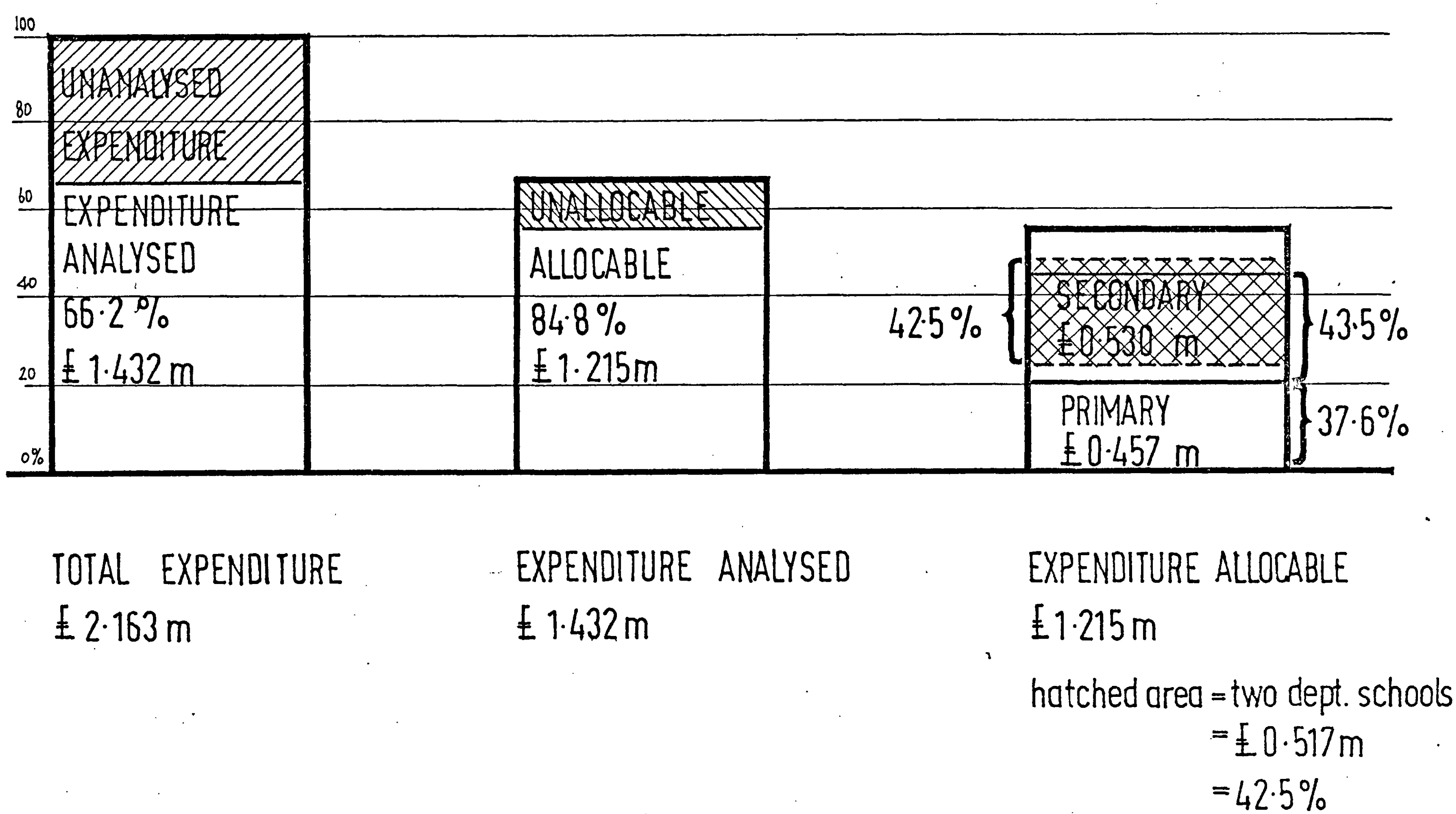

Fig 3.15 Fig 3.15

Total Allocable Expenditure - Area A 1964/5

	TOTAL £	
Primary Schools	457,093	
Primary Depts. attached to Secondaries	89,212	
Joint Costs	120,667	
Secondary Schools (Incl. a Farm School)	530,461	
Nursery	8,653	
Special Schools	8,631	
F.E.	61,501	
Unallocable	155,692	
	TOTAL	£1,431,910

Calculation of Unit Costs in Primary and Secondary Schools

In order to calculate complete unit costs for primary and secondary schools separately, it is necessary to gross up the basic unit costs obtained by accurate analysis of the accounts of the authority, namely £60.93 for primary and £132.19 for secondary. The grossing up will be done in two stages. Both stages have in common the assumption that the expenditure which could not be allocated to a particular school may be divided proportionally in the same ratio as that which was found by the analysis, i.e. in the ratio of 133/61 or 2.18/1 between secondary and primary.

Stage 1:

This involves allocating back to primary and secondary the total amount, which could not be allocated to any particular school (£217,193), less expenditure on F.E. (£61,501) namely £155,692. Much of this was expenditure on central administration, large bulk fuel supplies, school houses, and expenses incurred under the heads, school meals and milk, central kitchens, school health service, school crossing patrols etc. Allowing the secondary pupils to have the weight of 2.18 to every primary pupil, the cost per primary pupil is derived as follows:

$$\text{Cost per primary pupil:} = \frac{155,692}{2.18 \times 4877 + 9754}$$

$$= £7.64 \quad *$$

The adjustment for secondary pupils is, therefore, £16.65 per pupil. The result of this first grossing up is to give the costs of primary education as £68.57 per pupil, and secondary education as £148.84 per pupil. See Fig. 3.16.

Stage 2 :

This is more difficult in that it involves finding out how much was spent in Area A on Schools (including Nursery and Special) as opposed to other educational institutions. This involved eliminating expenditure on items other than schools, i.e. items which deal with expenditure in further education and adult education, in order to find the total which can be allocated to schools (a) from the work of the S.E.C.P. and(b) from the form F.2 data on Area A. [17] In fact, of the £1.432m analysed, £0.061 could be allocated to F.E. or A.E. It is assumed that the resulting £1.371m was spent on schools. On the F.2 form for 1964/5 the total cost of education was £2.163m, of which £0.134m could be allocated to F.E. or A.E. The resulting £2.029m is allocable to schools for the purposes of the present calculation. Consequently, the unanalysed portion of educational expenditure is £2.029m less £1.371m or £0.658m. This method of estimation is only roughly correct in view of the fact that the figures in Form F.2 and those in the project are not striclty comparable due to the difference in the 'years' - Fiscal and Local Authority.[18]

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[17] The decision was taken to err on the side of over estimating the share of schools in the non-analysed expenditure. Clearly, there would be justification for allocating some of the central administrative costs to F.E. Also, heads such as Loan Charges, youth services, insurance, rates are not wholly attributable to schools. There is a direct comparison here with the decision taken with regard to Scottish expenditure on schools - compare Note 6.

[18] The F.2 form is the Education Account Outturn and Estimates for the Education Authority year 16th May - 15th May. All of the expenditure on teachers' salaries in the project was referred to the Fiscal year 1st April - 31st March because teachers' salary records are kept with a view to tax returns rather than F.2 return.

Once again this sum must be allocated between primary and secondary on the basis of the ratio of 2.18/1 between secondary and primary pupils. When this is done in the same way as shown * at the cost per pupil of secondary education is £219.21, and of primary education £100.85. Fig 3.16 summarises the two grossing up stages.

Fig 3.16

Fig 3.16

Derivation of UNIT COSTS OF Primary and Secondary Schools. Area A 1964/5

Costs	Primary £457,093	Secondary £530,461	Other £155,692	Unanalysed Part £658,000
Per Pupil	£ 60.93	£132,19		
UNALLOCABLE	£ 7.64	£ 16.65		
Gross Stage 1	£ 68.57	£148.84		
UNALLOCABLE	£ 32.28	£ 70.37		
Gross Stage 2 Total Per Pupil Costs	£100.85	£219.21		

The gross cost of primary education appears then to be £101 per pupil for a year, or £0.06 (1/2d) per pupil-period [19], or 9/4d per pupil-day [20], and of secondary education to be £219 per pupil or £0.13 per pupil-period (2/7d) or 20/8d per day; these calculations being summarized in Fig.3.17.

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[19] Assumes a 40 week year and 40 periods per week

[20] Assumes 8 periods in a day i.e. Col.2 x 8 = Col.3.

Fig 3.17

Fig 3.17

Three Unit Costs of Primary and Secondary Education

Area A 1964/5

	Col.1 Cost per pupil	Col.2 Cost per pupil-period	Col.3 Cost per pupil-day
PRIMARY	£101	£0.06 (1/2d)	9/4d
SECONDARY	£219	£0.13 (2/7d)	20/8d

The following paragraphs refer to the Reports of the S.E.C.P. cost analysis which are given in Appendix 3/H.

REPORT 1

Report 1 gives the tabulation of expense heads as totals and, where appropriate, the cost in pounds per pupil. The total of primary Teachers' Salaries [21] for one year is £415,406, which gives a per pupil expenditure of £42.58 (using the figure of 9754 primary pupils). Fig 3.18 summarises Report 1. Corresponding figures for the total of secondary Teachers' Salaries [21] are £429,465 or £88.05 per pupil (taking the figure of 4877 secondary pupils). Thus, the ratio of secondary Teachers' Salaries to primary is rather more than 2/1. The total of Teachers' Salaries allocable to Years I - III is £318,386 or £82.68 per pupil (taking the figure of 3850 as the number of pupils in Years I - III throughout the authority), and the total of Teachers' Salaries for Years IV - VI was £111,079 or £145.20 per head

[21] Important Note: "Teachers' Salaries" here refers to the teaching element of the cost to the authority of a teacher. As explained in Chapter 2, the cost of a teacher to the authority is the sum of salary (the sum of basic salary + responsibility allowance), contribution to superannuation, N.I. G.P. The total cost was allocated between teaching and school administration - the elements of the cost being called teaching element and responsibility allowance, R.A. element of the cost, respectively. Clearly, if a teacher has no R.A. in his salary, he is considered as causing no increase in the cost of school administration. What we have here, then, is the total of the teaching elements of the salary. The R.A. element is mentioned under the discussion of school administration.

(using 765 as the number of pupils in Years IV-VI)[22]. The ratio of Teachers' Salaries is thus about 7/4 between Years IV-VI and Years I-III.

Fig.3.18

Fig.3.18

Part of The Analysis of Heads of Expenditure - Area A

1964/5

Principal Expense Head	Sub-head	EXPENDITURE Total £	Per-Pupil £
Teaching	Primary Teachers	415,406	42.58
	Lower School Secondary Teachers	318,386	82.68
	Upper School Secondary Teachers	111,079	145.20
	All Secondary Teachers	429,465	88.05
	All Teachers	844,871	57.70
	Audio Visual Aids	1,560	0.10
	All teaching supplies	38,599	2.63
School Administration	Non-teaching headmasters	43,252	2.95
	Responsibility Allowances	54,964	3.75
	Telephone	3,583	0.24
Central Administration	Administrators,Psychologists etc.	12,003	0.82
	Clerical	14,323	0.98
Provision and Maintenance of Buildings	Janitors,Cleaners	68,242	4.66
	Repair of buildings	28,836	1.83
	Electricity	24,423	1.66
	Gas	734	0.05
	Oil	585	0.03
	Solid Fuel	34,720	2.37
Transport/ Accommodation	Pupils,Travel	23,358	-
	Total Expenditure	38,797	2.58
Meals/Milk	Cooks,D.R.A.	66,119	4.51
General Misc.	Total	26,930	1.84
Source:	Appendix 3/H Report 1		

[22] The discrepancy in the total number of secondary pupils, given as 4877 in the first set of calculations of unit costs but shown as 4651 (3850 + 765) when split between Years I-III and IV-VI can be put down to the fact that two sets of statistical returns had to be used for ascertaining school rolls. These returns were made at different times in the school year. The local administrator held the view that the difference of 262 in the two figures would not alter the ratio of unit costs in the two halves of secondary schools since the ratio of pupils in Years IV-VI to those in Years I-III does not change significantly in the course of a school year. Clearly the level of the unit costs for both the lower and upper school is somewhat higher than it should be.

These differentials in unit salary costs between Primary and Sec ondary reflect; (a) the difference in class sizes, 28.4 in primary departments and 16.2 in secondary departments,

(b) the difference in qualifications of primary and secondary teachers.

Similarly, the difference in mean size of teaching groups (15.2 for years I-III and 9.8 for years IV-VI) and the higher average qualifications of teachers in the upper school, cause the differential in unit salary costs between years I-III and years IV-VI.

Expenditure on Teachers'Salaries (£57.7 per pupil) swamps all other subheads of the class of expense - Teaching - which accounts for roughly £0.955m or £65 per head. Consumable Teaching Supplies (52/- per pupil) and Capital Equipment for Teaching (8/- per pupil) are quite insignificant in comparison. Further attention is given to the labour-intensive nature of teaching in Chapter 4.

The second principal class of expense - School Administration - represented more than £8 per pupil, the greater part of this being the responsibility allowances of teachers and the entire cost of non-teaching headmasters.

Expenses directly allocable to Central Administration worked out at just more than a quarter of those allocable to School Administration. Of the £2.28 per pupil allocable to Central Administration £1.8 is allocable to salaries of administrators and clerical helpers.

Administration at the two levels of school and Education Authority accounts for approximately £10.5 per pupil or roughly 2/13 of the level of expenditure per head on Teaching. It would be easy to dispute the allocation of the responsibility allowance element of a Teachers' Salary to the head School Administration. The fact is that some teachers do perform administrative tasks during their non-teaching time and, it must be emphasised, at other times too. To obtain a more accurate allocation of Teachers Salaries to administration it would be necessary to study what teachers did with their time i.e. undertake a job analysis. Such a task was outwith the scope of the present work, hence the adoption of the short-cut method of allocating that part of the salary given for extra work, to school administration. The decision to allocate all of the salary of non-teaching head-teachers to School Administration is less open to question for most head-teachers behave like managers or administrators rather than as teachers.

It may be concluded that the function - administration - is a significant part of educational expenditure. Evidence above indicates that it amounts to between 1/6 and 1/7 of the level of expenditure devoted to the Teaching function.

Provision and Maintenance of Buildings is the second largest principal class of expense amounting to over £180,000 or £12.35 per pupil. The largest sub-head is once again that on personnel; Janitors'/ Cleaners' wages cost £4.7 per pupil roughly. The main mode of heating - in as much as per pupil costs measure it - is coal, £2.4 per pupil being spent on it compared with £1.7 per pupil on electricity. Gas and oil heating are insignificant, £0.05 and £0.03 per pupil respectively.

No analysis of Transport and Accommodation costs was obtained other than crude totals. £2.6 per pupil was spent on this head. The form of accounts and records did not allow these expenses to be allocable to particular schools. Expenditure on Meals and Milk directly allocable to schools consisted mainly of outlays on cooks and dining room attendants - £4.5 per pupil. There was some £1.8 per pupil of General and Miscellaneous expenditure.

REPORT 2

Report 2A shows for each primary school, the total and salary costs per pupil, the pupil-teacher ratio and the salary as a proportion of the total. This data, along with that from Area B, provided the basis for an intensive study of the economies of scale in primary schools - see Chapter 5. This report, and Report 2B, were compiled from a tabulation of the total expenditure on all sub-heads and heads of expenditure for the 100 odd schools and educational institutions in Area A. Additional information concerning the staff, pupils and buildings was obtained from the education and architects departments.

PRIMARY CASE STUDY

The following 'case study' will give some idea of the detail obtained.

School	: "Countrytown" primary
Teachers	: 8
Pupils	: 246
Pupil teacher ratio	: 30.7
Built	: 1890
Classrooms	: 8 ; schoolhouse
Total floor area	: 9,522 sq.ft.
Type of Construction	: stone walls, slated roof, partly modernised in accordance with School Building Code 1954.
Mode of Heating	: Low pressure hot water, coal fired.
Source of data	: Director of Education's Department, County Architect's Department.

Fig 3.19 Fig 3.19

Analysis of Expenditure of One School - "Countrytown" primary 1964/5

CLASS OF EXPENSE	TOTAL EXPENDITURE £
Primary Teachers' (full-time)salaries	6865
Primary Teachers' (part-time) salaries	2930
Repairs to Audio visual Aids	20
Repairs to Course Equipment	6
Class Stationery	117
Course Supplies	64
Textbooks	154
Responsibility Allowances	629
Clerical Help	221
Telephone	39
Janitors', Cleaners' Wages	1217
"Capital" building	260
"Capital" electrical, heating system	375
"Capital" fixtures, fittings	215
Repair - buildings	409
Repair - heating, lighting	123
Electricity	183
Oil	2
Solid Fuel	513
Sundry Supplies	68
Pupils Travel Expenses (Allocable)	12
Cooks, D.R.A.	468
Meals - Repair of heating system	6
" - Electricity	9
School Crossing Patrol	9
TOTAL	14,914

Note: "Capital" : expected durability of more than two years, expenditure more than £25 (explanation in Chapter 2)

Source: From tabulation of coded accounts, Area A, 1964/5

The above data is fairly typical for primary schools in the authority. Of the overall cost of £60.6 per pupil, £42.3 or almost 70% is devoted to teachers. A total of £2515 was spent on general up-keep and a further £850 on Capital provision (including an extension of a playground and fitting of new cupboards) the costs of which should properly be spread over a number of years. Maintenance costs of buildings might be referred to either the roll of school (possibly misleading if roll is greatly below, or above the number of "places" provided [23]) or to the floor area. These costs work out as £13.7 per pupil or £0.35 per sq. ft. (using the sum of £2515 and £850 as the total maintenance costs).

CYCLICAL COSTS

Expenditure on teachers ranged from 56% to 88% of total allocable expenditure. Such a variation must, in part, be due to cyclical costs. An examination of the expenses incurred by those schools with low (less than 70%) proportions of expenditure allocable to Teachers' Salaries showed charges for exterior and interior decorating (on a five year cycle for most schools), general fabric improvements, furnishing replacements. These cyclical costs are major items of expenditure and some policy must be adopted with regard to their allocation.

Cyclical Costs:

A) Decoration, the simplest approach would be to determine the policy of the authority with respect to decoration; if buildings were re-painted every three years, then one-third of the total cost might be allocated to each of the three years.

B) Replacement or additions of furnishings. What a purist desires is to distinguish how much of expenditure on furnishings is replacement, and how much is net addition to capital. Knowing these facts would enable one to work with capital stocks, and depreciation and adjustment to capital.

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[23] Whether a school is fully occupied or not it normally must be heated, cleaned and maintained throughout. In other words these fabric costs are 'fixed' rather than 'variable' costs.

It proved impracticable to do either of these things. In the first place, the difficulty of allocating decoration costs at the stage of coding invoices was considered to be too great for the expected returns. Secondly, since there were no stocks of furnishings kept by schools and since there was no indication - either on the invoices or in the architect's records - of what was replacement, and what was addition to stocks, no action could be taken on allocating costs of replacement or additions of furnishings.

TWO DEPARTMENT SCHOOLS

Report 2B shows the unit costs of two-department schools and the appropriate pupil-teacher ratios. Fig 3.20 has been adapted from this report and other information available from the print-out. [24]

Fig 3.20 Costs Per Pupil and Pupil/teacher Ratios In Thirteen Secondary Departments. Scotland 1964 - 5 Fig 3.20

School Code	Unit Cost in £	Pupil/teacher ratio
30047	77	18.3
73020	93	20.5
30055	102	17.4
30069	109	16.0
62003	109	16.8
61054	111	15.5
70075	114	17.8
61082	128	17.0
70058	129	15.2
30034	130	17.7
71049	131	11.9
70060	153	13.5
52019	163	13.4

Source: Appendix3/HReport 2A; entries for 73020,62003 direct from computer print-out.

[24] The tabulation and processing of expenses was done by computer. Results therefore were available at first on the paper print-out or output from the computer.

The trend is as expected the lower the pupil/teacher ratio the higher the cost per pupil. Another factor influencing the unit costs is the size of the school. The effect of economies of scale on unit costs is taken up in Chapter 5. An even more potent influence on unit costs may be the type of school or range of courses offered. The influence of courses is covered in the section on subject costs in Chapter 4. The working of all three factors in a statistically perverse way is evident in the unit costs of the last two schools in Fig 3.20. School 70060 is a small (less than 200 pupils) four year school offering a limited range of subjects up to 16 years of age, while 52019 is a medium sized (around 800 pupils) selective senior secondary offering a wide range of academic courses up to 18 years of age. On the one hand, one would expect the smaller school to have considerably higher unit costs; on the other hand, part of this differential in unit costs due to size should be off set since school 70060 (the smaller one) is offering a more limited range of subjects. Looking at the question of costs from another standpoint, the similar pupil-teacher ratios might be expected to lead to similar unit costs, since the Teachers' Salaries element in the overall unit cost has been reckoned at about 75%. (Yet, schools 30034 and 71049 have very different P.T.R.'s and similar unit costs). Indeed, it appears that the variables determining unit cost in secondary schools work in a highly complex way and make prediction of the level of unit cost a very difficult business. More will be said on this subject in Chapters 5 and 8.

REPORT 3 UNIT COSTS OF TYPES AND SIZES OF SCHOOLS

Report 3 gives the same kind of analysis as Report 2, but the information is presented by size and type of school. The difficulty of treating joint costs of the two departments of a combined primary/ secondary school comes up once again.

The crude assumption that joint costs can be allocated on a per pupil basis between departments received some justification under Two Department Schools. What this assumption amounted to was that the primary department of a two department school was, for accounting purposes, a one-stream or 'Viable' primary. As can be seen in Fig 3.21 the sum of columns 2 and 3(£63 per head) is rather near to unit cost in the 'Viable' primary type. (£66 per head).

Fig 3.21 Fig 3.21

Comparison of The Unit Costs in 'Viable' Primaries and Primary Departments of Two Department Schools.

	Expenditure Per Pupil		
	1	2	3
		Two Department Schools	
Description of Account Head	'Viable' Primary	Primary Dept.	Joint Cost
Primary Teacher Full-Time	£37	£32	-
Primary Teacher Part-Time	£ 9	£ 6	-
Stationery	£ 0.6	£ 0.04	£1.32
Janitors/Cleaners	£ 3.3	-	£5.21
Heating/Lighting	£ 2.7	-	£3.1
TOTAL	£66	£39.6	£23.5

Source: Appendix 3/H Report 3

However, a comparison of the sum of columns 2 and 3, with column 1 for the separate sub-heads of expenditure shows that there is a larger difference in costs of the two kinds of school.

The difference in unit salary costs (£8) is not large and within the 'limits of prediction' [25]. On the other hand there is a 100% difference in unit costs of stationery. The joint costs for this item should be allocated on a more rational basis than that adopted viz 1 : 1 apportionment between primary and secondary. In fact, an alternative assumption is that expenditure on stationery is proportional to the total capitation allowance. The ratio of unit cost of stationery in a secondary to that in a primary school is then something like 8 : 3 for authority A in that year [26]. Data collected in Area B shows that the ratio of cost per pupil of cleaning and janitorial work in secondary schools to that in primary schools is 7 : 4; the corresponding ratio for heating/lighting is 7 : 2. The size of the latter two ratios is hardly surprising considering that the building standards of secondary schools (causing higher heating and cleaning bills) are more generous than in primary departments.

The above comparison of unit costs in primary and secondary departments shows that the simplistic allocation of joint costs adopted under Two Department Schools, and subsequently is far from satisfactory. What is required is an apportionment of all sub-heads based on reliable data. The three ratios quoted above are merely indicators of a procedure which might produce more realistic unit costs in two department schools.

REPORT 4 ANALYSIS OF SUBHEADS OF EXPENSE WITHIN SCHOOLS

Report 4 tabulates for each school the five principal sub-heads of expenditure - 1. Salaries, Wages; 2. Capital; 3. Repairs; 4. Consumables; 5. Other subheads - together with the ratio of Salaries/ Wages to overall unit cost. The aim of this report was to determine how much was spent on any head, say consumable items, whether the expenditure was incurred for teaching purposes, administrative purposes, cleaning or whatever.

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[25] In Chapter 5 there are derived linear regression equations which express the relationship between roll and unit cost for primary schools. Any regression equation may be used to predict the value of the unit cost (dependent variable) which is, on the average, associated with a value of the roll (independent variable). There is always associated with the use of a regression equation, a so-called error of prediction, normally expressed as the 95% confidence limits. Having calculated the prediction limits, one can be 95% confident that the value of the dependent variable associated with the chosen value of the independent variable lies within these limits.

[26] Appendix 3/E Capitation Allowances

Fig 3.22 is an extract from the report, which lists each school separately.

Fig 3.22 ANALYSIS OF SUB-HEADS WITHIN FOUR SCHOOLS Fig 3.22

	1	2	3	4	5	6	7
	PER PUPIL COSTS						$\frac{\text{Col 1}}{\text{Col 6}} \times 100$
School Code	Sals/ Wages	Capital	Repairs	Consumables	Others	Total	$\frac{\text{Sals.Wages}}{\text{TOTAL}}$
91086 (Nursery)	£ 87.9	-	£4.8	£15.2	£0.60	£108	81%
91087 (Nursery)	£ 91.0	£1.4	£3.8	£ 7.7	£1.0	£105	87%
92089 (Special)	£ 95.5	-	£4.5	£ 2.9	£0.6	£103	93%
92092 (Occupation Centre)	£213.2	-	£3.8	£13.1	£2.0	£232	92%

Source: Appendix 3/H Report 4

We observe that unit oosts in nursery and special schools are of the order of secondary school costs, while the single example of the unit costs of Occupation Centres given is substantially greater than senior secondary costs (£163). This special category of schools inevitably has high unit costs because they have very small pupil/teacher ratios. There were 9 pupils in the only class in the Occupation Centre in this study.

The proportion of costs taken up by salaries is similar to that in both primary and secondary schools. The consistently high proportion of expenditure reported as being spent on salaries/wages must be viewed cautiously. More precisely, the proportion represents the amount of allocable expenditure devoted to salaries/wages. The unallocable expenditure (see Fig.3.15) is most likely to fall into non-labour categories. Consequently, the proportions should not be taken as indicating that over the country almost 90% of expenditure in education is taken up by paying people. This point is pursued in Chapter 4.

REPORT 5 ANALYSIS OF SUB-HEADS OF EXPENSE WITHIN SCHOOL TYPE

This report shows the same information as the previous report but referenced to type and size of school. Part of it is shown in Fig.3.23 It can be seen that;

1) the factor of economies of scale operates clearly in primary departments.

2) Salaries/Wages dominate all other sub-heads; the amount of "Capital" equipment purchased was very small indeed;

3) unit outlays on Salaries/Wages are consistently higher in secondary departments than in primary departments;

4) no obvious connection exists between unit outlays on Salaries/ Wages and size and type of secondary school. More will be said on this subject in Chapter 5.

Fig 3.23 Fig 3.23

Part of The Analysis of Sub-heads of Expenditure Within School Type

	PER PUPIL COSTS				
	Salaries/ Wages	"Capital"	Repairs	Consumables	Sundries
One & two teacher primary	£ 81	£0.9	£6.5	£6.5	£1.2
"Viable" primary	£ 56	£0.7	£3.2	£5.3	£0.3
Two stream primary	£ 46	£0.5	£1.3	£3.0	£0.1
Senior secondary (1)	£147	£1.6	£2.1	£9.7	£0.1
Comprehensive	£ 97	£0.8	£0.9	£9.9	£0.1
Four year secondary	£ 84	£1.6	£1.3	£6.1	£0.1

Source: Appendix 3/H Report 5

(1) unit costs here include amounts allocated from joint costs.

REPORT 6 ANALYSIS OF EXPENSES WITHIN SUBJECTS FOR EACH SCHOOL

A rigorous treatment of subject costs is to be found in the last section of Chapter 4. The influence of scale on subject costs is treated in Chapter 5.

REPORT 7 ANALYSIS OF SECONDARY SCHOOL EXPENSES WITHIN SUBJECTS

This differs from Report 6 in that expenses are grouped together under subjects over all schools (see Chapter 4).

The results of the study of the costs in a representative sample of 14 schools, 9 primary departments and 5 secondary departments, in Area B for the same year 1964/5, follow.

THE COSTS OF SCHOOLS : AREA B YEAR 1964/5

The aim of this second regional enquiry was to cross-check quickly the complete analysis of costs obtained from Area A. A simplified set of school and account codes was devised, and only the major and accessible areas of expense were investigated, These heads of expense were 1) Teachers' Salaries; 2) Janitors'/Cleaners' wages; 3) Consumable Teaching Supplies; 4) Heating/Lighting; 5) Salaries/Wages of Auxiliaries, Clerical Assistants; 6) a few minor sub-heads. Only those expenses which were directly allocable to the sample 14 schools were analysed [27], so that no overall comparison can be made with the unit costs in Area A. Comparison will be made between sub-heads in the two areas e.g. unit cost of Teachers'Salaries in the two areas.

SUMMARY OF FINDINGS: AREA B

Almost £0.6m was allocable to the 14 schools. Of that, about 78.6% represented Teachers' Salaries, 7.3% Consumable teaching supplies, 5.0% Janitors'/Cleaners' Wages, 5.3% Heating/Lighting. Full details in Appendix 3/I Report 1.

Roughly £133,000 was allocated directly to the 9 primary departments. The cost per pupil of Teachers' Salaries was £36.4, of Consumable Teaching Supplies, £1.72, of Janitors'/Cleaners' Wages, £3.3, and of Heating/Lighting, £2.1. The overall cost [28] of a primary pupil was £44.5. See Appendix 3/I. Report 2A.

[27] With one exception, that of auxiliary teaching staff, the expenditure on which was investigated for the whole authority.

[28] Important: As pointed out in the first paragraph on the results of Area B no direct comparison can be made at this stage between this unit cost and those in Fig 3.16 for primary pupils in Area A.

Over £450,000 was allocated directly to the 5 secondary departments. In per pupil terms, this sum represented £104.1 for Teachers' Salaries, £12.9 for Consumable Teaching Supplies, £5.8 for Janitors'/Cleaners' Wages, £7.3 for Heating/Lighting. The overall cost /28/ of a secondary pupil was £132. Details are to be found in Appendix 3/I Report 2B.

Fig 3.24 Fig 3.24

COMPARISON OF UNIT COSTS IN AREAS A and B

	AREA A			AREA B		
Head of Expenditure	Primary	Secondary	Ratio of Sec:Prim.	Primary	Secondary	Ratio of Sec:Prim.
Teachers' Salaries	£44.83	£ 94.43	2.11	£36.46	£104.16	2.86
Janitors' Wages	£ 3.58(b)	£ 5.47(c)	1.53	£ 1.82	£ 1.81	0.99 } 1.74
Cleaners' Wages				£ 1.51	£ 4.00	2.65 }
Clerical Assistants	£ 1.02(d)	£ 0.89(e)	0.87	£ -	£ 0.81	-
Consumable teaching Supplies	£ 1.64(e)	£ 5.60(f)	3.41	£ 1.72	£ 6.48(a)	3.77
Heating/Lighting	£ 2.05	£ 3.07(c)	1.50	£ 2.15	£ 7.36	3.42
Sum of Main Heads	£53.12	£109.46	2.06	£43.66	£124.62	2.85

(a) Based on only four schools, fifth school omitted since it was in first year of operation and much expenditure was of a 'capital' nature. See also Chapter4.

(b) Excludes two department schools.

(c) Based on two large schools only.

(d) Based on those schools with clerical assistance i.e. total outlay is divided by pupils in two stream and three stream primary departments.

(e) Excludes outlay on two department schools, includes allocation of 'Schools General' expenditure.

(f) Outlay on all secondary departments (excluding Farm School) together with allocation from 'Schools general' expenditure and joint costs of two department schools. The unit costs for class equipment/textbooks were built up from the following figures for Area A.

	PRIMARY	SECONDARY
Total Allocable Expenditure	£11,374	£24,249
Allocation from 'Schools general'	900	585
Allocation of joint costs	-	2,500
Total Expenditure	£12,274	£27,334
Pupils	7,500	4,877

Source: Area A from reports 2 and 3: Area B data Appendix 3/I Report 2A,B

/28/ Important: As pointed out in the first paragraph on the results of Area B no direct comparison can be made at this stage between this unit cost and those in Fig. 3.16 for primary pupils in Area A.

The unit costs in the two areas are compared in Fig 3.24, along with the ratio of unit costs at the first two levels of education. We observe that the cost per pupil of Teachers' Salaries in secondary departments is almost three times that in primary departments in Area B, whereas the same ratio, in Area A, is a little over two. Another estimate of this ratio comes from another Scottish education authority (a city), where the value was 2.1 : 1 in 1964/5 [29]. At least part of the difference in secondary : primary ratios between Areas A and B can be put down to the composition of the 'sample' of 9 primary schools in Area B. No school with fewer than 3 teachers was represented and the pupil-teacher ratios in all 9 schools were over 22.0. These two factors work to produce a per pupil expenditure on Teachers' Salaries in primary schools, which is on the low side. That is, the figure of £36.46 per pupil is an underestimate of the average outlay on Teachers' Salaries for the education authority as a whole. In consequence, the secondary : primary unit cost ratio is somewhat larger than it would be if all schools in Area B had been included in the survey.

A higher degree of agreement exists in the secondary : primary unit cost ratio for Janitors'/Cleaners' Wages and Consumable Teaching Supplies. In 1964/5, expenditure per pupil on Janitors'/Cleaners' wages was $1\frac{1}{2}$ to $1\frac{3}{4}$ times as much in secondary departments as it was in primary departments The largest differential in the five main heads covered was expenditure on Consumable Teaching Supplies roughly $3\frac{1}{2}$ times being spent per secondary pupil as was spent on a primary pupil. The estimated unit cost of Heating/Lighting in Area A secondaries is almost certainly too low because it was made from data for only two large secondary schools. [All other secondary departments being ruled out because of the problem of allocating joint costs]. Hence the secondary primary ratio, 1.50 is too low and does not compare with the 3.42 obtained from the sample of 5 schools in Area B.

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[29] Unit expenditures on Teachers' Salaries 1964/5 Primary £58, Secondary £117. Data from S.E.D.

The unit costs of individual schools are given in Appendix 3/J Report 3, along with school rolls and pupil-teacher ratios. The influence of economies of scale was again immediately obvious for the primary school costs - see Chapter 5.

Fig 3.25 INFLUENCE OF SIZE ON UNIT COSTS Fig 3.25

SCHOOL SIZE	UNIT COST OF TEACHERS' SALARIES	OTHER COSTS
692	£35	£ 6.8
66	£72	£11.1

Source: Appendix 3/I Report 3

The marked influence of pupil-teacher ratio on secondary staff costs is evident from the report on unit costs in the five secondary schools. This data was taken along with observations from Area A and the results appear in Chapter 5.

TIMETABLES

An analysis of the timetables of the five secondary schools was carried out to ascertain 1) the number of pupil-contacts each teacher made in each subject [30]; 2) the amount of teaching-periods and non-teaching periods for each teacher;

3) the costs of each subject were calculated using the data from steps 1) and 2) in each school (results in Chapter 4); 4) further data on the relative costs and use of teaching resources at the lower and upper ends of the secondary school.

It is to this very important topic that we now turn.

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[30] Pupil contacts: a teacher facing a class of 40 pupils for one 'period' makes 40 pupil contacts. The total number of pupil contacts for a teacher is normally referred to one week. It is computed from the sum of the products for each class (teaching unit) of a) the number of pupils in a class nominally on the roll and b) the number of meetings of a class. A teacher facing a class of 30 pupils for 6 meetings makes 180 pupil contacts. The term pupil contact is used here synonymously with pupil period.

ANALYSIS OF THE INPUT

The increase of voluntary staying on at school after the statutory leaving age (the 'trend'), and development of the streams going on to further and higher education, and the acceptance of the principle that subject options should be available to older pupils, have been major features of secondary education in Scotland in the 1960's. In the analysis of the inputs to education under the head Unit Costs, it was pointed out that there had been a 50% increase in expenditure per pupil over the period 1959/60 - 1966/7 (in constant 1959 terms). However, in view of the change in age structure of the school population, and particularly in view of the rapid increase in numbers participating in certificate courses (which have also increased in scope), just how meaningful is a comparison of expenditures over time? On the average, inputs have increased by 50%. Have inputs to primary slipped back to accommodate the growth of secondary education? What proportion of the extra resources has been consumed in providing the added quantities of secondary education, how much in lowering class sizes, how much in employing more teachers so as to increase the range of curriculum? Of course we do not know enough about how we allocate our resources to say how much is earmarked for particular programmes (using programme here to mean a set of activities with a particular objective). The writer confined attention to two questions which seem immediately relevant to a discussion of inputs at a time when the educational industry is exploding. These are:

1. In terms of money and teachers' time, how does the primary stage of education compare with the secondary stage?

2. In terms of money and teachers' time, how do the earlier stages of secondary education compare with the later stages?

The second question raises a problem of where to draw the line as far as 'early' and 'late' stages of secondary are concerned. It was decided to use the division of years I-III and IV-VI. This division corresponds roughly to 12 - 15 year olds and 16 — 18 year olds in Scotland. Reports of English data on unit costs are based on the pre-sixth form and sixth form categories. Since pupils are roughly 16 years of age and over in the sixth form, there is a high degree of correspondence in the divisions made.

UNIT COST RATIOS COMPARED

The ratios in Col. 1 of Fig 3.26 below were calculated by dividing the unit cost of a secondary pupil by that of a primary pupil; the unit costs including all outlays allocable to primary and secondary pupils. The ratios in Col. 2 were found by dividing the unit cost of Teachers' Salaries of a secondary pupil in years IV-VI by that of a secondary pupil in years I-III.

Fig 3.26 Fig 3.26

UNIT COST RATIOS SCOTTISH AND ENGLISH DATA COMPARED

DATE	AREA/SOURCE	Col.1 Secondary: Primary Unit Cost Ratio	Col.2 Upper Sec. Lower Sec. Unit Cost Ratio
1964/5	Area 'A' Complete survey	2.06 (1)	1.76 (2)
1964/5	Area 'B' Sample survey	2.85 (3)	1.28 (4)
1964/5	Scottish City: estimate from S.E.D. data	2.04 (5)	-
1965/6	All English Counties	1.86 (6)	-
1964/5	L.E.A. Inter-Authority Recoupment Rates (7)	-	2
1965/6		-	2
1966/7		-	1.73
1967/8		-	1.76

Sources: See Appendix 3/J for explanation of notes (1) to (7)

The evidence from the data in Fig 3.26 suggests that:

1) The secondary:primary unit cost ratio lies in the region 2-2.5 remembering the above remarks about the possible accuracy of ratio for Area B:

2) The upper secondary:lower secondary unit cost ratio lies in the region $1\frac{1}{4}$ - $1\frac{3}{4}$,assuming overall unit costs are largely determined by Teachers' Salaries:

3) The gap between unit costs in primary and secondary schools is larger in Scotland than in England.

It appears that it is at least twice as expensive to educate a secondary pupil as a primary pupil and roughly one-and-a-half to one-and-three-quarters times as expensive to educate a pupil in his last three years in a secondary school as a pupil in his first three years.

THE 'COST' IN TEACHER RESOURCES

Pedagogic tradition, reinforced by statutory regulations (for schools), concerning the maximum size of class, cause class sizes to decrease as the child grows up. At seven, a child may be one of a class of 35; at fourteen, he is likely to spend a good deal of time in a practical class of 20; by seventeen, he is probably being taught in a class of 12; and at university, he may be lectured to in a class of 100 but he will have tutorials within a group of 8. Broadly, that is the trend. But, how much more intensive in the use of a teacher's time is a secondary pupil compared with a primary pupil? What are suitable units for measuring the 'intensity' of use of teachers? In fact, has labour-intensiveness- a familiar concept in the study of the economics of industry - any meaning in the field of education? By investigating the measures of the use of labour, and comparing values for different sectors of the educational system we aim to clarify the notion of 'labour-intensiveness'.

Firstly, we shall take the question of the measures, or units, of use of labour. The most obvious unit for differentiating between primary and secondary schools in their use of teachers is the pupil/teacher ratio (P.T.R.). Fig 3.27 shows the P.T.R's for primary and secondary departments in Areas A and B in 1964/5.

Fig 3.27 Fig 3.27

PUPIL/TEACHER RATIOS - PRIMARY AND SECONDARY DEPTS. COMPARED

AREA	PRIMARY	SECONDARY
A (all schools)	28.4	16.2
B (sample)	33.1	13.5

Source: Area A - see Authority A Collected Statistics

Area B - Appendix 3/I Report 3

A later estimate (1967) of the number of pupils per teacher, put the PTR in primary departments at 29.3 and the secondary ratio at 15.0 [31]

[31] Scottish Educational Statistics 1967, p.27 Edinburgh: H.M.S.O

From these three pairs of observations, the evidence is that the secondary pupil uses up twice as much teachers' time as a primary pupil. The 2 : 1 ratio receives further support from the secondary : primary unit cost ratio in Fig 3.25, Col 1. The PTR is a fair guide to class size in the primary school [32], but it has another meaning altogether for a secondary school. A PTR of 15.0 in a secondary department means that for every one teacher going into the school building each day, there are fifteen pupils. Class sizes will, on the average, be greater than 15, because secondary staff spend roughly one fifth of their time in non-teaching functions e.g. administration, preparation, correction [33]. But, no matter how the PTR's are built up, the fact is inescapable. Secondary schools use twice the input of teachers' time that primary schools do.

Since the PTR is an unsatisfactory index of class size in the secondary school, we shall dispense with it in looking at the use of teachers' time in the upper and lower parts of the secondary school. One possible unit for investigating the use of teachers' time is the teaching-minutes per pupil unit. An example will explain what this unit means. A teacher facing a class of 10 pupils for a total of 320 minutes over one week is devoting 32 teaching minutes per pupil per week. Fig 3.28 was obtained by analysing the timetables of the secondary departments in both areas into:
a) time spent teaching years I-III, b) time spent teaching years IV-VI.

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[32] The three PTR's quoted in para 75 for primary schools were obtained by dividing the total number of pupils by the total number of teachers. This latter figure includes non-teacher head teachers, so that class size must be larger in each case than the PTR.

[33] This estimate is based on the analysis of the timetables of 20 secondary schools. The fifth represents the median of estimates of non-teaching time.

Fig 3.28 Fig 3.28

TEACHING MINUTES PER PUPIL - LOWER AND UPPER SECONDARY COMPARED

1964/5 (Scotland)

	YEARS I-III	YEARS IV-VI	Ratio of Upper : lower
Area A (all schools)	77.5	127.5	1.64
Area B (sample)	81.4	99.7	1.22

Source: Area A; timetables for schools 1964/5.
Area B; Appendix 3/J note 4.

The data in Fig 3.28 is interpreted as follows: In Area A, in one week, each pupil in years I-III received 77.5 teaching-minutes of instruction, while a pupil in years IV-VI received 127.5 teaching-minutes. In Area A, pupils in years IV-VI are each using 64% more teachers' time than pupils in years I-III. Hence, the high upper secondary : lower secondary unit cost ratio (see Fig.3.26). In Area B, upper secondary school pupils are using only 22% more teachers' time than lower secondary school pupils [34].

Thus, the general rule is the older the pupil, the more it costs to educate him. One cause is that older pupils make greater demand on teachers' time than younger pupils. In the next Chapter another cause will be revealed, namely that teachers of older pupils are apt to be better qualified and more experienced than the teachers of younger pupils.

Addendum

A brief look at the notion of educational 'quality' is in order. "Quality" is used in education, as in other fields, with two distinct meanings. "Quality" may be purely descriptive: primary schools differ from secondary schools in the curricula they provide - a qualitative difference. On the other hand, we may evaluate the 'quality' of teacher 'A' as against that of teacher 'B', deciding one is better than the other.

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[34] Multiplication of each of these two ratios by the 'expensiveness constant' (see Appendix 3/J)1.048 gives values approximating quite well to the upper secondary:lower secondary unit cost ratios, i.e.
1.64 x 1.048 = 1.72 and
1.22 x 1.048 = 1.28 (cf Fig.3.25) The rationale behind the expensiveness constant appears in Appendix 4/E

The interpretation of some of the facts reported on cost differentials between authorities and between schools raises a major problem. Do higher costs reflect 'quality' differences in either the descriptive or evaluative sense? Or do they represent the cost of providing essentially the same quality of educational service, the higher cost being the result of environmental factors? These questions may be clearer if we particularise. Unit costs of education in Authority X are higher than in Authority Y; this could be for three reasons and for any interaction between these reasons.

1. Authority X provides a service which is intrinsically more expensive.

2. Authority X provides a better service than Authority Y i.e. the educational outputs are of higher quality.

3. The conditions on which Authority X operates makes the service more costly.

The writer raises these questions at this point but prefers to wait until Chapter 7 before attempting to answer them.

SUMMARY AND CONCLUSIONS

The analysis of expenditure in Scottish Education Authorities has been pursued in this Chapter at three levels. Initially we looked at total expenditure by all the Authorities. Here, we chose to trace trends in total expenditure over an eight-year period; then, we focussed attention on the separate elements of expenditure, picking out the account heads of Teachers' Salaries and School Maintenance for more thorough probing. Secondly, we attempted to provide an explanatory background to the pattern of unit costs in the thirty-five different Authorities. We singled out for special investigation the influence of demography, building and maintenance, and teacher supply on the unit costs of areas. Finally, we sought to isolate the costs of individual educational institutions and the costs of various educational functions such as Teaching and School Administration. This final section consisted of the straightforward reporting of the results of the analysis of expenditure undertaken in the S.E.C.P.

Among the specific findings reported in the chapter were the following:

1) Expenditure by the Education Authorities on their school pupils rose by 50% per pupil in constant prices during the period 1959/60 - 1966/67.

2) Expenditure on School Maintenance accelerated more than that on Teachers' Salaries (63% per pupil as against 37% per pupil). However, when the composite head of expenditure - School Maintenance - is broken down we see that outlays on the more directly educational items, i.e. books, apparatus, equipment, decreased as a proportion of the overall School Maintenance expenditure from 21.6% in 1959/60 to 19.0% in 1966/67.

3) Outlay per pupil in the thirty-five Authorities was found to be closely related to geography. In 1965/66, the mean expenditures per pupil were as follows: Cities, £147; Industrial Areas, £131; Mixed Industrial/Agricultural Areas, £139; Rural Areas, £152; Heath and Moor Areas, £187.

4) While in Authorities with school populations of less than 5,000 there tended to be a very large range of unit costs, in Authorities with school populations in excess of 30,000 the unit costs were both smaller and less influenced by increasing size.

5) Costs per pupil in one rural Authority in 1964/5 were £101 (primary) and £219 (secondary). The ratio of secondary Teachers' Salaries to primary Teachers' Salaries was rather more than 2 : 1. The ratio of Teachers' Salaries between the upper and lower years of secondary school turned out to be 7 : 4.

6) Roughly 70 - 75% of expenditure allocable to individual schools was taken up by Teachers' Salaries.

7) Economies of scale were found to be present in the operation of primary schools. For instance, per pupil costs of Repairs were found to be £6.5 in One and two teacher schools, £3.2 in "Viable" schools, and £1.3 in Two stream schools.

8) Using pupil/teacher ratios as measures of the use of teacher resources, the evidence pointed to secondary pupils using up twice as much teachers' time as primary pupils.

9) Two Authorities were compared for the use of teacher resources by pupils in the upper and lower parts of the secondary school. In Area A, pupils in years IV-VI were using 64% more teachers' time than pupils in years I-III. The same measure was only 22% in Area B.

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CHAPTER 4

EDUCATION AS AN ECONOMIC ACTIVITY

Introduction

A short pause will be made in the discussion of the results of the research into Scottish educational costs so that there may be presented an adequate airing of views regarding education as an industry, as an economic activity, as an investment. The use of such economic terms as labour-intensive, capital-intensive, factors of production mix, is increasing in the discussion of educational problems. How appropriate are such terms when applied in education? Following this theoretical part are further cost statistics, the first set of which illustrate just how much labour is used in the education process. The chapter ends with an analysis of the costs of different school subjects. A strong plea is made for care in applying economic notions in education and, to back this up, reference is made to the Scientific Management era in American education.

Part 1

Is Education An Industry?

What evidence in hard facts supports the view that education is an industry? In modern industrial economies, education is a user of basic national resources: skilled labour (mainly teachers), potential labour (children who could enter the labour fórce), capital (buildings and equipment) and land. In the U.K. something like 5½% of our G.N.P. is tied up in education, in Sweden the figure is in excess of 6% and in developing countries it is of the order of 1 - 2%. That education is a consumer of resources is plain. More and more, for motives which will be discussed later, those who press for a larger slice of the national cake to be devoted to education, have given out that education is also a form of investment . Typical of this approach (and an early example of it) is the introduction to an N.U.T. paper of 1961:

> "We take it for granted that all responsible citizens will agree that more education is desirable in itself. We wish to assert that it is also necessary for our economy". (N.U.T., 1961)

Giving actual figures for the proportion of the G.N.P. spent on education requires the assumption that education is a definable activity bounded by what goes on in public and private institutions of education. It is no easy matter to delimit education or educational expenditure, for there would be some sense in excluding expenditure on school meals and milk (which is included in educational expenditure at present) and including the opportunity costs of young adults while studying or of mothers who remain at home to "baby-sit" (which are excluded). When education is used in the same breath as investment, it is what goes on in schools and other institutions that is meant, and not the life-long process from mother's knee to "24 hours". This is an important limitation if one seeks relationships between investment in education and returns from that investment.

An industry is a systematic economic activity giving rise to a product and using scarce resources. Clearly education is an industry in that sense, in so far as what goes on in educational institutions involves human and other resources (which have alternative uses) and ends up in a product.

The Economic Activity of Education.

Two fundamental questions arise if we regard education as an economic activity. First, does education have a measureable product? Secondly, even if it does not, is it proper to discuss the use of resources in education? An answer to the first question requires a study of the aims of eudcation. It is frequently bound to the question of how far expenditures on education are relatable to'output' of educational institutions. The second question comes down to an investigation of the benefits, and possible dangers too, of applying economic principles and especially cost analysis in the educational field.

A more thorough probing of the notion of quality in education occurs in Chapter 7. We may, however, anticipate the outcome of that discussion by stating that the output or product of education must be viewed from several standpoints simultaneously. The product can be judged from inside, say in terms of familiar academic criteria, and from outside, say in terms of social and economic criteria. If the aims of the educational system have been set in accordance with both inside and outside criteria, and if these criteria generate measures, then the product is measurable. The trouble with this neat analysis is that modern societies are not sure of their aims nor of their ideals, so much so that identification and quantification of the product is impossible. Yet, there do appear to be links between education and personal wealth, or more accurately, earnings, and between education and national wealth, measured by the G.N.P. (the secular God). And if what one earns is also related to what kind of product one is, then it is not altogether fanciful to suppose that the amount spent on education should be related to the quality of the end-product.

Economists have become accustomed to regard expenditures on education as partly investment and partly consumption. What this means is that some expenditures on educational institutions can be regarded as investment from which there is a return while some expenditures give no return but are used up by the institution and/or the pupils (consumers). Unfortunately, the dichotomy is not as easy to make as that. True, expenditures on vocational training are more easily justified as investment than, say, expenditure on tennis courts for the trainees. But, how is the division in expenditures to be made when one considers primary education, most of which is general education and a pre-requisite of training in, say, nuclear physics or retail distribution Much of what goes on under the name of general studies in the avowedly vocational sector of Further Education might well contribute, though indirectly, to productivity. In short, the economists' bipartite scheme of education for investment and for consumption is valuable in so far as it reminds us that education has wider aims than the increase of G.N.P. In practice, it is an impossible task to subdivide expenditures.

Shaw, with typical pungency, captures the essential meaning of education as an investment in his "Major Barbara".

Undershaft: But, Mr. Cusins, this is a serious matter of business. You are not bringing any capital into the concern.

Cusins : What! No capital! Is my mastery of Greek no capital? Is my access to the subtlest thought, the loftiest poetry yet attained by humanity,

> no capital? My character! My intellect!
> my life! my career! what Barbara calls my
> soul, are these no capital? Say another word;
> and I double my salary.
>
> G.B. Shaw (1905) Major Barbara, Act III.

We now have the empirical studies at two levels to support this poetic insight. These tend to show that, first there is a link between education and income differentials; then, at a national level that education plays a significant part in the residual factor in economic growth. These two economic notions have already been raised in Chapter 1 and any further explanation of their origins would be out of place here. The "human capital" concept is not without critics, both from the fields of education and economics. The more idealistic educationist is revolted by talk of man being a piece of capital equipment equivalent to a machine, or as Schultz (1961,A) has termed him, a produced means of production. Shaffer (1961) criticises this view from a theoretical economic standpoint. He argues that investment in man is fundamentally different from investment in non-human capital, for at least a part of any one direct expenditure for the improvement of man is undertaken not with a view to monetary return and its effects on future output are not traceable. The investment cannot then be called rational because it is not based on a careful comparison of alternative investment opportunities.

The "human capital" concept will clearly benefit from continuous examination and refinement. So far as it has been developed, it has provided added justification for educational expansion in both developed and developing countries. It is the same concept which also stimulates questions such as, "Does education have a measureable product?" because the logical conclusion of investigations of "human capital" is the prediction of the quantity of capital from information about expenditures on education. As long as the educational product is ill-defined, there is little chance of economists being able to control "human capital". That is the position at present.

Even if the product of education is agonisingly imponderable, what value is there in investigating the use of resources in education?

If we were to assess the value or validity of exploring resource utilization in education, we might begin by examining whether such an investigation is necessary or not. A thorough probing of the use of resources in education is now necessary since education is such a vast user of public funds as well as real resources. It is not only for the sake of public accountability that resources in education must be examined; planning of overall government spending, as well as spending within education itself, requires considerable information about what resources are currently employed in the various educational levels and how they might be employed as demands (social and manpower) change. Modern industrial societies must budget for growth and change.

We are forced quickly to realise that resource utilization data is necessary for national long term planning. Also, unless these studies are done on a systematic basis, and it is economics which provides "the system", we cannot be sure that we are not "wasting" resources. Measures of wastage are not readily evident in education, though student dropout, teacher deployment, underuse of buildings and machines suggest themselves as areas for initial examination and application of economic principles.

We may allow that questions regarding money, people and capital are valid in education andpotentially valuable in that they may "save" resources, or allow more to be done with the present level. If so then the question of what techniques, concepts, methods or strategies can be borrowed from economics to aid the study of the economics of education is a vital one.

An Economic Strategy.

One strategy of economics is that of varying the proportions of the factors of production; what has been called the "mix" of men to machines. The aim is to determine the ideal mix, or the particular proportion of capital, labour and land, which maximises output. The application of this strategy to education raises several questions.

(1)/

(1) What is the present combination of factors, at national level, at the three levels of education and, also in educational institutions?

(2) What has been the trend in the mix over a number of years?

(3) What opportunities are there for varying the mix in education?

(4) Is there some ideal mix of the factors of production in education ?

There is some degree of overlap in the final two questions because it is probable that there will be, in fact there is currently, a shortage of one or more factors of production, thereby necessitating a shift in the proportions of the mix. Yet we are far from being in a position to judge or assess the suitability of any particular mix of resources, let alone set criteria for the ideal mix. Putting that another way, although educators are impotent to assess the output in anything like as rigorous a way as conventional industry this is no reason to maintain a fixed combination of the human and capital factors in education. Indeed, the shortage of skilled manpower makes it inevitable that the mix will be varied.

Value and Output in Education

No such doubts concerning the ability of educators to judge the quality of output in relation to input of resources apparently entered the head of Strayer, one of the most influential of early, 20th century American educators. His own dissertation - later to serve as a model - contains the following statement which now appears naive:

> "The best way to decide just what is the best way to apportion the money among the various items of the budget would be to find out which school system is doing the best work, by testing the pupils in the system, and then to adopt as the ideal apportionment that distribution of moneys which is found in the most efficient school systems". (Strayer, 1905).

Modern educational economists, such as Schultz, have not gone as far as Strayer and his contemporaries in proposing quick solutions to pretty intractable problems. Schultz identifies the main sources of inefficiency in education as the use of students' time and the mix of the factors of production. As far as the latter is concerned he says:

"The/

> "The price of human effort of both teachers and students has risen markedly relative to the price of material inputs. Such a large shift in the relative prices of inputs argues for the substitution of material inputs for human effort in education wherever this is feasible ....
> There are firmly established beliefs that equipment, better classrooms and library facilities, and other material inputs can supplement teachers and students but cannot, in any significant measure, substitute for their time. These traditional beliefs must be put to test because of changes in económic circumstances". (Schultz, 1961 B).

What we must answer, then, is the charge that it is the traditional beliefs or the conventional wisdom of teaching which is the main factor in the lack of material inputs to our schools. To do this completely is beyond the scope of the present investigation but some clues might be found in the figures of educational equipment outlays related (a) to the various levels of education and (b) to the various subjects within secondary school. These figures appear in subsequent parts of this chapter.

PART II

The Factors Of Production Mix At The National Level

Having reviewed the evidence that education may usefully be regarded as an industry it is appropriate to pass now to a consideration of the "mix", initially at national level.

Labour-intensive, capital-intensive

In the preface to the updated version of the pace-setting The Costs of Education, Vaizey (1968) deals with just this problem of the mix of resources, when he states that the purpose of the new edition is to show that the nature of the resources used in education has changed. A major conclusion is

> "There has been a switch away from the use of teachers to the use of other forms of labour, and from labour to things".

Labour was 75% of total outlay in 1920, 58% in 1948 and 55% in 1965. Working from figures like these, Vaizey concludes that less labour-intensive techniques are now applied and that the task of projects such as the Nuffield Resources for Learning Project is to stimulate the development of the more capital-intensive techniques.[1] The use of these two economic terms in education may be misleading. On the one hand, if a strict economic definition is adopted and attention is fixed on the proportion of expenditure devoted to "labour" then, over the years, education has become less labour-intensive. On the other hand, the mix of the factors of production at the level of the classroom has, in all probability, altered in favour of labour. While a smaller proportion of total expenditure is being spent on "labour", classes have become smaller and there has been little compensating rise in the material inputs at classroom level.

Capital-intensive offers another problem of definition. The most evident class of things which are capital goods in the education sector is the stock of buildings. In addition, there is the mass of small items such as furniture, books, apparatus, some of which might be purchased on the capital account (the accepted procedure for new schools) and some may be of a capital nature (in so far as they are "durable" and not consumable) but are purchased on current account. The business of education requires both first-order educational equipment - the things used in teaching, e.g. books, desks, blackboard-and second order equipment, e.g. cleaning equipment, filing cabinets, cupboards. Inevitably, there is some degree of overlap in these categories. The important point is that an observation that education is more capital-intensive may be the result of more money being spent on buildings and/or on second order equipment, and/or first order equipment.

[1] Labour-Intensive,Capital Intensive: The classical division of the factors of production is into human resources, natural resources and man-made resources; or into labour, land and capital. All three factors must be combined in any productive activity though they need not be combined in a fixed way or even for a fixed purpose. An activity which has become more labour-intensive is one where the proportion of labour used in the production process has increased. In contrast, automation is almost inevitably accompanied by a decrease in labour-intensiveness.

Labour-intensive and capital-intensive are neither clearly definable notions, nor are they polarities on some human-material scale. Caution must be applied when using both terms in the educational context.

Educational Personnel

A further source of confusion over terms arises from the use of the word 'personnel'. More than likely the confusion arises from the non-compatibility of costing statistics. The following figures collected by Edding (1966) are open to question, see Figure 4.1.

Fig 4.1 Fig 4.1

Current Outlay On Education (all levels) Per Student By Major Purpose In Selected Countries; circa 1959

Countries	Year	Total Current	thereof	
			Personnel	Other Current
Austria	1959	100	58.5%	41.5%
Belgium	1959	100	75.7	24.3
Federal Republic of Germany	1959	100	57.8	42.2
France	1960	100	80.1	19.8
Ireland	1959	100	72.0	28.0
Italy	1959	100	69.7	30.3
Netherlands	1958	100	73.6	26.4
Norway	1959	100	69.5	30.5
Sweden	1958	100	87.1	12.9
United Kingdom	1959	100	49.6	50.4

Source: Derived from: Friedrich Edding, Expenditure on Education IEA Conference Menthen-St. Bernard (Annecy)1963, Annex III,table 5, (unpublished paper)

Although he claims that part of the large discrepancies in proportions of current outlay per student are due to differing definitions of current expenditure it is just as likely that the definition of 'personnel' varies considerably. A difference of 37% in the proportion of current outlay devoted to personnel (between Sweden and the U.K.) is surely too large to be due to minor discrepancies e.g. inclusion of school welfare expenditure in total current outlay. There/

There is little evidence to support the assertion that:

> 'it seems likely that similar goals of education are reached by different structures of outlay in the various countries' Edding (1966/p17)

The easiest explanation of the large (greater than 70%) personnel figures is that all labour (teaching and non-teaching) is subsumed within the figures for personnel.

The "Mix" of Resources

Pursuing the question of the "mix" of resources in U.K., Vaizey sets the proportion of "labour" at 55% in 1965, but without a clear statement of what "labour" is, or for that matter which total expenditure is being used (loan charges are omitted on that estimate). An estimate made by the writer from published figures shows that in 1962/3 Salaries of all forms of Labour were 76% of the total current expenditure by all domestic users of funds at all levels. Fig 4.2 shows the proportions derived for the various users of funds.

Fig 4.2 Fig 4.2

Education Expenditure (U.K.) By Various Domestic Users Analysed With Respect To Labour, Non-Labour Economic Categories. Year 1962/3

1 Users of funds	2 Total Current	3 Total inc. Capital + Loan Charges	4 Wages / Salaries Teachers	5 Others	6 $\frac{(4)}{(2)}$x100	7 $\frac{(5)}{(2)}$x100	8 $\frac{(4)}{(3)}$x100	9 $\frac{(5)}{(3)}$
	£m	£m	£m	£m				
All Local Gov. Inst. (mainly Schools)	746.210	987.872	481.454	98.776	64.5%	13.2%	48.7%	9.9%
Univers-ities	80.598	107.229	36.358	8.545	45.1%	10.6%	33.9%	7.9%
Other Aided Inst.	47.171	56.379	30.356	5.165	64.3%	10.9%	53.8%	9.1%
All dom-estic Users	952.591	1233.936	603.009	122.252	63.3%	12.8%	48.8%	9.9%

Source: Adapted from figures in Table 3.5 Peacock, A., Glennerster, H., and Lavers, R., (1968) Educational Finance London: Oliver & Boyd.

The statistics in Fig 4.2 are to be interpreted as follows: in local government institutions (mainly schools) 64.5% of Current expenditure was taken up by Teachers' Salaries, and a further 13.2% by Wages and Salaries of other forms of labour; when loan charges and expenditures related to Capital are included in the total expenditure then Teachers' Salaries are just less than 50% of the Total expenditure, while the Wages and Salaries of other forms of labour are 9.9% of the Total. Fig 4.2 shows just how much the mix of labour to non-labour outlays can vary according to:

1. the level of education, roughly indicated by the user of the funds (Col 1),

2. whether salaries of non-teachers are included as 'labour' as they should be for any analysis by economic categories,

3. whether loan charges are included or not.

There is one further and vital point which cannot be deduced from Fig 4.2. It concerns the definition of education expenditure. The study from which Fig 4.2 was compiled went as far as available data allowed in separating education expenditure from other expenditure incurred in connection with health, welfare and recreational purposes viz. educational support services. It was estimated that in 1962/3 some £1265m [2] was spent on education and an additional £196m on these support services including Meals/Milk, Health, Boarding, Youth Service, Youth Employment Service, County Libraries. If this £196m is added to the Total expenditure including Capital and Loan Charges (£1234m), then "all salaries" [3] are 50.7% of the total education and non-education expenditure (including capital and loan charges). Fig 4.2 shows that the proportion of total education expenditure (incl. loan charges) devoted to all forms of labour was 58.7% (Col.8 + Col.9). Half of all resources devoted to education - in its widest definition - is taken up by salaries and wages of persons involved directly with education [Salaries/wages within the support services are not counted as "labour" in this context, though they do occur as part of the total expenditure].

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[2] This differs from £1233.9 (Col.3) because of 'other private' expenditure.

[3] Teachers and others.

If these U.K. analyses are performed for Scotland (Fig 4.3), they show that the Salaries of Teachers in Education Authority Institutions account for a higher proportion of both current and total education expenditure (68.7% for Scotland as against 64.5% and 50.5% as against 48.7% respectively). Expenditure on all forms of labour by all domestic users in Scotland similarly constitutes a larger proportion of total education expenditure (60.4% against 58.7%) and of total education and non-education expenditure (52.1% against 50.7%).

Fig 4.3 Fig 4.3

Education Expenditure (Scotland) By Various Domestic Users Analysed With Respect To Labour And Non-labour Economic Categories. Year 1962/3

Users of Funds	Total Current	Total Capital Incl. Loan charges	Wages / Salaries Teachers	Wages / Salaries Others	$\frac{(4)\times 100}{(2)}$	$\frac{(5)\times 100}{(2)}$	$\frac{(4)\times 100}{(3)}$	$\frac{(5)\times 100}{(3)}$
1	2	3	4	5	6	7	8	9
	£m	£m	£m	£m				
Educ. Auth. Inst.	75.716	103.084	52.077	7.705	68.7%	10.1%	50.5%	7.4%
Univers-ities	10.031	12.012	4.781	0.894	47.6%	8.9%	39.8%	7.4%
Other Aided	8.829	10.657	5.548	1.109	62.8%	12.5%	52.0%	10.4%
All Domest. Users	97.423	128.695	63.856	10.618	65.5%	10.8%	49.6%	10.8%

Source: Adapted from Table VIII in Peacock, A., Glennerster, H., Lavers, R., (1968) Educational Finance. London: Oliver & Boyd.

More discussion on the mix of labour to non-labour at the different levels of education is called for in view of the pressing need to allocate scarce resources between the competing levels of education. A glance at Fig 4.2 will show that 55.7% of current and 41.8% of total education expenditure in universities is on labour, while the estimates for schools from the same set of figures [the category "local government institutions" being dominated by schools] are 77.7% and 58.6% respectively. Teachers' Salaries as a proportion of current education expenditure are 20% higher in schools than in universitites; we cannot go on to conclude that schools are more labour-intensive. British universities have a student/staff ratio of roughly 8 : 1. Corresponding ratios are roughly 16 : 1 in secondary schools, and 30 : 1 in primary schools. Universities, then, are more intensive users of labour in the sense that the finished product (a "qualified" student) is produced with a larger input of labour per unit of output than in the case of schools. Again labour-intensiveness- a fashionable term in some educational circles - is seen to be paradoxical ! Dispelling the ambiguity slightly, it is more accurate to say that universities use more equipment, or have a larger proportion of non-labour outlay, than the lower levels of education. If we take non-labour outlay to mean investment in buildings and (more significantly) in plant then universities, during the expansion - era of the sixties, were also more capital-intensive than schools; but that is essentially a different matter from claiming that universities are more capital-intensive in their teaching methods than schools. Before ending this discussion of the resource mix at various levels, some attention must be given to the fastest growing sector - Further Education. A recent study indicates that in the year 1964/5, 68% of Technical College expenditure was taken up under the heading employees; Teachers' Salaries werearound 55% (Capps,1969). The expenditure referred to here lies somewhere between Total current and Total including Capital and Loan Charges (see Figs 4.2 and 4.3) but no useful comparison with the statistics in the schools and universities can be made. The proportion of Total expenditure spent on salaries in Technical Colleges is however, of the same order of magnitude as that in the other sectors of education.

Summary

The employment of terms such as labour-intensive, capital intensive in education is potentially misleading, unless it is made clear that these terms refer to the whole economic activity of education and not narrowly to the actual teacher-learner activity in the classroom. While labour has undoubtedly decreased in recent years as a proportion of total resources employed in education, the classroom process has become more labour-intensive, because classes have tended to decrease in size with little compensating rise in expenditures on directly educational (i.e. teaching) materials.

A "Constant" Referent.

If the main concern for the mix of resources lies in the relative expenditures on people (particularly on teachers) and on materials (particularly educational materials/equipment) a reasonable procedure would be to monitor the ratios of expenditure on materials to expenditure on Teachers' Salaries or to expenditure on all forms of labour. Even with the difficulty of taking price inflation into account, this seems a clearer way of stating trends in capital-or labour-intensiveness than the mixed bag of statistical referents used at present. The lack of price indices in the education sphere means that we must follow the trends of the ratio of expenditures at current prices. Such a ratio conveys how much money was spent on materials compared with teachers but it does not inform us on the relative quantities of real resources.

Fig 4.4/

Fig 4.4

EXPENDITURE ON NON-TEACHER HEADS AS PROPORTIONS OF EXPENDITURE ON TEACHERS'SALARIES

		Scottish Education Authorities 1959/60 to 1967/8								
		59/60	60/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68
Teachers' Salaries	£m	37.7	40.7	47.0	48.8	54.5	55.1	57.0	65.7	66.8
Index		100	100	100	100	100	100	100	100	100
Maintenance of Schools	£m	13.8	14.7	17.7	19.5	20.8	23.0	26.2	28.7	32.3
Index [1]		36.6	36.1	37.6	39.9	40.0	41.7	46.0	43.7	48.3
Educational Equipment,Books,Apparatus	£m	2.9	3.2	3.5	3.6	3.7	4.3	4.7	5.3	N.A.
Index [2]		7.7	7.9	7.4	7.4	6.8	7.8	8.2	8.1	-
Loan Charges	£m	5.7	6.3	7.5	8.5	9.6	11.5	13.5	15.4	17.2
Index [3]		15.1	15.5	15.9	17.4	17.6	20.9	23.7	23.4	25.7
Aid to Pupils-Travelling	£m	N.A.	1.7	1.8	1.9	2.1	2.2	2.5	2.7	3.0
Index [4]		-	4.2	3.8	3.9	3.8	4.0	4.4	4.1	4.5

Source: For data on 1959/60 - 1961/2 see Appendix 3/B and 3/D
1962/63 - 1967/8 see Scottish Educational Statistics 1967 and 1968; also Append

Note : N.A. not available

In Figure 4.4, four subheads of expenditure are shown for a number of years in terms of an index relative to expenditure on Teachers' Salaries taken as 100. For instance, in 1959/60 Maintenance Expenditure was £13.8m., which was 36.6% of the level of expenditure on Teachers' Salaries in that year (£37.7m).We conclude from Fig 4.4 that;

1) The composite head Maintenance of Schools has increased by 12% its level of expenditure relative to Teachers' Salaries. The most eye-catching feature is the fall off in 1966/67 following the salary rise of teachers in April '66. In this case, the price of teachers rose rapidly relative to materials, causing expenditure on Maintenance relative to Teachers' Salaries to fall.

2) The expenditure on first order educational equipment, textbooks etc., relative to expenditure on Teachers' Salaries has fluctuated slightly and in a non-predictable way. Certainly there has been a small rise in the level of expenditure on Educational materials (7.7% to 8.1% over 8 years) but that is hardly indicative of a major change of the "mix" in resources.

3) The most staggering rise in level of expenditure relative to Teachers' Salaries (from 15.1 to 25.7) has been in Loan Charges indicating the increased rate of building and, more significantly, the upward movement of rates of interest in the period.

4) The Aid to Pupils-Travelling sub-head illustrates how steady are second order educational expenditures relative to Teachers' Salaries except when a significant rise in price level affects the latter. (c.f. Chapter 3 UNIT COSTS)

The resource mix problem will now be pursued at the micro level; the relative expenditures on labour and on things will be analysed in individual schools, and then the use of labour and things will be broken down by school subject.

PART III The Resource Mix: A Comparison At The Micro Level

Results of the S.E.C.P.

Introduction : The Problem.

At the centre of the education business are the individual institutions the schools, the colleges of further education and the universities. It is no mere cliché that the whole will not function optimally without each part also working most efficiently [4]. Into autonomous institutions like universities and the less autonomous schools the country sinks resources each year. Are these institutions managed as well as they might be? Do some schools have "better" (more expensive) facilities than others? How do primary schools compare with secondary schools with regard to equipment? Can anything be done to solve the apparently intractable problems in timetabling by providing blueprints at a national level? Can we afford to run the risk of sub-optimisation with respect to teacher deployment? More bluntly, can we continue to allow head teachers to have the monopoly over decision taking in the curriculum? (There are indications that some secondary departments on present staffing standards, are over-staffed, because headteachers have built up the range of courses and options largely on their own initiative [S.E.D.1968]). These are some of questions with which this part of the chapter will deal in detail.

Before embarking on a discussion of the results of the cost study at a micro-economic level, an effort must be made to make a clear and valid distinction between expenditure on an institution and that on <u>education</u> in general.

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[4] One part of a system may work optimally for itself but to the detriment of other parts of the system. These are the dangers of sub-optimising (see Chapter 7).

Reference has been made above to the separation of education from non-education expenditure (the latter being mainly outlay on support welfare services). A roughly parallel distinction must be drawn between school and non-school education expenditure. School expenditure consists of:

a) Teachers' Salaries;

b) Salaries and Wages of other personnel;

c) Repair and Maintenance of building, including heating, lighting;

d) Administration within school;

e) Educational Equipment, supplies, textbooks, stationery.

Only these heads of expenditures are considered since estimates of debt charges, insurance, rates, etc., are not available for the individual schools.

PRIMARY SCHOOLS

The costs of individual primary schools were found by an analysis of (i) the original salary records and (ii) the invoices for supplies and services. This time-consuming procedure was necessary because neither in Scotland nor in England and Wales are accounts kept in such a way that the cost of an individual school (in the local government and education authority systems) can be found. Some seventy primary schools of all sizes and from two contrasting areas of Scotland were studied.

Fig 4.5/

Fig 4.5 Fig 4.5

Wages and Salaries [1] as a Proportion of Total School Expenditure

Sample of Primary Schools : Scotland 1964/5

Area and Size of School	(1) Salaries and Wages Teachers	(2) Others	(3) Total [2] Current	(4) (1)x100 / (3)	(5) (2)x100 / (3)
	£	£	£		
One and two teacher schools	83,306	5,195	105,619	78.8%	4.9%
Three to seven teacher	76,397	5,512	96,217	79.4%	5.7%
Two stream	118,501	15,374	148,945	79.5%	10.3%
Three stream	60,332	6,050	73,737	81.8%	8.2%
All area A	338,536	32,131	424,518	79.7%	7.5%
Sample of Area B [3]	108,808	10,723	136,594 [4]	79.6%	7.8%

Number of pupils in Area A + Area B = 10,484

Notes [1] The figures shown are the totals for the separate sizes and samples of schools, the resulting proportions on Cols. (4) and (5) are therefore averaged over a number of schools.

[2] This may not be all expenditure on individual schools, because some could not be allocated directly to a school. (cf Chapter 3 Fig 3.14) Total Current means, therefore, expenditure on heads a) to e) (see above Introduction). This expenditure is allocable to individual schools

[3] Area A was studied completely, all schools being included in the project. Only nine of Area B's schools representing the small, medium and very large schools were investigated.

[4] The repairs expenses of the nine schools were not available, so an estimate was made on the basis of the mean figures for repairs found in Area A. This sum was added to the total current less expenditure on repairs to give the Total Current in Col. 3.

The Fig 4.5 shows that Teachers' Salaries are a remarkably constant proportion (80% of total current school outlay) regardless of size or geographical area. The proportion of Salaries/Wages of other school personnel in the total outlay increases with size. This/

This may be partly explicable by the fact that in Area A only schools of more than seven teachers are allowed clerical help. Something like 87% of school expenditure is devoted to personnel (i.e. teachers and other labour).

SECONDARY SCHOOLS

Fig 4.6 shows similar statistics for nine individual secondary schools, drawn from three Scottish Education Authorities.

Fig 4.6 Fig 4.6

Wages and Salaries as a Proportion of Total School Expenditure.

Nine Secondary Schools. Scotland 1964/5

(1) School	(2) Roll	(3) Salaries and Wages: Teachers £	(4) Salaries and Wages: Others £	(5) Total Current £	(6) (3)x100 / (5)	(7) (4)x100 / (5)
A	471	33,469	3,482	47,382	70.6%	7.3%
B	565	64,175	4,620	76,579	83.8%	6.0%
C	610	69,201	3,610	80,814	85.7%	4.4%
D	661	72,511	4,765	112,582	64.4%	4.2%
E	804	72,104	4,825	86,577	83.2%	5.5%
F	784	77,322	N.A.	96,073	80.4%	-
G	1,104	81,671	7,306	98,844	82.6%	7.3%
H	1,124	117,933	6,930	139,294	84.6%	4.9%
I	1,188	101,587	N.A.	115,772	87.7%	-
Total	7,311	690,053	35,538	853,917	80.8%	-

Source: For all schools except "F" and "I": Chapter 3, Appendix 3/H Report 2 Tabulations, and Appendix 3/I Report 3 (Secondary). Data for schools "F" and "I" were made available by the County Treasurer.

Contrary to what might be expected in view of the known greater use of educational equipment in secondary schools, the proportion of total school expenditure devoted to Teachers' Salaries is slightly greater in secondary schools, 80.8% averaged over nine schools (7311 pupils), as against 79.7% averaged over 74 primary departments (10,484). Some light is shed on this somewhat surprising observation by reference to unit outlays on Teachers' Salaries at both levels.

In the 74 primary schools £42.6 per pupil, and in the nine secondaries £94 per pupil, go on Teachers' Salaries. The difference in unit outlays reflects the smaller classes and better qualified and remunerated staff in secondary departments. The outlay per pupil on items other than personnel is calculated from Figures 4.5 and 4.6 to be £6.9 in primary and £16.4 in secondary ; some of this difference lies in the larger allocations of educational equipment etc., in secondary schools.

Thus, compared with primary schools the higher expenditure on personnel in secondary schools is roughly counterbalanced by higher expenditure on other items, so that the overall proportion of school expenditure taken up by Salaries/Wages of personnel is roughly comparable in primary and secondary schools. It is worth pointing out that the extremely low (64.4%) proportion which Teachers' Salaries occupy in the total school outlay for school D, is due to the school being in its first year of operation in a new building. School D had an unusually large outlay on major items of educational equipment, most of which (on close examination of the invoices) was of a capital (i.e. expensive and durable) nature. Apparently, initial stocking of that school was done partly through revenue expenditure, although it would have been more appropriate to charge all the intitial equipping to the capital account.

PRIMARY AND SECONDARY COMPARED.

In order to probe more deeply the observed differences in expenditure on "non-labour" in primary and secondary schools and to answer questions concerning the "capital-intensiveness" nature of modern education, some more refined treatment of the head 'Non-labour" is necessary. Fig 4.7 shows a breakdown of this head into the main sub-heads for selected types and sizes of school as used in the S.E.C.P. The inclusion of a main item on non-education (by our definition) school expenditure - Meals and Milk - is justified only in so far as it draws attention to the neglect of educational equipment in comparison with "welfare" expenditure.

Fig 4.7/

Fig 4.7 Fig 4.7

ANALYSIS OF EXPENDITURE ON NON-LABOUR CATEGORIES, GROUPS AND INDIVIDUAL SCHOOLS 1964/5

Size and Type of Schools	EXPENDITURE PER PUPIL (1) Educational Apparatus Stationery £	(2) Equipment / Textbooks £	(3) Repairs of Fabric £	(4) Heating/ Lighting £	(5) Meals/Milk staff cost only £
1 & 2 teacher[1]	1.06	0.83	7.10	3.67	5.15
3 to 7 teacher[1]	0.92	0.70	3.61	2.74	3.54
two stream [1]	0.79	0.63	1.69	1.13	2.76
three stream[1]	0.82	0.53	0.95	1.93	4.03
Sample of Area B primary [1]	0.74	0.87	-	1.94	-
Sample of Area B secondaries [2]	7.11	3.62	-	7.35	-
Comprehensive School E	3.77	1.31	1.15	5.10	1.09
Senior Secondary [3]	4.30	1.71	-	-	-
Four Year Secondary School G	3.57	1.01	1.50	1.56	3.08

Notes [1] The Unit outlay for primaries represent the average of individual schools.

[2] 5 secondary schools are included in the "Sample of Area B".

[3] The Senior Secondary is part of an all-age school, consequently there may be some joint costs with the primary department. Only educational purchases could be separated at the cost analysis stage. Hence no separate figures are available for the other sub-heads of expenditure.

Fig 4.7 is to be interpreted as follows : in the five secondary departments of Area B, £7.11 was spent per pupil over the year 1964/5 on the items, Educational Apparatus, Stationery.

The factor of economy of scale is obviously at work in the case of Repairs of Fabric costs. The average unit outlay in the largest primary school is roughly 600% lower than in the small one and two teacher schools. Accordingly, expenditure on educational equipment and books compares least favourably with expenditure on other heads in those small schools, total unit outlay £1.89 for first order educational materials £10.77 for maintenance of fabric. This is the extreme case of a phenomenon which can be observed for all the primary school "samples" in Fig 4.7 - namely that the more readily constrained expenditure (on educational materials) is swamped by the relatively uncontrollable expenditure (on the fabric). In periods of financial stringency, it is all too easy to hold per capita allocations constant or even decrease them. Not only is the effect of such action administratively straightforward, but the amount of money to be spent under that head (educational equipment say) is readily calculable. In contrast, cutting the repairs outlay is more difficult in that it involves considering each school /unit in isolation then deciding which repairs or cycle of redecorating/refurnishing may be postponed. Such action has, of course, unpredictable consequences. Emergency repairs are by their very nature unavoidable. Heating and lighting costs of buildings are set by the size of building, by the mode of heating, by the age of the building - in so far as this relates to the area per child allowances - and to some extent by the skill of the janitor in controlling the heating and lighting systems. Without lowering standards of comfort such costs are not readily reducible.

The more favourable position of secondary schools with regard to educational equipment is evident when the upper and lower halves of Columns (1) and (2) in Fig 4.7 are compared. The figures for unit outlays in Area B schools show the greatest contrast - unit outlays in secondaries being roughly six and a half times those in primary schools. However, it must be recalled that the sample of five secondary schools included School D (in first year of operation) where unit outlay on educational equipment was £39 in 1964/5. The figures for three secondary schools in Area A suggest that expenditure per head on educational equipment is nearer three and a half times higher in secondary schools. Not only is the amount of educational material larger, it is of a different type; whereas in primary schools a substantial proportion of outlay is taken up by the textbooks, 40-50%, in secondary schools a more modest sum, 22-32%, is spent on books. The difference is partly due to curriculum requirements.

In passing it is noted that the unit outlays on educational equipment are greatest in the senior secondary (around £6), less in the comprehensive (around £5) and least in the four year school (£4.6). The policy with regard to capitation allowances is generally to allocate more to academic course pupils and more to older pupils. Both factors work in the direction of favouring the grammer-school type of school (the senior secondary) as far as educational materials are considered.

Fig 4.8 Fig 4.8

Capitation Allowances from Primary, Lower Secondary and Upper Secondary levels

Four Scottish Education Authorities 1967/8

	PRIMARY	SECONDARY YEARS I-III	SECONDARY YEARS IV-VI
Area A	40/-	77/6	142/6
Area B	38/-	87/6	150/-*
Area C	45/-	100/-	150/-
Area E	45/-	88/-	132/-

* years IV-V only (year VI = 210/-)

The above table is to be interpreted like this: in Area C, 45/- was allocated per primary pupil for educational apparatus, books etc. It appears that about twice as much is allocated to younger secondary pupils compared with primary pupils. Three to three and a half times as much is allocated to older secondary pupils as is allocated to primary pupils. Spelling out the consequences of this policy, the larger the proportion of upper secondary pupils, the larger the total sum available for a particular secondary department. Senior secondary schools will have a larger allocation than a comprehensive with similar numbers of pupils, because the former are more heavily weighted with older pupils.

Educational Equipment

Some emphasis has been given in the discussion to the lowly position of basic (or first order) educational equipment in the struggle for resources. This has been done in order to counterbalance the claim that the observed growing proportion of total education expenditure devoted to non-labour expenditure indicates that education is becoming more capital-intensive. Overall expenditure on School Maintenance in Scotland was roughly seven times that on educational equipment in 1962/3 see Fig 4.9.

Fig 4.9 Fig 4.9

Expenses of Maintenance of Scottish Schools, Total and Unit Outlays In 1962/3

	Number of Pupils = 864,000	
Sub-head	Total £m	Outlay per pupil £
(a) Books, Apparatus etc.	2.802	3.24
(b) Furniture and Equipment	0.756	0.87
(c) Rent, Rates, Taxes	3.996	4.62
(d) Repairs, Maintenance	2.909	3.36
(e) Fuel, Light, Cleaning	7.835	9.06
(f) Clerical Assistance	0.417	0.48
(g) Other	0.449	0.51
Total	19.163	22.17

Source: (Cumming, 1968)

What might be termed second-order educational outlays (overheads) are more important in determining overall outlays. The technology of education - T.V., radio, visual aids, teaching machines - and the more traditional educational materials are pretty insignificant when compared to the Fuel/Light/Cleaning head which is more than one-third of outlay on School Maintenance.

Further evidence of the vulnerability of educational equipment in times of financial stress comes from a paper by Maclure (1968). He quotes an estimate by an English L.E.A. for 1969/70 that overall expenditure on Maintenance (subheads roughly equivalent to those in Fig 4.9 will be four and a half times that on educational equipment. The City of Leeds expenditure figures for 1966/7 show that outlay on educational equipment was roughly a quarter of total maintenance and only 4.8% of total expenditure (revenue expenditure only, includes Debt charges). Although the expenditure on textbooks, apparatus, visual aids is already far down the list of resource users, it is those very items which are destined to cuts at present. Maclure reports that one English county plan to cut visual aids by £6,000, take £40,600 off the expenditure on books and stationery and withdraw support from the Schools Council curriculum project - saving £8,000.

Summary

Fundamental to this chapter is the proposition that education is an economic activity. If that is accepted, then it is proper to investigate the use of resources in the activity. Attention has been focussed, till this point, on the resource mix at national and school level. The general conclusions to this study, which are worth reiterating, are as follows:

1) When comparing proportions of expenditure devoted to certain expenditure categories, it may be better to refer expenditures to some easily understood referent like Teachers' Salaries, so as to avoid falling into the trap of comparing different heads of expenditure.

2) Although the trend in the proportions of resources devoted to various items has been in favour of items other than Teachers' Salaries there has been no recognisable upsurge in the proportion of resources devoted to items of educational equipment, textbooks etc.

A corollary of the latter conclusion is that, because the amount of money spent on "things" is so insignificant, it follows that some more penetrating study of teacher resources must be made.

It is now fairly clear that with present staffing standards, the overall teacher shortage in primary schools has been met in Scotland. It is in secondary departments that there is still considerable pressure on the use of teacher resources. The following study of timetables and subject costs represents a legitimate mode of enquiry in resource utilization in education if the basic premise of this chapter - that education is an economic activity - is accepted. The objective of the study is to identify, and if possible quantify, the factors which correlate with unit cost differences between subjects, if these exist.

SUBJECT COSTS AND TIMETABLES

The timetable of a school is a principal feature of the internal organisation of a school. It is the tangible expression of school policy, incorporating the particular educational philosophy of the head teacher or other authority, compromised by consideration of staff numbers as well as their qualifications and ability, pupil numbers and accommodation. A sine qua non of present day education in the U.K. and many other countries is a broad curriculum; the availability of many subjects and permutations of subjects is considered as educationally and perhaps economically valuable. It is almost as if part of the quality factor of a school consisted of the range of subjects and the number of options the average pupil can take. But, can we afford this quality? If we are a nation "learning beyond our means", as Maclure suggests (Maclure 1968) the timetables of secondary schools may give a clue as to why.

Before setting out the results of the cost study of subjects, some remarks drawing upon American material will be seen to advise caution in applying the results of cost comparisons. The following scrutiny of two research papers from the "Scientific Management era" [5] on the topic of subject costs will give the flavour of the cost- accounting movement of those times.

In the first of these, Harris (1914) sets down a thorough method for comparison of costs of different schools and different subjects within those schools. Seeking some unit which would take account of (a) length of school year, (b) time which the teacher gives to actual instruction, and (c) number of pupils per class, Harris proposed the term , standard year-minutes. For a year of 40 school weeks, a teacher teaching 5 periods of 40 minutes each, per day, gives 5 x 40 year-minutes of instruction. Where the year is only 36 weeks, the teacher has 180 year-minutes $(\frac{36}{40} \times 200)$. Great attention is now given by educational planners to the most suitable and information-carrying units, knowledge about which is vital to budget projection as well as cost-effectiveness

[5] The "Scientific Management era" was that part of American history- roughly 1910-1930 - when T.W. Taylor's principles of Scientific Management were the mainspring of movements to make education (and other social systems) more "efficient".

studies (see Chapter 7). Half a century has lapsed since Harris, among others, pointed the way to rational units for cost comparison in education.

Harris found large differences in the cost of instruction in different high schools and indicated how, by varying the number of pupils in a class and the length of instruction, school boards could lower unit costs in "inefficient schools". Doubling-up classes could lead to savings;

"pupils of different years can be instructed in one class. In English and History, the courses can be arranged so that no pupil will be repeating; for example, the first and second year pupils can take Ancient History one year, the following year they can take Mediaeval History, and in the third year Modern History".

To Harris, also, can be traced an early use of the term <u>cost-efficiency</u>. He coined the term to describe his equation which embodied a standard teaching time and a standard number of pupils that a teacher should instruct (in a day). For the record, the elixir of education was to be found in the equation:

$$\text{Cost-efficiency} = S\left[\frac{200 - d_1}{200}\right] \times \left[\frac{125 - d_2;}{125}\right] \quad \text{where } S$$

is the teacher's salary; d_1 is the number of year-minutes above or below the standard 200; d_2 is the number of pupils above or below the standard 125. Harris insisted that these practical and monetary considerations in education were justified because a) society as a whole was pre-occupied with economy, b) there was a growing demand for subjects which required laboratory work, c) the expenditure on teachers' salaries was reckoned to be 70% of total school expenditure, d) the cost per pupil in high school was two and a half times that in elementary schools. The parallel with the present educational resources crisis is striking !

In the next number of the School Review , Bobbitt (Harris's teacher) writes at length on the application of cost-accounting in education (Bobbitt, 1915). According to Bobbitt, cost accounting "lies at the foundation of all successful business management" and represents "one method of diagnosing the situation and locating irregularities of management". This diagnosis when applied to education, extended to the setting up of standards for "satisfactory instruction" such as $50 per 1000 student-hours. Waste of money would be involved in costs of $75 per 1000 student-hours for the same instruction, while quality of work done would suffer if costs were as low as $30 per 1000 student-hours. These standards of practice Bobbitt advocated should be set up yearly and with respect to subjects as well as whole schools. The range of unit costs which Bobbitt regarded as acceptable or "safe" would be the middle two quartiles round the median price paid for 1000 student-hours of instruction (assuming that "the actual results secured in the different high schools are not greatly different"). This safe range of unit costs for each subject is termed the "zone of safety". Fig 4.10 shows Bobbitt's graphical treatment of this principle for Mathematics.

Modern advocates of team-teaching might be surprised to learn that Bobbitt suggested that timetables should be so organised that classes of varying size might be taught, lengths or periods should be varied, as should be the number of periods per teaching week. Yet another fall-out from these empirical studies was the exhortation to communities where unit costs were well below the zone of safety to exert themselves more. Bobbitt follows up this advice with the observation that some schools may be in need of state aid to equalise effort between cities. Shades of the Rate Support Grant weighting formulae are here in evidence.

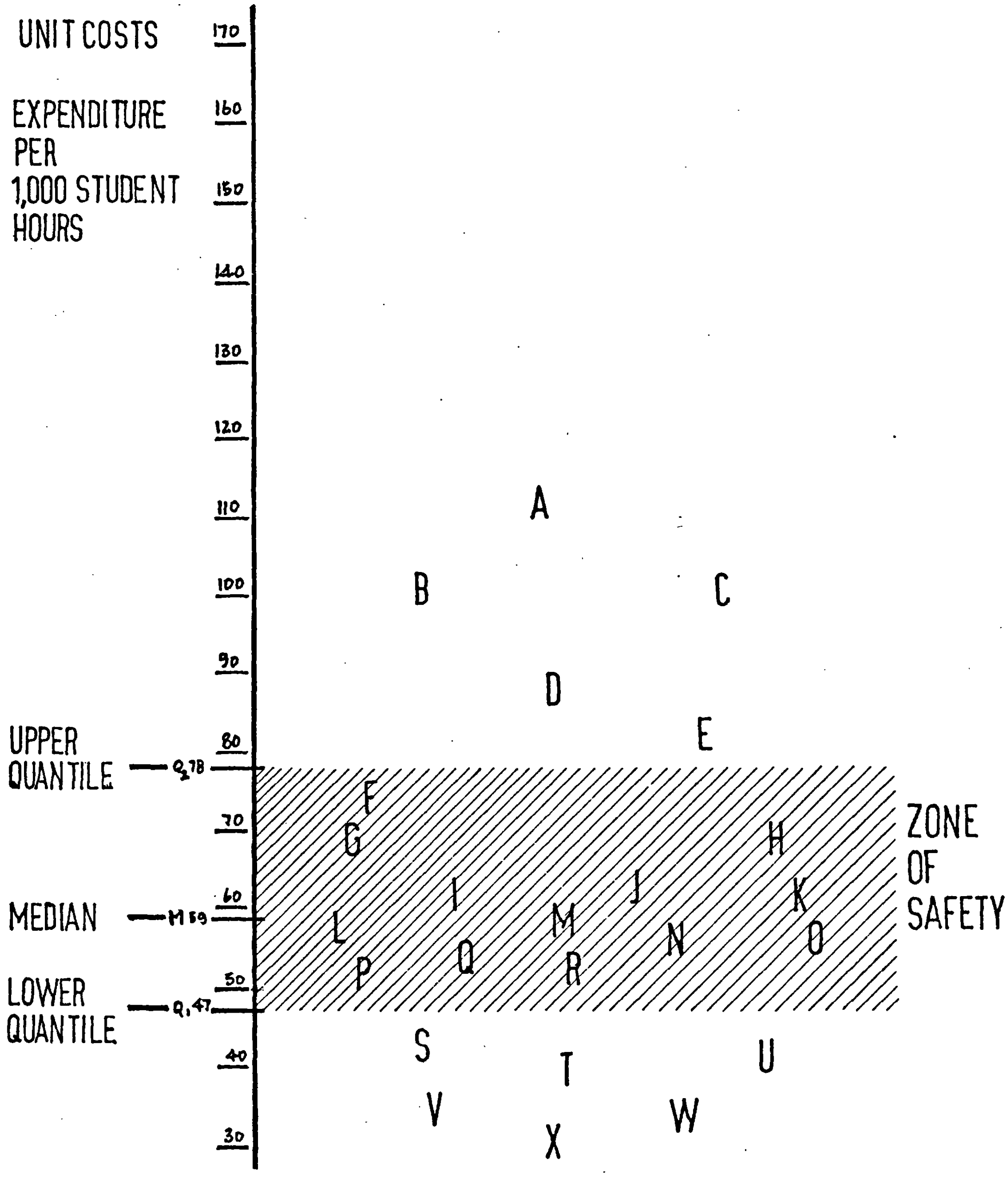
The search for standard unit costs in education initiated by Bobbitt and others like him is far from being over today. More sophisticated statistical treatments of unit costs are now possible with the advent of the computer in educational administration. The recent report by the Committee on the More Effective Use of Technical College Resources, seeks standard costs not dissimilar from Bobbitt's, though admitting that conditions particular to a single institution exist.

In/

Fig 4.10

Fig 4.10

EXPENDITURE PER 1000 STUDENT-HOURS IN MATHEMATICS IN SOME AMERICAN HIGH SCHOOLS.



"In order, then, to show not only how a particular college compares with other colleges, but also how that college is performing taking account of the particular conditions existing within it, it is necessary to have a standard against which to measure. A 'model' cost figure for a college can be calculated by finding the average cost per teaching hour for each grade of staff.....; the average cost per teaching hour for staff can then be converted into a cost for each level of work by applying the staffing formula. Any difference between the model and actual cost would be caused by staff being used other than in the way visualised in the staffing formula" (Capps, 1969).

In short, the adoption of the relative unit cost as an index of the value of a subject advocated by, amongst others, Harris and Bobbitt was simple-minded and inimical to education. It caused the elimination of some minority courses, the creation of larger classes and it fostered the notion that education had to pay its way in terms of narrow economic criteria, like any other business concern. The setting-up of standards of class-size, length of instruction and number of periods of instruction per week stemmed from a desire to make best use of available resources, i.e. a desire to plan the education service. It is these latter deposits of research which are useful today. It is from the desire to produce information concerning the use of resources that the following cost study derives.

Subject Costs Results Of Scottish Educational Costs Project

Two sets of unit cost data referring to subjects are set out.

From Area A : an analysis of the entire secondary department system in the authority including timetables, invoices, salary records for each school.

From Area B : an analysis of a sample of 5 secondary departments - their timetables, supplies invoices and salary records. By using some data from Area A in conjunction with this Area B sample data, a similar range of unit costs of subjects was obtained.

Two types of costs with very similar designations are distinguished as follows;

1) Staffing Costs; expenditure on teaching staff only;

2) Teaching Costs; all expenditure allocable to the teaching of a particular subject - teaching staff salaries, equipment and repairs thereto, textbooks, apparatus.

Staffing Costs were further analysed into lower and upper school Staffing Costs, the division between lower and upper being made at the end of year III. The Scottish pupil normally attains his fifteenth birthday during his third year of secondary school so that the division of staffing costs at that point is meant to show how unit costs in the compulsory years (I-III in general) compare with those in the "voluntary" schooling years (IV-VI)[6].

For each set of schools, four basic subject costs are possible - a,b,c,d, see Fig 4.11.

Fig 4.11 Fig 4.11

POSSIBLE SUBJECT COSTS

COSTS	Years I-III	Years IV-VI	All Years
Subject Costs	a	b	c
Teaching Costs	-	-	d

Fig 4.11 indicates that there are available total Staffing Costs for subjects allocated on the basis of teachers' time to years I-III (a), allocated to years IV-VI (b), and for all years (c). Because of the enormous difficulty in making a rational allocation of non-staffing costs between years I-III and years IV-VI there are no Teaching Costs available equivalent to a and b type staffing costs. The total Teaching Costs of subjects for all years, d, are available.

[6] A case might have been made for costing salaries in groups of two years i.e. years I-III (orientation years), years III-IV (years of preparation for 'O' grade or for labour market), years V-VI (years of preparation for 'H' grade). This finer division might have been more relevant had the school-leaving age been raised to 16 in 1970 as intended prior to Jan.'68. It would have required more time - especially in the detailed analysis in Area A - and was rejected for this reason.

The Construction of Unit Costs

But which units are to be adopted? A unit cost is obtained by dividing some total cost by the relevant unit e.g. pupils, sq.ft., minutes of instruction.[7] For the study of Area A, the following three unit costs were derived while in Area B only the second of these units was used.

1) Costs per pupil, 2) Costs per pupil-period, 3) Costs per teaching-group. Staffing Costs are denoted by "S" and Teaching Costs by "C". Suffices p,pp and tg attached to S and C relate to unit costs in years I-III, and years IV-VI. Suffices P,PP, and TG attached to S and C relate to unit costs over All Years. Fig 4.12 lays out the possible unit costs.

Fig 4.12 Fig 4.12

Possible Unit Costs for School Subjects

Costs	Years I-III			Years IV-VI			All Years		
Staffing	S_{p} I-III	S_{pp} I-III	S_{tg} I-III	S_{p} IV-VI	S_{pp} IV-VI	S_{tg} IV-VI	S_{P}	S_{PP}	S_{TG}
Teaching	-			-			C_{P}	C_{PP}	C_{TG}

Definition of Unit Cost Terms

(1) Cost per pupil : Total cost divided by the number of pupils; this indicated the cost of instruction for one pupil.

(2) Cost per pupil-period : Total cost divided by the number of pupil-periods (One pupil-period being one pupil receiving one period of instruction per week).

(3)/

[7] The relevance of the unit is judged with respect to the object of the cost-accounting; clearly heating costs of schools could be referred to number of pupils or area/volume of buildings, costs of school transport might be referred to pupils or miles-run etc.

Fig 4.13

Analysis of Secondary School Expenses Within Subjects: UNIT Staffing Costs.

SUBJECT	S_p I-III	S_p IV-VI	S_{pp} I-III	S_{pp} IV-VI	S_{tg} I-III	S_{tg} IV-VI	S_P	S_{PP}	S_{TG}
English	£12.43	£17.75	£1.81	£2.40	£225.54	£237.38	£13.34	£1.92	228.12
History	5.09	26.55	2.24	3.59	116.47	211.50	6.63	2.51	133.63
Geography	3.94	18.57	1.67	3.45	86.55	163.65	5.22	1.99	101.42
Modern Studies	6.64	9.87	1.30	2.17	161.33	158.00	6.96	1.38	160.85
Mathematics	11.17	17.23	1.81	2.36	162.94	184.06	12.15	1.91	167.35
Physics	8.57	18.63	3.64	4.80	136.45	150.81	11.89	4.16	143.52
Chemistry	10.20	18.04	4.44	4.27	170.26	172.03	12.83	4.36	171.07
Biology	6.77	24.90	2.94	4.55	104.35	249.87	10.79	3.59	148.57
General Science	10.08	15.80	2.41	2.77	145.10	249.33	10.33	2.43	149.82
Classics	23.17	40.57	4.66	6.14	185.42	145.77	31.25	5.45	159.31
Modern Languages	13.14	28.56	2.22	4.39	257.88	308.09	17.64	2.90	279.41
Art	7.33	14.51	2.51	3.90	103.99	99.78	8.00	2.68	103.25
Music	2.84	5.90	1.44	3.45	55.50	67.57	3.26	1.68	58.09
Physical Education	4.48	4.54	1.48	1.62	69.16	65.56	4.49	1.50	68.56
Commercial	8.20	13.35	1.25	2.32	99.09	268.00	9.81	1.56	135.28
Domestic Science	12.92	28.86	2.22	5.08	106.09	173.20	14.47	2.49	114.73
Technical	16.19	24.43	2.55	4.06	129.89	125.72	17.39	2.76	129.02

Fig

(3) Cost per teaching group : Total cost divided by the number of teaching groups ("classes" might have been used instead of "teaching groups"); this cost indicates the cost of instruction for one group or class of pupils.

Unit Staffing Costs Compared

Fig 4.13 shows the staffing-costs of the various school subjects as averaged over the fifteen schools in Area A. Details of the teaching costs are to be found in Appendix 4/B. These staffing costs are the actual "teaching elements" of the total salary i.e. the responsibility allowances (R.A.) have been subtracted from the total salary to leave that part which is a function of the teachers' qualifications and experience. The R.A. part is allocated to a separate sub-head - administration of subject-and thus is included in the teaching cost of the subject.

The interpretation of these figures is as follows: the Staffing Cost per pupil of Classics is £31.25 which means that the total of Teachers' Salaries over one year allocable to Classics, divided by the total number of pupils (taken at 20th Sept.) is £31.25. The Staffing Cost is in the nature of an average cost and should not be interpreted as a marginal cost. [The marginal cost would be, in theory, the addition or increment to the existing total cost involved in expanding pupil numbers (or pupil-periods, teaching groups, for that matter) by one unit]. The cost per pupil-period of Classics turns out to be £5.45 and this is derived by dividing the total of Teachers' Salaries over a year by the number of pupil-periods over a week [8]. What £5.45 per pupil-period means, then, is that a single pupil-period of instruction in Classics each week in a school year costs £5.45. The cost per teaching-group was found by dividing the total of Teachers' Salaries by the number of teaching-groups ("classes") operating in one week. Thus, £159 per teaching-group in Classics means that, on the average, a class in Classics cost £159 to run for a school year.

A quick look at the last three columns of Fig 4.13 will reveal that/

[8] The reason for doing this is so that the unit costs are in pounds sterling, and not in a decimal fraction of a pound sterling, as they would be if S_{pp} figures were further divided by the number of weeks in a school year. In other words the unit cost of an actual pupil, pupil-period, or teaching group is the value quoted in Fig 4.13 divided by the number of weeks in a school year, say 40.

the highest per pupil and per pupil-period costs occur in Classics, £31.25 and £5.45 respectively. But note that the cost per teaching-group in Classics is £159 compared to £228 in English. It appears that using one unit English is more costly than Classics, whereas using the other two it is less costly. The anomaly can be explained. In the fifteen schools covered, the basic provision (in terms of the amount of teachers' time) of English was over seven times greater than that of Classics. [Actual figures in Appendix 4/F (i)]. The classes in English are three times larger, on the average, than those in Classics [Fig 4.14]. So, for equivalent amounts of basic provision in English and Classics there are fewer separate teaching units in English with the result that the cost per teaching-group is higher in English. The larger size of teaching group in English leads to the cost per pupil and cost per pupil-period being lower than in Classics. The extremely low mean size of teaching-groups for Classics - 8.0 for years I-III and 3.5 for years IV-VI - must be a major factor in determining the cost pattern of Classics. To some extent, the qualifications (and corresponding salary scales) are also responsible for the cost pattern. Thus, six of the seven Classics' teachers are first or second class honours graduates and are paid on the top scale. In contrast, music - one of the "cheapest" subjects - £3.26 per pupil and £1.68 per pupil-period - is poorly staffed. Roughly 30% of the music teachers teaching years I-III are uncertificated and therefore paid on the lowest scale.

The broad conclusions from Fig 4.13 are:

(a) All three unit costs are higher for the upper school than for the lower school. They are on the average one-and-a-half to four times higher using pupils as the unit comparison, and one-and-a-half to two times higher using the pupil-period unit and in most cases greater by as much as three times for the teaching-group comparison.

(b) There is a range of roughly 1000% (£3.26 - £31.25) in per pupil costs, S_p, but a much smaller range of 350% (£1.50 - £5.45) in the per pupil-period costs. The explanation of this finding lies in the meaning of these two units and might best be seen by a close study of the unit costs of physical education and English. S_p values for these two subjects are £4.49 and £13.34 respectively. English/

English, then, is roughly three times as expensive as physical education in per pupil terms. However, S_{pp} values are £1.50 and £1.92 respectively. English is approximately 40% more expensive than physical education in per pupil-period terms. The observed difference in "expensiveness" reflects the different time allocations of these subjects; English receiving six or seven periods per week in the main, while two or three periods per week are the norm for physical education. Assuming similar numbers of pupils taking both subjects, since the pupil-period is the product of both pupils and time, the larger amount of instruction (in terms of periods) given in English lowers the per pupil-period unit cost proportionally more relative to physical education [9]. Accordingly, it is suggested that the most suitable unit for comparison of staffing costs is the pupil-period. It is the real "quantum" of educational organisation.

Unit Costs and Class Size

The most obvious cause of the variations in unit costs between subjects is the variation in class size. From the following extract from the analysis of the timetables of the 15 secondary schools (see Appendix 4/C) in Fig 4.14 it is clear that classes in the upper school are smaller than those in the lower school. In part, this is due to statutory control of class size (see Appendix 5/A) and partly because of the policy of allowing pupils a large measure of choice in their own curricula, thus necessitating alternative times for some subjects. In only one case, commercial, is the size of the teaching group in years IV-VI higher than in years I-III. It is hardly surprising, then, that unit costs (in terms of all three units) are higher in the upper years of the secondary school. However, class size is not the only factor influencing unit costs in subjects; salary scales and teaching experience also come into the reckoning.

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[9] It follows that the ratio of cost per pupil to cost per pupil-period gives the average number of periods of instruction in each subject, e.g. the ratio for Maths is £12.15:£1.91,or 6.36 periods.

Fig 4.14

Fig 4.14

The Sizes of Teaching - Groups in Different Subjects

SUBJECT	Size of Teaching Group, Years I-III M_{tg} I - III	Size of Teaching-Group, Years IV-VI M_{tg} IV - VI
English	18.1	13.3
History	22.8	7.9
Geography	21.9	8.8
Modern Studies	24.2	16.0
Mathematics	14.5	10.6
Physics	15.9	8.0
Chemistry	16.6	9.5
Biology	15.3	10.0
General Science	14.3	15.7
Classics	8.0	3.5
Modern Languages	19.6	10.7
Art	14.1	6.7
Music	19.5	11.4
Physical Education	14.9	14.4
Commercial	12.0	20.0
Homecraft	8.2	6.0
Technical	8.0	5.3

Source: The timetables of the fifteen secondary departments in Area A.

The language subjects, maths, science, history and geography, are in Scotland "graduate only" subjects. Apart from uncertificated [10] teachers teachers of those subjects are invariably on the top three salary scales. The practical and aesthetic subjects, staffed mainly by holders of diplomas, e.g. T.S. Dip., D.A., L.R.A.M., are paid on lower scales. The combined effect of the factors of class size and qualifications may be illustrated by a comparison of the per pupil period staffing costs (lower school) of maths and English.

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[10] In 1964/5, the term for those teachers whose qualifications for teaching were unacceptable to the S.E.D. was "uncertificated". Currently, the General Teaching Council control teacher qualifications and their term is "unregistered".

While the mean size of teaching groups in English is greater than maths - 18.1 as against 14.5 for years I-III - the qualifications of English teachers are, on the whole, better: 39.7% of English teachers, teaching in the lower school, have honours degrees as against 23% of maths' teachers. The first factor (class size) operates to decrease English staffing costs relative to Maths, while the second factor operates in the opposite direction. In fact, English and maths show the same unit costs - £1.81 per pupil-period.

Determinants of Unit Costs

Although no data was collected on age or experience of teachers, this is yet another factor which affects costs. An extreme case might be if one subject department were staffed by teachers all of whom had 15 years or more experience and were consequently on their maximum salary, while another department was staffed by equally well-qualified but relatively inexperienced teachers. The total staffing bill for the two departments might differ by as much as 100%.

Unit staffing costs, then, depend on the variable of class size and a variable or index of qualifications and experience. Putting this mathematically: $U = (f\ M_{tg},\ Q/E)$

i.e. U, unit cost, is a function of both the mean size of teaching group M_{tg}, and an index of qualifications and experience (Q/E). In any attempt to quantify this type of relationship, two things must be borne in mind.

1) The suitability of the variable for quantification. In the present case, the average size of class for each teacher of a subject is obtained directly from the data in timetables, and the average of these averages is readily available and is meaningful [11]. The problem of constructing an index which relates basic qualifications and experience has two facets. First, the construction for each teacher of some scale to express the qualifications and experience. Secondly, the difficulty of combining separate indices for each teacher into one index meaningful for the set of teachers of each subject. It is apparent that the first of the two variables, i.e. M_{tg}, is the more suitable for quantification.

[11] Notwithstanding that the median might have been chosen instead of the mean.

2) The accessibility of the data required. As already mentioned the timetables of each subject are the only original documents necessary to arrive at the value of M_{tg} for each subject. Information regarding qualifications and age (or position on basic scale) is given on the teachers salary card. In order to obtain an index (Q/E) for a subject, it would have been necessary to code each teacher with the appropriate index at the initial coding stage[12], then sort all punched cards into subject groupings and decide upon an index for each subject by examining the set of cards relevant to that subject. Clearly, digging out the data for the variable (Q/E) involves a greater expenditure of effort than that necessary for determining M_{tg}.

Thus, the variable Q/E looks unsuitable for quantification; and even if a meaningful index could have been constructed the data gathering would have involved too much time (and therefore money) to justify it. As a compromise, the built-in facility of a code to represent the salary scale was used in a special analysis carried out after the main processing [13].

All the data cards for secondary school teachers in Area A were sorted by school, by subject, by salary scale (a rough index of initial qualification) and by upper and lower school. Some of the results are presented in Fig 4.15. It must be recalled from Chapter 2 that a secondary teacher may have more than one data card because staff may take more than one subject, more than one age group i.e. they may teach in both the lower and upper school, and even in more than one school. The Fig 4.15 was derived by 1) selection of one card for each teacher at random, 2) sorting of these cards into subjects, 3) sorting and counting of the cards related to each scale.

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[12] As it was, each teacher was coded for salary scale [0-9] which was available from the salary card.

[13] This time-consuming task was performed on a counter-sorter by John A. Murphy, B.Sc., as part of a dissertation: Data Processing in Education, presented as a Diploma in Education dissertation, Glasgow University: 1969.

Fig 4.15 shows that some 28 teachers were involved in teaching English and 24 in teaching Maths in years IV-VI. Nine honours graduates (Scales 1 and 2) taught Maths but 21 honours graduates taught English. The general drift of the figures shows the proportions of more highly remunerated staff are highest in the "academic" subjects (Scales 1,2,3) while in the practical subjects the weighting is in favour of lesser paid staff. The large numbers of teachers on Scale 5 in physical education and technical subjects must go some way to keeping unit costs down in the two curricular areas where class size is traditionally smaller than in academic subjects and would in other circumstances lead to higher unit costs.

In the search for a "dynamic" relationship between unit costs and their correlates, attention was turned to the other variable - mean size of teaching-group. It was decided to determine if there was a relationship between class size and unit cost (per pupil-period). Using the $S_{pp \; I-III}$ and $S_{pp \; IV-VI}$ values in Fig 4.13 and the appropriate class sizes in Fig 4.14, 34 pairs of observations in all, it was determined that the equation relating to U (i.e. S_{pp} values) and M_{tg} was of the form $U = - 0.16 M_{tg} + 5.15$. The correlation coefficient between U and M_{tg} being - 0.69 (details in Appendix 4/D). What this means is that 47.6% of the variability in unit costs can be accounted for by the relationship between unit cost and mean size of teaching-group. In addition, for an increase of one pupil in the size of teaching-group, unit costs <u>decrease</u> by £0.16.

It is hardly surprising that the relationship is only as strong as the correlation coefficient of - 0.69 indicates, in view of what was said about the qualifications profiles of various subjects. In other words, class size is important only up to a point because the "mix" of resources (qualifications mix of staff in each subject) characteristic of each subject plays a part in controlling unit costs. The above regression equation is of limited usefulness because a vital part of the determinants of the unit costs lies unquantified, and because it was derived from observations over a narrow range of class sizes (5-24).

Fig 4.15

Analysis Of The Qualifications Of Teachers According to Subject Taught

Fig 4.15

	English	History	Geography	Modern Studies	General English Studies	Maths and Arithmetic	Physics	Chemistry	Biology	General Science	Classics	Modern Languages	General Languages	Art	Music	Physical Education	Commercial	Domestic Science	Nursing Studies	Technical Studies	Religious Instruction	Primary Subjects	Secondary Subjects	Unallocable	
Scale 1	20	9	7	1	-	9	7	9	5	2	5	15	-	-	-	-	1	-	-	-	-	-	-	-	90.
Scale 2	1	1	-	1	-	-	1	2	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	8.
Scale 3	7	4	3	2	-	14	4	2	8	3	2	7		17	6	-	5	1	-	4	1	-	1	-	91
Scale 4	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	2	5	-	3	-	-	-	-	12
Scale 5	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2	14	-	-	-	15	-	-	-	-	32
Scale 6	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2	-	-	-	-	-	-	-	-	-	3
Scale 7	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	13	-	1	-	-	-	-	15
Scale 8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Others	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	2	2	-	1	-	-	1	-	8
Totals	28	14	11	4	-	24	12	13	14	7	7	23	-	18	11	15	10	21	-	24	1	-	2	-	259

All teachers of secondary subjects taking years IV-VI Total Allocations = 259.

A valid conclusion to this study of the factors determining the costs of subjects, would be that roughly half of the variability in these costs can be put down to the relationship between unit costs and class sizes.

We must now consider what implications there are for curriculum planning in the more general findings concerning subject costs.

Curriculum Costs

The summary of unit Teaching Costs presented in Fig 4.16 is taken from Appendix 4/B.

Fig 4.16

Fig 4.16

Unit Teaching Costs Of Subjects Compared

Subject	Teaching Cost Per Pupil-Period*
Classics	£6.40
Sciences	£3.51
Technical	£3.17
Modern Languages	£3.12
Art	£2.99
Domestic Science	£2.77
History	£2.77
Geography	£2.18
Mathematics	£2.06
English	£2.05
Music	£2.00
Commercial	£1.85
Physical Education	£1.78
Modern Studies	£1.54

* Criticism could be levelled at the assumption implicit in compiling per pupil-period statistics of Teaching Costs that textbooks, apparatus and the responsibility allowance (R.A.) element of salary can rationally be allocated over a unit such as pupil-period. The meaning presented by a statement such as "the cost of physics equipment per pupil-period is £x" is not clear. Instruction in physics and its cost per pupil-period is such that the cost can be regarded as being consumed (or invested) in that time by one pupil. However, equipment is not consumed by a single pupil or in a single period only. Part of the stock of equipment is used, and perhaps used up, each period. In defence of such a procedure the writer claims that the benefits of the allocation over pupil-periods in the form of the inter subject comparison above outweigh the doubt as to the meaning of what is a very small part of the overall cost.

Teaching Costs are Staffing Costs together with any items of expenditure which could be allocated unambiguously to a particular subject. Fig 4.16 shows immediately that there is a 400% range in unit costs. A programme of expansion of technical education will involve 50% higher unit expenditures than development in English or maths. In a situation where there was a more plentiful supply of teachers curricular plans ought to take account of such costs because the never-never land where finance is unlimited does not exist. Putting that another way, plans for R.S.L.A. might well consider the cost of the additional year at a level deeper than the school level. Expansion of the physical recreation content in the curriculum in connection with the R.S.L.A. involves unit costs (recurrent expenditure) only half as high as an added involvement in technical education. The latter has high unit costs because of a tradition/policy of very small classes, no doubt on account of the need for supervision of each pupil engaged in practical work. Assuming then, for the sake of this cost argument, that technical classes must remain "small" it is certain that plans for vocational courses - called "Brunton" [14] courses in Scotland - will involve more expenditure than courses aiming at education for leisure, consisting perhaps of physical education/games, drama, music, art, general English studies. Clearly the curricula of any one school will show a balance of both these elements (vocational and leisure) and this balance or proportion of high to low cost curricula will determine overall school expenditure, and ultimately education authority and national expenditure. These curriculum costs may go some way to explain why the overall costs of secondary departments vary so widely and apparently do not depend, in any straightforward way, on the size of a school, (Chapter 5 deals with this point). Where the mix of the curriculum in terms of high and low cost curriculum areas varies there will inevitably be a profound affect on overall costs. The obvious weakness of planning education on the basis of curriculum costs is the disregard for the educational benefits derived from various types of curricula. Sidestepping the problem of the intangibles for the present, the above work and reasoning is still justificable and valid if it is seen as part of the necessary sub-structure to projection or budgeting of educational expenditures.

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[14] The term "Brunton" was coined after the publication of <u>From School to Further Education</u> (S.E.D.,1964), a report of a committee chaired by J.S. Brunton, H.M.C.I. The report called for courses with a vocational impulse for pupils in the final year of a non-certificate course.

A vital part of educational planning, of which curriculum planning is one aspect, is the estimation of the required resources. What has been reported and discussed here shows that even the planning of the minutiae of curriculum changes has cost implications.

Equipment for Subjects

Returning now to the theme of capital/labour, the question of which subject is the greatest user of equipment arises. Fig 4.17 goes some way towards dealing with the question by showing the proportion of Teaching Costs taken up by salary (both teaching element and responsibility allowance included). The science subjects and technical stand out as the greatest users of equipment. The figures are to be interpreted as follows: English : averaged over all secondary schools in Area A, £13.34 was spent per pupil in 1964/5 on the so-called "teaching element" of Teachers' Salaries and a further £0.53 per pupil was spent on the additional part of salaries earned by holders of posts of responsibility. Taken together, these two unit costs represent 97.47% of the total expenditure allocable to the subject. A glance down the last column shows just how much labour dominates in the actual process of teaching. Educational materials, books, aids, apparatus in most cases represent only a few percent of the resources brought to play on the process of classroom teaching.

The startlingly low figure of 75% for physics may be misleading as an indicator of the "normal" position because the year in question (1946/5) was one in which the Scottish new syllabus in physics and chemistry was being developed - a grant of £3,000 per annum being available in Area A for the stocking and re-equipping of Science labs. The nature of the new physics syllabus requires high cost and durable items of equipment e.g. cathode ray tubes and so a considerable proportion of this grant appears to have found its way into physics labs. A closer look at expenditure on physics equipment shows that £1.4 per pupil might be allocated to "capital" type equipment compared with £2.5 per pupil on consumable items or repairs.

Fig 4.17 Fig 4.17

- Analysis of Secondary School Expenses Within Subjects
- Salary Element as a Proportion of Whole Teaching Cost per pupil

SUBJECT	Staffing Cost per pupil S_P	Responsibility Allowance Cost per pupil RA_P	S_P+RA_P	Teaching Cost per pupil C_P	$\frac{S_P + RA_P}{C_P} \times 100$
English	£13.34	£0.53	£13.87	£14.23	97.47%
History	6.63	0.44	7.07	7.30	96.80
Geography	5.22	0.28	5.50	5.71	96.30
Modern Studies	6.96	0.73	7.69	7.75	99.22
Mathematics	12.15	0.53	12.68	13.09	96.86
Physics	11.89	0.24	12.13	16.09	75.38
Chemistry	12.83	0.99	13.82	15.09	91.58
Biology	10.79	0.29	11.08	12.09	91.64
General Science	10.33	0.56	10.89	11.46	95.02
Classics	31.25	4.49	35.74	36.70	97.38
Modern Languages	17.64	0.85	18.49	18.96	97.52
Art	8.00	0.41	8.41	3.89	94.60
Music	3.26	0.30	3.56	3.83	92.95
Physical Education	4.49	0.45	4.94	5.33	92.68
Commercial	9.81	0.95	10.75	11.64	92.35
Domestic Science	14.47	0.78	15.25	16.10	94.72
Technical	17.39	0.89	18.28	19.96	91.58

Down at this micro level we can see just how small is the outlay on educational "things". At the U.K. national level, Teachers' Salaries account for 64.5% of current and 48.7% of all expenditure (1962/3 figures) at the school level they are roughly 80% of allocable expenditure, and at the subject level they are over 90%. All of which pulls the ground from the feet of the "cut-out-the-frills" critics of educational change.

All of these percentages must be interpreted with some care since a varying base for total expenditure is used. Nevertheless, the trend is clear. When the items of expenditure are whittled away to leave those "things" used by the teacher in the classroom there is precious little left. The "frills", or all expenditures other than Teachers' Salaries, are just as likely to be substantial loan charges on capital or heating and lighting bills as some patently gimmicky teaching machine costing thousands of pounds. It is hard not to conclude that the <u>educational</u>

revolution has not hit our schools yet.

Subject Costs in Different Schools

Not only do unit costs of different subjects vary but unit costs of the same subject vary between schools. To illustrate this the unit costs of English teaching in twelve secondary schools are arranged in Fig 4.18. Some explanation of the figures is necessary. Schools A and C have roughly the same rolls but the former is a senior secondary (grammar school), while the latter is a comprehensive school. Notice that the overall Staffing Cost, S_{PP} is just lower in the comprehensive, although the unit Staffing Costs of both the lower and upper school are higher. The smaller number [15] of pupils in the upper years of the comprehensive school, compared with the senior secondary explains this apparent anomaly. Incidentally, the per pupil Staffing Costs of the Schools A and B are £131 and £85 respectively. Contrasting that with the similar overall Staffing Costs of one subject-English - we see that a high cost differential between schools may not be reflected in the operating costs of all the departments or sub-units.

Using Bobbitt's jargon, schools F and H clearly fall outside the "zone of safety". Why do the unit costs of English teaching show a range of over 500%? Does such a range indicate differences in objectives or the means of attaining similar objectives? A basic assumption in the work of both Harris and Bobbitt was that their sample schools were attempting to secure similar results. Such a premise could not be held in the Scottish study. Schools H,I,J contain no pupils who are aiming at external exams; schools A and C contain widely different proportions of such pupils and school E has an agricultural bias in its curriculum. Even supposing the objectives of a school differ, does this justify such a large variation in educational resources? Could it be that educational inequalities are less subtle than might be thought? If one could with certainty assert that the "quality" of English teaching given for £2.32 per pupil-period in a senior secondary is similar to that given for only £1.68 per pupil period in a four year secondary, then it is not entirely mischievous/

[15] The actual numbers are School A - 362 in years IV-VI
School C - 135 in years IV-VI

to ask why all instruction in English cannot be given at the lower price. These cost figures reflect the qualification and age of the teachers and the size of the class. Almost certainly the higher unit cost school will have better qualified teachers and smaller classes than the lower unit cost school. Both of these factors are by tradition conducive to high "quality" education. In other words, does the lower level of inputs in the four year school indicate a lower quality of education? If so, is this a source of social injustice? The cost/quality relationship in education will be pursued at greater length in Chapter 7. For the moment, it will be enough to observe again that there are obvious inequalities in the input of resources at this micro-educational level.

Fig 4.18

Fig 4.18

Unit Costs of English in Twelve Secondary Schools

SCHOOL	Unit Staffing Costs S_{pp} I-III	S_{pp} IV-VI	S_{PP}	Unit Teaching Costs C_{PP}
A	£1.73	£2.43	£2.10	£2.32
B	1.45	2.18	1.55	1.68
C	1.91	2.70	2.05	2.20
D	2.13	2.18	2.13	2.25
E	1.43	3.16	1.81	1.93
F	3.48	1.98	3.23	3.42
G	1.63	2.58	1.74	1.79
H	0.62	-	0.62	0.62
I	2.35	-	2.35	2.36
J	1.98	-	1.98	2.03
K	2.04	4.30	2.18	2.37
L	2.07	1.49	2.01	2.12

Data for 1964/5

A more rapid, but fairly crude estimate of staffing costs in the five secondary schools in Area B was made - see Appendix 4/F. The unit costs were of the same order of magnitude as those found above and similar variations in unit costs between subjects, and for individual subjects between schools, were found. Because the five secondary departments had different lengths of period, the staffing costs were put on a base of a pupil-hour. Fig 4.19 shows staffing costs per pupil-hour (over a year) Maths in the five secondary departments.

Fig 4.19

Fig 4.19

Staffing Costs per Pupil-hour In Five Area B Secondary Schools

Subject Maths	Cost per Pupil-hour
School Code	
M	£3.91
N	£5.85
P	£7.14
Q	£4.36
R	£6.93

Source: Appendix 4/F

SUMMARY AND CONCLUSIONS

The aim of this chapter is to analyse educational costs with special reference to the relative proportions of the different resources. This approach is legitimate since education is an economic activity with a product which is admittedly only partly, attestable; education is also a user of vast money resources (mainly public) and valuable real resources, of which people and buildings are the most prominent.

Enough has been said about Teachers' Salaries in relation to total expenditure at both macro and micro educational levels to leave no doubt that the use of manpower is one field requiring enquiry. Just how much of the teacher shortage is real and how much it is due to ramifications of timetables in individual subjects, it is not possible to estimate at present. What can be said is that if the educational "benefit" of all possible subjects being available in all secondary schools in a reasonably flexible timetable is held desirable - politically, socially or even (in the long term) economically - then certain cost patterns follow. Conversely, with a fixed amount of manpower resources there is a limit to the benefits which can be derived. It follows that in secondary (and to some extent in tertiary) level education, we must search for ways of utilizing the available manpower as best we can in accordance with social, educational, economic and political objectives.

The specific findings are on the one hand methodological, and on the other substantive. Under the former heading we could place:

1) The warning to avoid misinterpretation of comparative cost statistics through (a) proportions being referred to different totals e.g. including or excluding capital charges (b) account heads themselves being too broad e.g. "labour".

2) National and international figures might, more appropriately be referenced to some "stable", more easily definable quantity such as Teachers' Salaries.

3) Average or unit costs in education should for some purposes of comparison be based on a unit which includes some measure of the number of pupils <u>and</u> some measure of the time. The pupil-period (or pupil-hour) is suggested as an adequate unit for comparing costs of different subjects. As explained in Appendix 4A(ii) the interpretation of cost per pupil-period given in this report has the limitation of assuming that the total of Teachers' Salaries should be allocated to "teaching", whereas in reality, a certain proportion of a teachers' time is spent in tasks other than "teaching". By adopting the stated procedure we imply that these other activities - correction, library supervision etc., have zero cost.

Quite specific findings are as follows:

(1) Half of <u>all</u> money spent on education in 1962/3 was taken up by salaries and wages.

(2) Some 52.1% of <u>all</u> money spent on education in Scotland in 1962/3 was taken up by salaries and wages compared with 50.7% for U.K. as a whole.

(3) In 1959/60 the level of expenditure on Maintenance of Schools in Scotland was 36.6% of that on Teachers' Salaries while in 1967/8 the level had risen to 48.3%. Over the same period, the relative level of expenditure on first order educational equipment (books etc.) rose insignificantly while Loan Charges shot up from being 15% of the level of expenditure on Teachers' Salaries to almost 26% in the 8 years.

(4) On the average, about 80% of expenses directly allocable to individual schools consists of salaries and related expenditure on teachers.

(5) The proportion of total allocable expenditure taken up by salaries and wages of labour other than teachers is almost 5% for one and two teacher primary schools but 10% for "large" primaries (up to 14 teachers).

(6) The average expenditure on Repairs of Fabric is roughly 600% lower in the largest primaries than in the one and two teacher schools.

(7) Expenditure per head on first order educational equipment is some three to three and a half times higher in secondary than in primary depts.

(8) While first order educational equipment is about one seventh of total expenses on Maintenance of Schools, Fuel/Light/Cleaning is more than one third of the same total.

(9) Unit Staffing and Teaching costs of school subjects vary considerably (1) between subjects (2) between upper and lower school (3) between schools for the same subject.

(10) Staffing Costs of subjects per pupil-period range over 350%, averaged over 15 secondary departments.

(11) Roughly half of the variability in these unit costs can be ascribed to a relationship between unit costs and class size.

(12) First order educational equipment represents only a few percent (more for science and technical than other subjects) of expenditure allocable to subjects.

(13) Costs per pupil-period for English show a range of some 500% over the 15 secondary departments studied in Area A.

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CHAPTER 5

ECONOMIES OF SCALE IN EDUCATION

Introduction

It has been well known for some time that in the agricultural and industrial sectors of the economy there are considerable economies as the scale of operation increases. Mechanisation, automation and mass production have led to the lowering of unit costs of articles which, when made by hand, are expensive. Any suggestion that unit costs in education could be lowered by processes equivalent to mechanisation and automation is apt to provoke reactions about the quality of education and how it may suffer. Nevertheless, although the eggs laid by the battery chickens may not seem it, they are just as nourishing as those of the free range variety, and the nuts and bolts turned out in their millions by an automatic plant are of as high a quality as the variety turned out singly. It is interesting to reflect on the possibility of so operating the school system that the desired 'quality' of the output - in terms of general education and specific skills - is maximised for the minimum input of resources. In other words, it would be interesting to know if there is an optimum organisation of schools which has, as one of its features, schools of the most economic size, given a specific set of educational objectives and considerations.

PART 1

Review of Literature

A couple of examples will help to set the scene for this chapter. It is reported that small school districts in the U.S.A. are both uneconomical and unable to provide the services or opportunities required to meet present day needs of education. (Morphet and Ross, 1961) A question arising out of this assertion is what is the minimum size in economic terms for a school district to offer a set of services or educational opportunities. Secondly, there are calculations which show that if 3,750 pupils were organised in 3 secondary schools of 1,250 each, a total staff of 266 would be required instead of the 190 required for the single 3,750 school (McIntosh and Ewan, 1967). Translated into money terms this would mean that the outlay per pupil of the former type of organisation would be considerably greater than that of the latter. Two questions arise here: 1) What will be the increased demand on resources in money terms of the three smaller units, remembering that thesmaller schools will require proportionally more small classes and well paid staff? 2) Will the smaller units be able to offer as wide a curriculum as the larger one, without an unacceptable level of expenditure? Clearly, the questions are integrally related.

Research into the economies of scale in education is certainly needed, as one way of reducing unit costs. But the implications of the results of research into the economies of scale in education are not clear. Supposing that it is found that there is an economic advantage in having primary schools of no less that 500 pupils, it is not evident how far this one factor should weigh in a decision which must inevitably take into account factors such as the demographic distribution of the population, the willingness of parents to allow their children to travel distances, the ease of communication in the area, as well as the educational benefits to be derived from a school of that size. In this chapter the benefits or quality side of education and other more imponderable aspects of decisions are left out since the objective of the chapter is to establish in a quantitative fashion what, if any, are the economies of scale operating in education. Nevertheless, the writer recognises the need to take the unquantifiable aspects of decisions about optimum size into account.

Riew (1966) in a very rigorous study of 109 four and three-year high schools concluded that within the range of enrolment 143 to 900 the advantages of the larger school were overwhelming. In addition, he brings into sharp focus the question of costs and quality when he argues that

> "Whether schools with an enrolment of more than 701 - 900 provide additional economy depends on one's appraisal of the cost differential as against the differences in what the schools offer. With enrolment of 1101 - 1600, or 1601 - 2400, the per pupil expenditures are \$407 or \$406 as compared with \$374 for schools with 701 - 900 pupils. However, these larger schools distinguish themselves with broader curricula, higher proportion of faculty holding advanced degrees and teachers with more experience.

If one believes these improvements in standards more than compensate for the differences in expenditures, this then may be construed as an economy".

Pursuing the connections between size and cost per pupil still further, Riew then employed the statistical technique of least squares multiple regression analysis, in which he assumed the relationship between per pupil cost and enrolment was parabolic.[1] The other five variables need not concern us. The important point is that, holding constant the effects of changes in the other five variables, only 18.3% of the variation in per pupil operating expenditures was explainable in terms of variation in enrolment.

May and Johnson (1965) quote Department of Education and Science data relating Teachers' Salaries (T) and Running Costs (R) to the size of secondary school (X). The relationship between the Teachers' Salaries and size, as well as Running Costs and size is linear and the regression equations turn out to be

$$T = 87.58X + 4{,}772.5$$
$$R = 36.44X - 293.9 \quad \text{(equations 5.1)}$$

Unfortunatley, they do not quote a value for the correlation coefficient associated with each of the pairs of variables, so that the amount of variance due to the size cannot be stated. Nevertheless, such equations enable one to make tentative calculations of the average values of T and R and so calculate the total cost of hypothetical schools. Examples are shown in fig 5.1

Fig 5.1 Fig 5.1

Total and Unit Costs of Schools of Three Sizes, derived from Regression equations.

Size X	Teachers' Salaries £T	Running Costs £R	Overall Costs £T+R	Cost per pupil = $\frac{T + R}{X}$ £*
100	13,530	3,350	16,880	169
500	48,562	17,926	66,488	133
1000	92,352	36,146	128,498	128

* Rounded to nearest £.

Fig 5.1 shows that increasing the size of the school from 100 to 1000 pupils will result in a decrease of unit costs from £169 to £128. Unfortunately, no value of the standard of error of estimate is available from these figures, nor is there a value of the correlation coefficient.

[1] An explanation of the statistical technique of regression analysis is given in two later sections of this chapter All Primary Schools A Linear Relationship and Regression Techniques. An overview of the application of linear regression and analysis appears in Chapter 8.

These two statistics would have enabled us to say something about the degree of accuracy of predictions using equations 5.1.

Fig 5.2 Fig 5.2

Relationship of Size to Teachers' Salaries and Running Costs for Data of Fig 5.1

Size Index	100	500	1,000
Teachers' Salaries T	£ 13530	£48,562	£92,352
Index	100	359	682
Running Costs R	£ 3350	£17,926	£36,146
Index	100	535	1,079

Source: Fig 5.1

Fig 5.2 is an attempt to show, in index terms, the influence of size on costs. For a 500% increase in size, Teachers' Salaries rise in level by 359%,but Running Costs go up to 535% of their initial level. Teachers' Salaries are influenced by size of school in such a way that, provided the linear relationship holds over the full range 100 - 1000, two schools, one of which has only 100 pupils while the other has 1000, can be expected to have Salary Costs in the ratio of 1:6.82. In contrast, the increase in the level of Running Costs is greater than the increase in size; for two schools one of which has 100 pupils and the other of which has 1000 pupils one can expect the ratio of Running Costs in the two schools to be 1:10.79. The salary element being normally over 70% of the overall recurrent cost of a secondary school, one implication for planning of this exercise might be to plan schools with regard to efficient deployment of staff. The additional overheads of the larger school are possibly the result of extra services, e.g. auxiliary staff or equipment, not available in smaller schools. Consequently, unless these additional benefits are thought to be not worth paying for or unnecessary, planning the sizes of schools - at least secondary schools - might rest on the relationship between Teachers' Salaries and size.

MacLennan (1965) using data collected from 18 grant-aided schools in Scotland, found that there was a linear relationship between the average cost per pupil (C) and the number of pupils (N). The equation was $C = 157 - 0.03N$ (equation 5.2)

The correlation coefficient was quoted as - 0.8, showing a high negative correlation between average cost and size of school. In fact, roughly 64% of the variability in average cost can be explained by the relation between average cost and size of school. The interesting fact about this data is that the relationship is <u>linear</u>. Riew assumed a parabolic relationship between average cost per pupil and size of school.

An attempt to set up the optimum size of schools is included in the report of the Mediterranean Regional Project in Italy. (OECD,1965) The size of schools recommended is a minimum of 700 for lower secondary, and a maximum of 600 for vocational schools. These figures were in fact calculated on the thesis that

> "The size of the educational unit should be small enough for one person - the headmaster - to be able to co-ordinate the activities of the teacher staff efficiently; large enough for the number of pupils to prevent service and equipment costs proving too heavy for the establishment's budget."

Clearly, the decision regarding size is taken in the light of factors other than the relationship between Teachers' Salaries and size. Here, some imponderables - efficient co-ordination of teaching staff - are explicitly drawn in.

The report of the same project in Greece states that for efficient operation a secondary school must have at least six classes - normally an enrolment of 200 pupils. Incidentally, they quote the average enrolment of public day secondary school (gymnasia) as 620 pupils in 1961. (OECD, 1965) Apparently, Greek secondary schools are three times their optimum size !

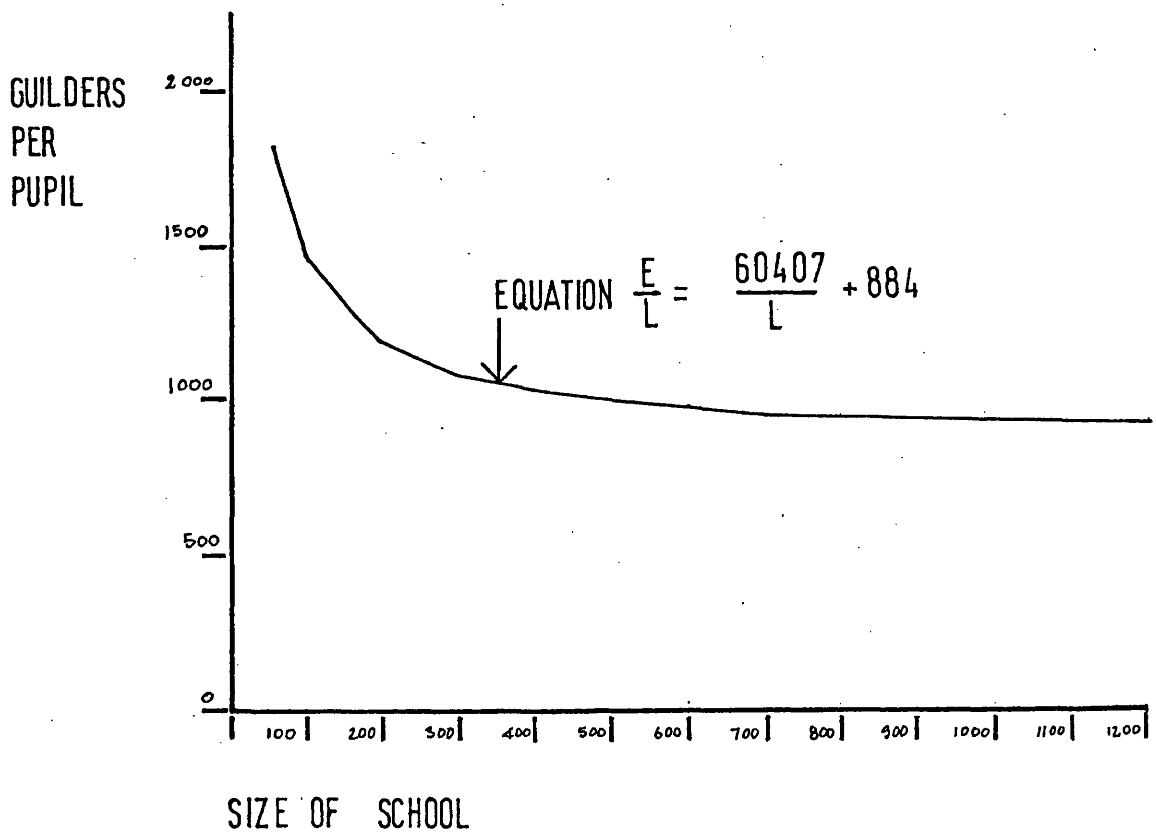
Fitswater (1957) reported that, in his study in the State of Washington, elementary schools which had rolls of less than 50 pupils cost 60% more per pupil than schools which had between 150 and 399 pupils.

Morphet and Ross in their study of schools and school districts in California concluded that a junior high school should have at least 500 pupils, or at least 300 if operated as one unit of junior/senior high school campus. As regards senior high schools, the unit costs are higher in schools having fewer than 600 - 700 pupils, in four year high schools at least 700 - 800 are needed if extraordinary high costs or poor educational facilities are to be avoided.

A study by the Netherlands Central Bureau of Statistics concludes that when secondary grammar schools expand to over six or seven hundred pupils, a reduction in average expenditure per pupil will be no more than 2% or 1% per additional unit of 100 pupils (Netherlands Central Bureau of Statistics, 1958). In addition, they point out that a school with 1000 pupils is per pupil about 10% cheaper than two schools with a total of 1000 pupils. These conclusions were based on a regression - analysis of data of 330 schools. Their results are summed up in Fig 5.3.

Fig 5.3 Fig 5.3

<u>Relation between Size of School and Cost Per Pupil In Secondary Grammar Schools 1958</u>



'E' STANDS FOR TOTAL COSTS PER ANNUM OF THE SCHOOL
'L' STANDS FOR THE NUMBER OF PUPILS

The results are rather neat and satisfying, and the inevitable conclusion is, when the number of pupils increases to over 500 - 600 the drop in costs per pupil [2] becomes less and less "significant". The significance of the function

$$\frac{E}{L} = \frac{60,407}{L} + 884 \quad \text{(equation 5.3)}$$

may be less than it appears at first sight, since it may have been derived by dividing the total costs equation (E = 60,407 + 884L) by L; which procedure is not mathematically correct (involving as it does the division of an equation by a variable (L)).

Social Factors and Size

Benson (1961), arguing from the basis that parents must have direct contact with the teachers who control the schools of which their children are pupils, comes down on the side of having relatively small schools, even although these have higher unit costs than somewhat larger ones would have. In a theoretical exercise, he hypothesises that unit costs should decrease as the size of district increases because of the expansion of administrative and supporting services. An "equilibrium" point might be regarded as the economically (though not educationally) ideal size. However, if it is decided that a minimum of 75% of parents should have direct access to teachers, then a maximum size must be set even though such a size is lower than the "equilibrium" size.

Leaving aside, for the present, the fact that Benson refers principally to districts rather than schools (although small districts in the U.S.A. are apt to have only one school in them) this study shows how factors other than economics have to be brought in when deciding upon the optimum size of schools.

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[2] In a letter to the writer the Director of the Netherlands Central Bureau of Statistics states that the costs per school referred to are those running costs such as maintenance of buildings, caretakers' wages and salaries of the staff that administer school; thus, teachers' salaries are not included in the costs per school.

In his Education for Tomorrow, Vaizey postulates that 600 is the minimum size for an "effective" secondary school and, indeed, sees the comprehensivation circular of 1965 as pointing the way to a network of schools of this size over the country (Vaizey, 1966). Vaizey's view is typical of those educators and economists who have recourse to opinions based on experience or on their own philosophy of education. There are few research findings to back up such views. Incidentally, since Scottish secondary schools are larger (on the average) than English secondary schools, practice and tradition may lead Scottish educators to propose 1000 as the "right" size.

PART II

Research Findings

Introduction

What follows now is a discussion of the results of some statistical investigations of the data gathered in connection with the S.E.C.P. There are two major divisions:

(a) Primary Schools; we consider economies of scale in individual primary schools for the year 1964/5. There are 74 primary schools in all, drawn from Area A and Area B (see Chapter 2 for details of choice of areas and Chapter 3, part III, for details of how the unit outlays were derived). Four statistical treatments of the data are given:

1. All 74 schools, relationship between log values of unit outlays and log values of roll.
2. For schools with fewer than 80 pupils, direct relationship of unit outlay and roll; similar investigation for schools with more than 80 pupils.
3. For schools with fewer than 80 pupils, relationship between unit outlay and the reciprocal of roll; similar investigation for schools with more than 80 pupils.
4. All 74 schools, relationship between unit outlay and pupil-teacher ratio.

(b) Secondary Schools; we consider economies of scale in individual secondary schools for the year 1964/5. There are two samples of schools; one sample of 23 from Scottish Education Authorities, Area A and Area B, Area C and Area F; and another sample of 18 Scottish Grant-Aided Schools. The two statistical treatments of the data given are as follows: 1./

1. For both samples, the relationship of total cost and roll.
2. For the sample of 23, the relationship of unit outlay to pupil/ teacher ratio.

RESULTS AND DISCUSSION OF S.E.C.P. INVESTIGATION

(a) Primary Schools

Primary schools in Scotland can have rolls ranging from 2 or 3 pupils, these schools being mostly in the remote Highland areas, to over 600 or more pupils. Official policy now tends towards the two stream primary, that is two classes in each of the seven years of primary schooling giving 14 classes in all. This size of school will generally have between 420 and 560 pupils, depending upon whether the pupil/teacher ratio is 30:1 or 40:1. In rural areas the centralisation plan has led to many one teacher schools being closed and the creation of three teacher units serving infant, junior and senior primary pupils. The Schools (Scotland) Code, recognising the difficulty of teaching pupils of varying ages in one class, sets down certain maxima for classes in rural areas, for specific requirements see Appendix 5/A. Special schooling difficulties in rural areas are connected with the staffing problem and the demographic mobility. "Remote" payments to teachers are in fact part of the Scottish set-up to encourage teachers to go to remote schools. The high mobility of some sectors of the rural population further complicates the staffing of small schools by causing the rolls of these schools to fluctuate. Thus, the removal of a family of six children from a 2 teacher school might result in the pupil-teacher ratio falling below the maximum stated for a single-teacher school. The education authority has then to decide whether to transfer one of the two teachers to a school with a vacancy or allow the school to remain well staffed. If the former course is taken, (a) the roll might rise in the next term, perhaps above the limit for a one teacher school (b) the teacher may not want to be transferred and may leave the authority's staff. A constraining factor in such decision-making is the immobility of married women teachers (who form about 30% of the rural Area A staff).

It is not surprising then that in the present study a wide variation in the outlays of the rural schools was found. Out of 54 schools havang one, two or three teachers, the range of per pupil Total Outlays was £51 - £152 [3]. The pupil-teacher ratios relating to these costs were 23.1 and 14 respectively. The clear influence of size on unit outlays is evident in Figure 5.4 which shows the relationship of Teachers' Salaries per pupil and the roll of the school. The mathematical relationship is exponential, that is to say, for increasing size of school the drecrease of per pupil outlay becomes less and less.

Roughly speaking, for schools with rolls up to 80 pupils there are considerable ranges of outlays and considerable economies of scale, whereas schools with rolls of more than 80 pupils do not show the same range of per pupil outlays, nor do they have the marked variation due to size. The shape of the curve relating the per pupil Total Outlays to the size of the schools is rather similar to that of Fig 5.4 The Salary element in the total outlay is so great (about 75%) that the shape of the curve of the second relationship is determined almost wholly by the Teachers' Salaries element. (In an attempt to relate the per pupil outlays of the other running expenses and the size of the school, no discernible relationship could be found).

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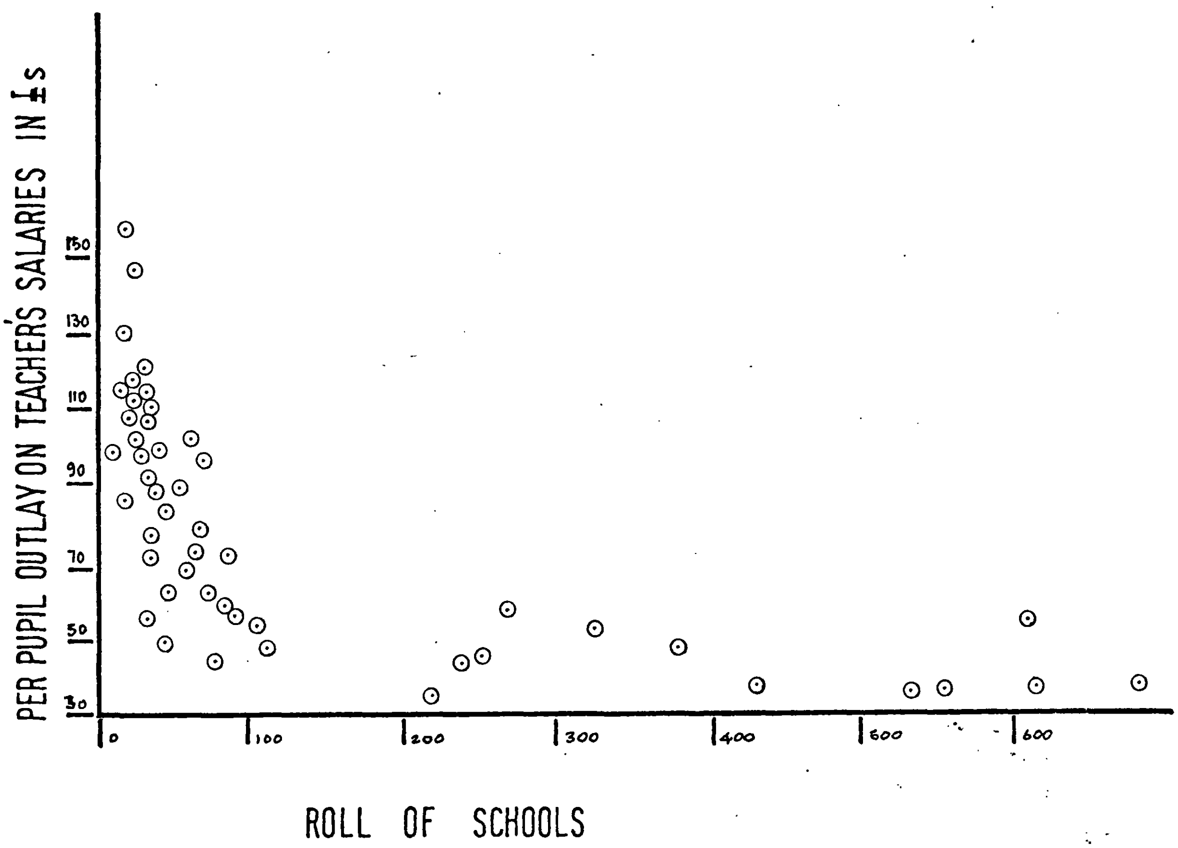
[3]

Per pupil total outlays were found by dividing total allocable expenditure on each school by the roll of the school.

Fig 5.4

Fig 5.4

Scatter Diagram Showing Relationship Between Per Pupil Outlays on Teachers' Salaries and Roll.



All Primary Schools : A Linear Relationship

The data shown in Figure 5.4 was replotted on double log paper and found to fit a linear relationship suggesting that the form of the mathematical function was:

$\log Y_c = - b \log X + a$

where Y_c is the per pupil outlay on Teachers' Salaries,

X is the roll of the school i.e. a number of pupils,

a and b are constants, b being the regression coefficient.

The log values of the original observations were taken and the exact form of relationship, calculated by linear regression analysis, was derived as -

$\log Y_c = - 0.2624 \log X + 2.2418, r = - 0.8568$ (equation 5.4)

A similar equation was computed relating the per pupil total outlays and size of school. It was found to be -

$\log Y^*_c = - 0.2659 \log X + 2.3511, r = - 0.8809$ (equation 5.5)

where Y^*_c is the per pupil Total Outlay.

The regression coefficients are both highly significant and the values of the correlation coefficients are also high. Since the square of the correlation coefficient gives the proportion of the variability of the dependent variable (Y_c or Y^*_c) which can be explained by the relationship between the dependent variable and independent variable (X), the value of r^2 is of great interest. r^2 for equation 5.4 is 0.7341, and for equation 5.5, 0.7760, from which we can conclude that 73.41% of the variability of the per pupil outlays on Teachers' Salaries is accounted for by the relationship between the per pupil outlays and the roll of school, and that 77.60% of the variability of the per pupil Total Outlays is explained by the relationship between the per pupil Total Outlays and roll of school.

Regression Techniques.

A comment on the application of regression equations would be in order here. Regression equations have a predictive value. But that is not to say that one can forecast accurately from such equations. Rather one can say that if X, "roll" in the present series of equations, has a certain value, then according to the regression equations, the value of Y_c which can be associated with this value of X will be such and such. The value of Y_c associated with X will be a mean value, that is the value which, on the average, will be associated with X. An example will help to clarify this point. Supposing that the size of a school is 500 pupils, then, substituting 500 in the equations 5.4 and 5.5 it is possible to calculate what are termed the 95% prediction limits. These turn out to be for equation 5.4 £16,475 and £17,695 and mean that we can be 95% certain that the total of Teachers' Salaries for a school of roll 500 will lie between £16,475 and £17,695. These figures refer to 1964/5, so than any "predictions" made on the basis of these equations for future years would have to be inflated by some teachers' salaries price index for equation 5.4 and general education price index for equation 5.5 [4].

"Small" and "Large" Schools

The form of the scatter diagram, Figure 5.4 suggested that the 74 observations could be divided into two groups. First, those containing schools of size 80 and less ('small' schools), and secondly, those of size 81 and over ('large' schools). For the former group of 50 schools the regression equations 5.6 and 5.7 were calculated.

'Small' Schools : Y_c = per pupil outlay on Teachers' Salaries

Y^*_c = per pupil Total Outlay.

$$Y_c = -0.5741X + 93.9744 \quad (r = -0.6164) \quad \text{(equation 5.6)}$$

$$Y^*_c = -0.75X + 119.74 \quad (r = -0.65) \quad \text{(equation 5.7)}$$

[4] Both equations generate values of the per pupil outlays, which when multiplied by 500 give the total outlays. The 95% prediction limits are for equation 5.4 £32.95 and £35.39; for equation 5.5, £40.91 and £44.07.

The correlation coefficients are both significant and the values are such that 38% of the variability in the per pupil outlays on Teachers' Salaries can be accounted for by the relationship between Y_c and roll; and that 42% of the variability in per pupil total outlays can be accounted for by the relationship between per pupil Total Outlays and roll of the school.

For the latter group of 24 schools the equations are as follows:
'Large' Schools: Y_c, Y^*_c as before.

$Y_c = -0.02X + 46.73 \ (r = -0.61)$ (equation 5.8)

$Y^*_c = -0.03X + 60.94 \ (r = -0.75)$ (equation 5.9)

In this case both correlation coefficients are significant and 37% of the variability in per pupil outlays on Teachers' Salaries can be accounted for by the relationship between per pupil outlays on Teachers' Salaries and the size of school, whereas 56% of the variability in per pupil Total Outlays is accounted for by the relationship between per pupil Total Outlays and the size of school. The substantial drop in the value of the correlation coefficient relating to the pairs of variables in these equations (5.6,5.7,5.8 and 5.9) compared with those pairs of variables in the first two 5.4 and 5.5, is due to assuming a linear relationship between per pupil outlays and size in the case of the equations 5.6,5.7 5.8 and 5.9 [5].

By the method shown in Appendix 5/B, the diagram (Fig 5.5) was compiled. It illustrates the influence of size on unit costs. What it means is that the regression analysis treating cost per pupil as the dependent variable, suggests that doubling the roll of the school (see p = 2) is associated with reducing the unit costs by 17%.

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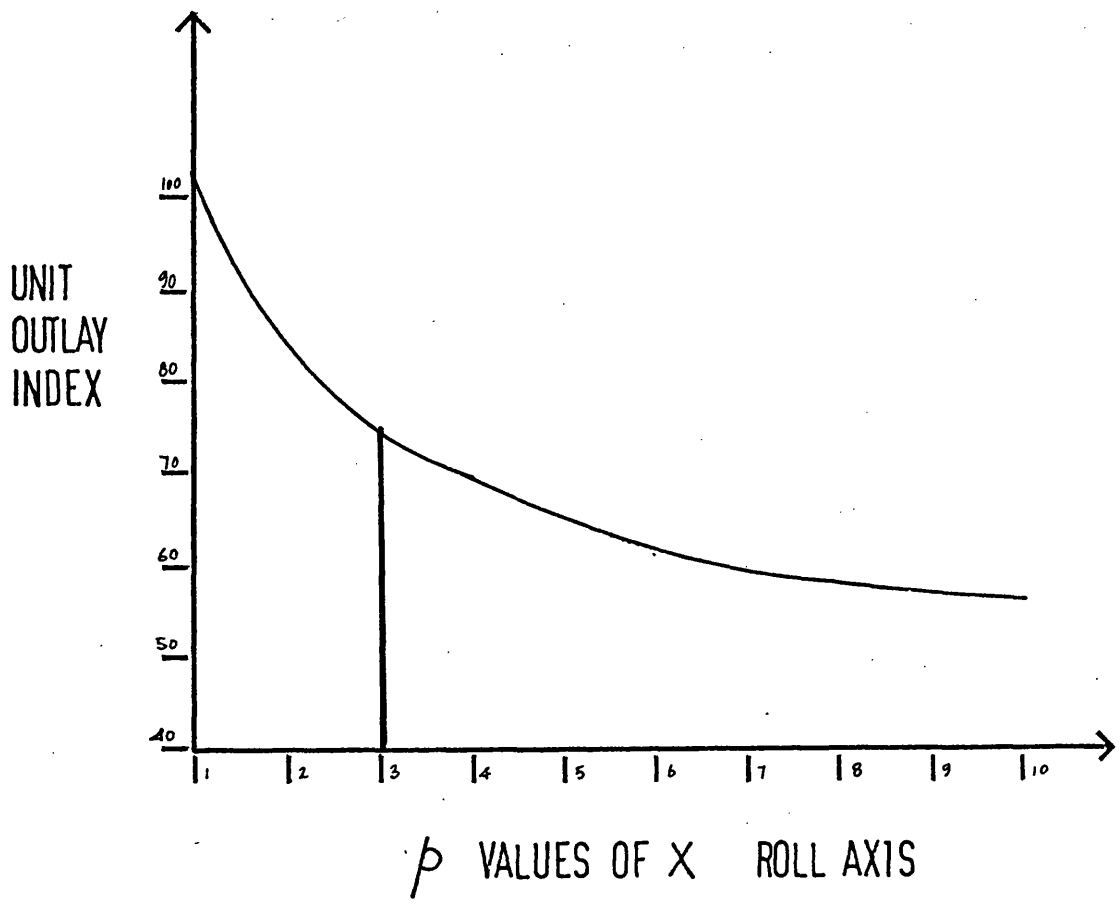
[5] The division of primary schools into 'Small' and 'Large' at roll 80 is not so much <u>arbitrary</u> as <u>empirical</u>. In the sample of 74 schools there is a gap in the observations between 100 and 200 after which point, the 'curve', see Fig 5.4 flattens out. From inspection it seems valid to include the few observations just below 100 as part of the 'Large' schools i.e. those observations on the flat part of the curve. The division at size 80 fulfils this 'restriction' and also limits the 'Small' schools to those with 3 or fewer teachers.

Fig 5.5

Fig 5.5

Relationship Of Unit Outlay To Size (Primaries)



[This is so whether one considers Teachers' Salaries per pupil or Total Outlay per pupil]. Alternatively, one may construe that given two schools, one of which is six times the size of the other, the smaller one may be expected to have unit costs roughly 40% lower than that of the larger one. The lack of observations of schools of rolls greater than 100 makes both equations 5.4 and 5.5 somewhat suspect for 'large' schools.

As already mentioned, the assumption behind equations 5.6, 5.7 5.8 and 5.9 is that there exists a linear relationship between per pupil outlays and roll. As a way of checking the assumption, the relationship between unit costs and the <u>reciprocal</u> of size (number of pupils on roll) is investigated. The form of the equation connecting unit outlays on Teachers' Salaries and the reciprocal of the school roll is as follows for 'Small' schools.

$$Y_c = 752.4090 \frac{1}{X} + 46.1266; \quad 0 < X \leqslant 80 \quad (r = 0.7260) \text{ (equation 5.10)}$$

That a linear relationship does exist between unit costs and the reciprocal of roll implies that the functional relationship between unit costs and roll is <u>not</u> linear.Fig 5.6 shows that between unit costs and roll there is an exponential decay type relationship. Since the value of r (0.7260) [6] is greater between Y and $\frac{1}{X}$ than that between Y and X (0.6164) we may conclude that for ' Small' schools <u>the best fitting function for unit costs and school roll is a shallow curve</u>. The curve in Fig 5.6 shows that for very small schools (say, less than 30 pupils) unit costs of Teachers' Salaries may range from £70 - £120; while for schools of around 60 to 80 pupils the range is much smaller (£56 - £59). Putting that another way, the difference in unit costs for two schools rolls 20 and 30 is roughly 17% whereas for schools of rolls 60 and 70 the difference is only 3½%.

The corresponding equation for 'large' primaries is

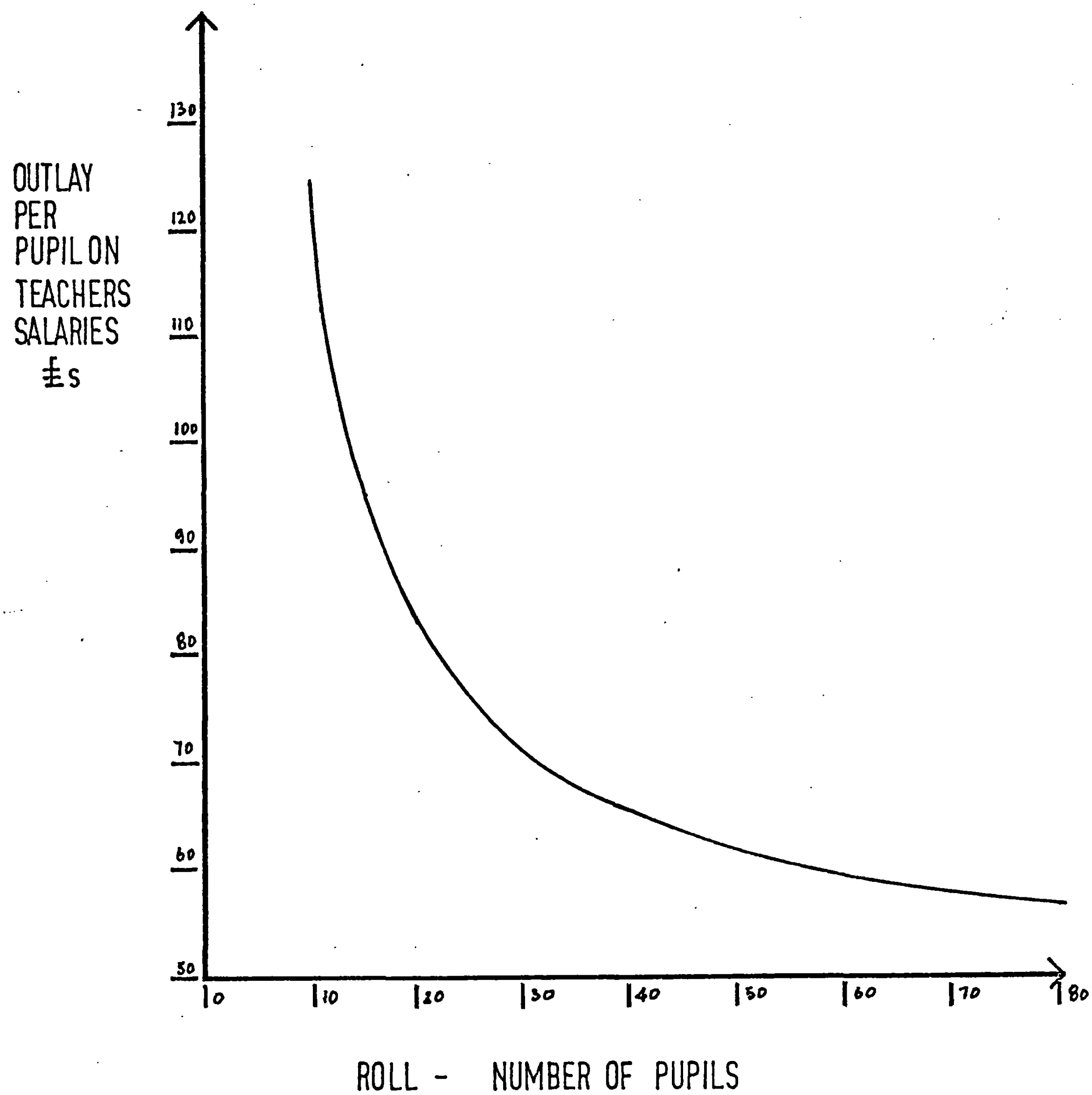
$$Y = 0.1196 \; 10^4 \frac{1}{X} + 34.5313; \quad X \geqslant 81 \quad (r = 0.5769) \text{ (equation 5.11)}$$

[6] The numerical values of correlation coefficients are being compared

Fig 5.6

Fig 5.6

Relationship Of Outlay Per Pupil On Teachers' Salaries To Roll
'Small' Schools 64/5



source: appendix 5/C.

Fig 5.7 Fig 5.7

Relationship Of Outlay Per Pupil On Teachers' Salaries To Roll

"Large" schools 64/5

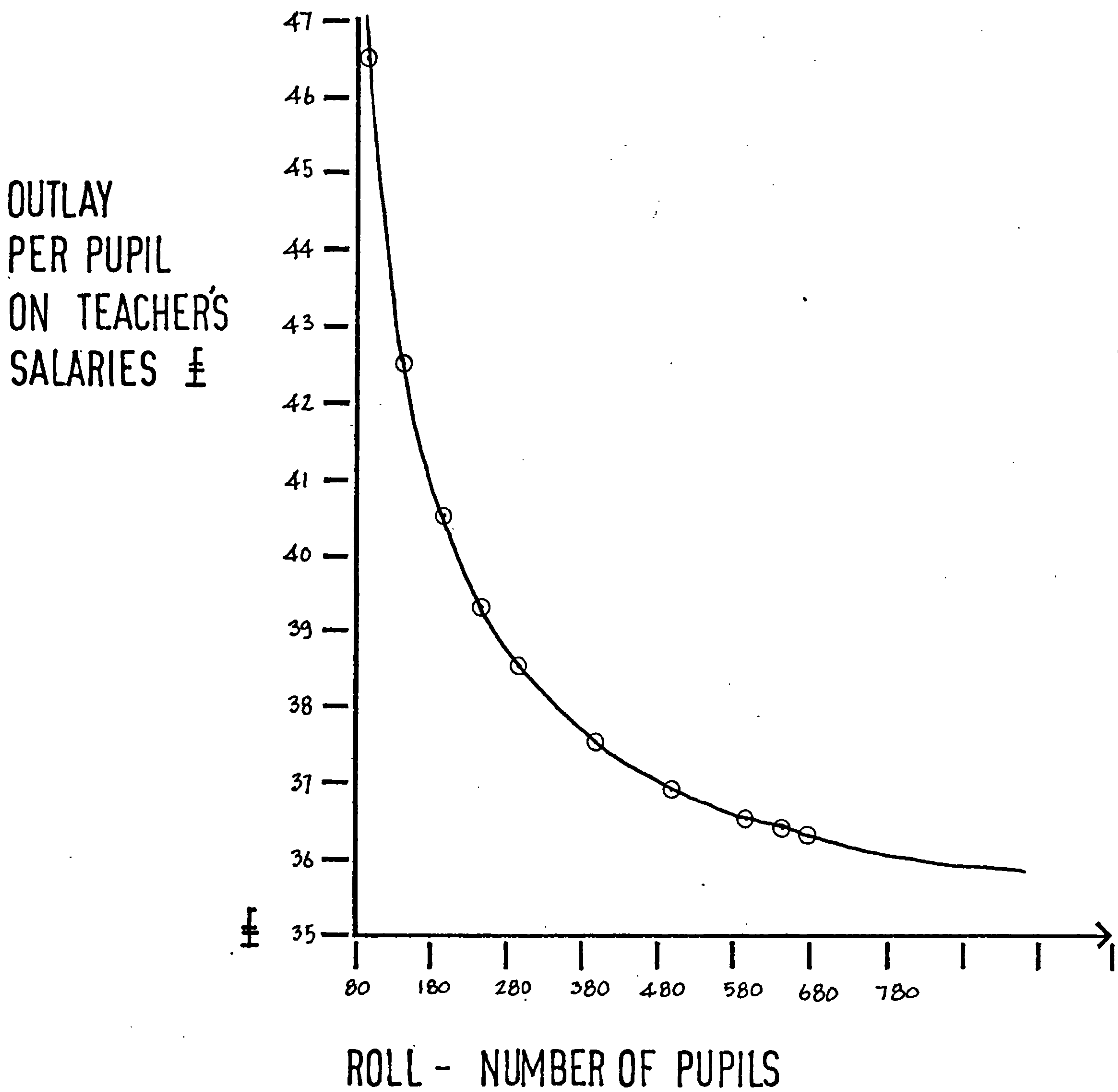


Fig 5.7 shows the "decay-type" curve for 'large' schools. In contrast with the relationship computed for 'small' schools, the correlation coefficient for the relationship between Y and $\frac{1}{X}$ (0.5719) is less than that between Y and X (0.61). We conclude that the linear function between unit costs and school roll for large schools fits marginally better.

These diagrams 5.6 and 5.7 and their related unit cost equations, are rather more easily interpreted than the unit outlay equations in log form i.e. Equations 5.4 and 5.5. Their usefulness is in being able to read off directly the unit cost for any particular size of school.

Unit Costs Related To Pupil/Teacher Ratios

The pupil/teacher ratio, P.T.R., is a critical measure of the use of staffing resources. For primary schools the P.T.R. is best thought of as the average size of class in a school. One would predict that schools with low P.T.R.s would have higher outlays than those with high P.T.R.s. However, the P.T.R. is only one of the variables determining the recurrent cost of a school. Adventitious factors such as the age and qualifications mix of the teachers come into play. A startling example of this was found in two very similar primary schools which had the same roll and yet had unit outlays on Teachers' Salaries of £47.5 and £71.8 respectively. In this case it was not the P.T.R.s (which were the same), but older and better qualified teachers in one of the schools which caused the disparity in the unit outlays.

A scatter diagram of per pupil outlays against P.T.R.s in the 74 schools revealed a roughly linear relationship for P.T.R. values between 20 and 30. In the range below 20 and above 30, the relationship was less clear. Regression equations were computed for the per pupil outlay on Teachers' Salaries related to the P.T.R. over the whole range of values of P.T.R, equation 5.12, and the per pupil Total Outlays related to the P.T.R., equation 5.13.

These turned out to be -

$$Y_c = -2.6170X + 122.29 \quad (r = -0.8317) \quad \text{(Equation 5.12)}$$
$$Y^*_c = -3.27X + 153.83 \quad (r = -0.83) \quad \text{(Equation 5.13)}$$

Both correlation coefficients are highly significant; in both cases 69% of the variability in per pupil outlays can be accounted for by the relationship between the per pupil outlays and P.T.R.

P.T.R. is, however, not only related to the overall roll of a school but also to policy decisions of education authorities, as well as to such constraining factors as the Schools (Scotland) Code and teacher supply. These equations 5.12 and 5.13 might be useful for planning exercises in which there was an interest in the effects of adopting different assumptions on the 'correct' level of staff resources. Equation 5.12 indicates that for an increase of one unit of pupil-teacher ratio the per pupil outlay on Teachers' Salaries decreases by 2.6170 units. This apparently arid fact will surely be of interest to those educationists who campaign for a reduction of class size. Equations 5.12 and 5.13 show just how sensitive unit costs are to changes in the P.T.R. At a time, like the present, when there is both an absolute shortage and a poor distribution of secondary teachers in the U.K., there is no possibility of significant reductions in class size. But, the time is not far off when in Scotland there will be a surplus of primaryschool teachers. To reduce the size of classes in the primary schools may increase the 'quality' of teaching. It certainly will increase unit outlays. Equation 5.13 shows that for a fall of one unit of P.T.R., the per pupil total outlays will rise by £3.27. Are we as a nation prepared to cut hospital building or road extension or slum clearance or abandon our aid to Developing countries (or raise more finance through taxation) to finance the lowering of the P.T.R.?

The P.T.R. is reasonably thought of as the class size in primaries where the ancient tradition of one teacher per box, per group of 'thirty' pupils still applies. No such facile interpretation of the P.T.R. can be given in secondary education which has a fundamentally more complex organisation.

(b) SECONDARY SCHOOLS

The movement to comprehensivisation has gone hand-in-hand with an increase in the average size of secondary schools. Often additional justification for a social policy, namely to abolish selection for secondary school, has been that such a policy would result in a more economic organisation. An almost widespread policy of co-education has meant that Scotland has had, on the average, larger secondary schools than England. Yet the pressure to build still larger schools has been felt even here. What are the savings in outlays of very large schools? How large is large?

Compared with a study of costs and rolls in primary schools, an investigation in secondary schools is made more difficult by the following factors: 1) There are fewer secondary schools to choose from because a) the schools tend to be larger b) fewer children are in attendance over the country; consequently, more education authority areas must be taken into the sample and this means more accounting and record keeping systems must be investigated. 2) School for school, secondary schools are more complex in their internal organisation, mainly because of the diversified curriculum. Even two senior secondary (grammar) schools of a similar size can have quite dissimilar courses. Certainly, there is little similarity in the curricular offerings at three year junior secondaries, a type of school rapidly disappearing, and the traditionally academic, senior secondary departments. Taking 'quality' in its descriptive rather than evaluative sense, it is clearly in doubt just how legitimate is a comparison of the costs of different schools which are known to vary in 'quality'. The study of the costs of secondary schools is entered warily.

Total Outlay And Roll

The relationship between total outlay on Teachers' Salaries and the roll of secondary departments was investigated for twenty-three schools drawn from four Scottish education authorities [7]. The scatter diagram of the twenty-three pairs of observations indicated a roughly linear relationship, the precise nature of which was determined by linear regression analysis. Equation 5.14 expresses the relationship

$Y_c = 80.46X + 554.33$ $(r = 0.90)$ (Equation 5.14)

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[7] Teachers' Salaries are definable quantities. The term is used throughout to indicate the sum of expenditures made by an authority in respect of each teacher; normally this includes salary, employers' national insurance, employers' portion of superannuation, employers' graduated pension payments. Running costs or other current expenditures are not so clearly defined. The data on secondary schools, being collected from a number of different education authorities and Grant-Aided schools, was more likely to be comparable if Teacher Salaries and not Running Costs were considered. An additional reason for basing the observations of secondary schools on Teachers' Salaries was the large number of secondary schools which had shared facilities, and therefore joint costs, with primary departments.

where Y_c is the computed value of the outlay on Teachers' Salaries in units of 10£, X is the size of the school in units of 10 pupils.

The highly significant value of the correlation coefficient shows that 81% of the variability in outlays can be explained by the relationship between Y_c and X. The size of the correlation coefficient, indicating just how much outlays depend on the size of the school is a little surprising. Secondary schools, unlike primary schools, are far from homogeneous in respect of the amount (in years) and type of education they offer. The group of twenty-three secondary schools did, in fact, contain 3 - year and 4- year and 6 - year schools. One might have expected the heterogeneity of the schools to interfere much more with the relationship between outlay and size and so lower the numerical value of the correlation coefficient.

The standard error of the estimate of $Y(S_y(e))$ for the function of 5.14 is large, 1393.9. The significance of this statistic is more readily understood by calculating the 95% prediction limits, the statistical expression for which involves the $S_Y(e)$ as one of the product of three terms. [The higher the $S_Y(e)$, the broader will be the limits of the prediction for any particular size and for a particular number of degrees of freedom. In other words, a high value of $S_Y(e)$ usually implies that the value of a function (such as 5.14) as a predictive instrument is low]. For a school size of 50.0 units i.e. 500 pupils, the 95% prediction limits are £38,235 and £53,311. Thus, for a school of 500 pupils, we can be confident that the total salary bill for for any one year will be between £38,235 and £53,311 (at 1965 prices). Clearly the value of equation 5.14 is a little limited as a predictive instrument.

The validity (not to mention the reliability) of the basic regression equation 5.14 might well be challenged on the grounds than no attempt was made to ensure that all the schools were of the same 'quality'. Riew (1966) insists that it is futile to attempt an inquiry into size-cost relations without taking into account the variations in "educational programmes" (which might be translated in this country as the type of course, say academic or non- academic, being followed), and the variations in quality (whatever this might imply). In a search for a more homogeneous sample of schools, another look will be taken at

Maclennan's study of Scottish Grant-aided schools.

The writer adjusted [8] the raw data on which Maclennan (1967) worked by subtracting from the total outlay on Teachers' Salaries an amount, based on the appropriate regression equations constructed for primary schools, representing outlay on primary Teachers' Salaries. What remained, therefore, was the total outlay on secondary Teachers' Salaries for 18 secondary schools. All of these schools are 6-year secondary schools offering a broadly similar academic type of education. (It should not be taken from this that the more ponderable 'qualities' such as pupil-teacher ratio, proportion of honours graduates, proportion of more experienced staff are necessarily alike in these schools).
Equation 5.15 was derived from the 18 pairs of observations:

$Y_c = 105.09X + 1154.18$ ($r = 0.93$) (equation 5.15). Once again Y_c is the computed value of the outlay on Teachers' Salaries in units of 10£, X is the roll of the school in units of 10 pupils.

86% of the variability in outlays can be explained by the relationship between Y_c and X. The standard error of the estimate of Y ($S_Y(e)$) is a little lower than for the equation 5.14, having a value of 1086.6. The 95% prediction limits will be correspondingly less and the equation 5.15 could be regarded as a better predictive instrument than equation 5.14.

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[8] The data available on grant-aided schools consists of total Salary Expenditure and rolls of primary and secondary departments. An estimate of the expenditure on Teachers' Salaries in secondary schools was obtained by subtracting from the Total Salary Expenditure an amount representing expenditure on Teachers' Salaries in the primary departments. This latter quantity is the product of the number of primary pupils and <u>predicted unit cost</u> for that size of school. The predicted unit costs are found by applying regression equation 5.4.

These equations relating <u>total</u> expenditure on Teachers' Salaries to size of school are not terribly useful because;
a) they are subject to a considerable range of error if used as predictive instruments; b) no indication can be obtained of the point (in the roll axis) at which unit costs drop off more slowly for increasing size. A direct plot of unit cost against size reveals no mathematical relationship, whether one takes the sample of 23 education authority schools or 18 G.A. schools. Further attempts to find a mathematical relationship between unit cost and roll were made by plotting these sets of observations on log 3 cycle x inch paper (testing to see if there is any relationship of form log Y = bx + a or Y = b log X + a) and on log 1 cycle x 1 cycle paper (testing to see if there is any relationship of form log Y = b log X + a). No discernible relationships could be found. These negative results of investigations are valuable in that they confirm that costs in secondary schools are rather more complex than in primary schools and suggest that any future work on costs of secondary schools must probe deeper into the internal organisation of the schools, and/or ensure that the sample is composed of schools of the same 'quality' (if this can be quantified in terms of courses available, staff qualifications, size of classes etc.,). Suggestions for follow-up work are included in Chapter 8.

Unit Costs And Pupil/Teacher Ratios

On account of the dissimilar patterns of education offered in the various secondary departments one would not anticipate a particularly strong relationship between unit costs and the P.T.R. However, a scatter diagram of per pupil expenditures on Teachers' Salaries against P.T.R.s for 23 secondary departments revealed a roughly linear relationship. Regression of Teachers' Salaries per pupil (Y_c, dependent variable) on P.T.R. (X, independent variable) generated the following equation.
$Y_c = -4.5781X + 165.4063$ ($r = -0.7044$) (Equation 5.16).

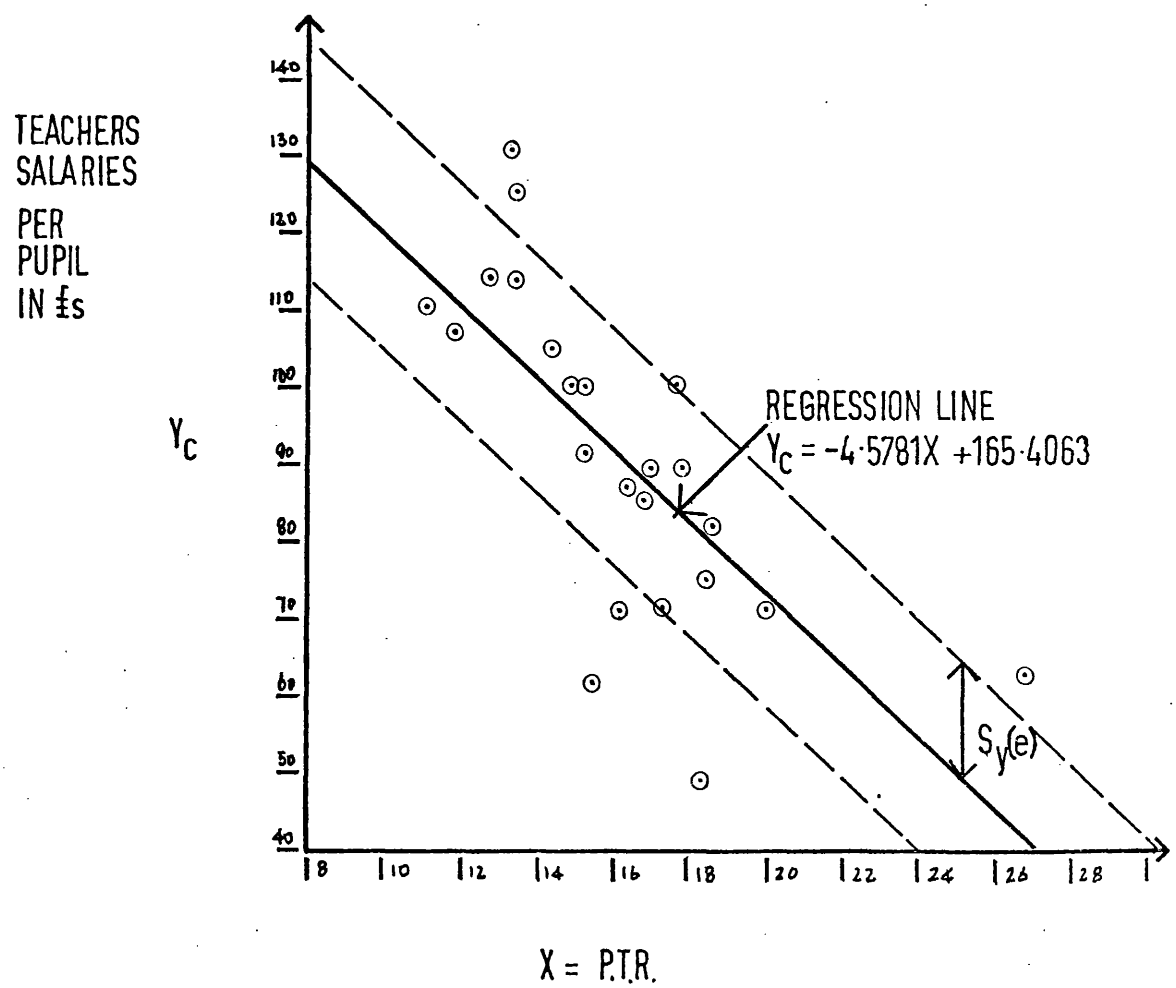
Both the regression and correlation coefficients are significant at the 0.01 level. The value of r^2 (0.4962) indicates that almost half ofthe variability in unit costs can be explained by the relationship between the per pupil expenditures on Teachers' Salaries and the P.T.R.. Parallel calculations for primary departments showed that 69% of the variability in unit costs could be explained by the unit costs -

P.T.R. Relationship. At least part of the decrease in the value of r(or r^2) can be ascribed to the more complex salary structure of secondary school staff and the heterogeneity of the 'sample' of 23 schools-some senior secondaries, some comprehensive schools, and some 3 year and 4 year secondary schools.

The above regression equation may be construed as the "best fitting" line for the 23 pairs of observations. As a consideration of Fig.5.8 shows, there are a few schools which are deviant in that their unit costs are wildly higher or lower than one would expect on the average. The broken lines on both sides of the regression line delimit the area covered by the standard error of estimate of Y_c i.e. $S_Y(e)$ = £15. This $S_Y(e)$ indicates the variability of the Y_c's about the line of regression.

Fig 5.8 Fig 5.8

Regression of Teachers' Salaries Per Pupil On P.T.R.



source: appendix 5/E

Briefly, what equation 5.16 means is that for an increase in P.T.R. of 1 unit costs decrease by about £4 10/-. As the report on Staffing In Secondary Schools has shown, there is no guarantee that a lower ratio of pupils to staff leads to an increase in the number of courses and subject options (S.E.D. 1969). Some headmasters (or timetables) manage to provide a range of courses on a P.T.R. of 20:1, that schools with a P.T.R. of 16:1 find impossible. Granted that the staffs of no two schools are equivalent in qualifications, age or temperament, there seems to be considerable opportunity for improving the use of present teacher resources.

Unit Staffing Costs Related to Size Of Class by Subject

Before leaving secondary schools it is appropriate to take a look at the possibilities of economies of scale within individual subject departments, the organisation of which has such a powerful influence on outlay on the school as was indicated in Chapter 4 Part III.

Fig 5.9 Fig 5.9

Relationship of Unit Staffing Outlay to Size of Class for Classics in 6 Secondary Schools

School	Outlay per pupil-period (for 1 year)	Index £4.38=100	Average Size of class	Index 1 = 100
A	£ 4.38	100	7.3	730
B	£ 5.09	116	5.7	570
C	£ 6.46	147	5.5	550
D	£ 9.00	205	1.5	150
E	£16.00	365	1.0	100
F	£29.59	675	1.0	100

Figure 5.9 shows unit outlays for one subject (Classics) for six schools and the relevant class sizes. Two points need attention.

(A) A fall in class size of 630% is accompanied by a rise in unit outlays of 575%.

(B) For a class of the same size (1 in this case), widely differing outlays can result from fortuitous circumstances of qualifications/experience of teacher, cf Schools E and F.

Normally, because of its minority appeal nowadays, in an account of the small teaching classes in Classics, the scale-of-operations factor is more obvious than in some other school subjects. Nevertheless, the example quoted does draw attention to the resources to be saved by having a 'viable' size of teaching unit. For instance, Classics' pupils in schools E and F might well have been transferred to one of the others so releasing the teachers for other work (provided that geographically this was possible). This simple step would have "saved" 1/3 of a teacher. Without drawing the absurd conclusion that 1/3 of a teacher might then have been employed in an area of shortage, the case in point does indicate what tightening of timetabling might mean to the staffing "shortage". Naturally, in a time of national shortage of teachers, no <u>money will be saved</u> on the re-allocation of a teacher. What is more likely to happen is that more can be done - in the way of teaching more children a particular subject - with the resources at hand. Briefly, the efficiency of the organisation of the educational system could be increased by attention to size of class within subject departments.

<u>Maintenance Costs and Size Of School</u>

The discussion of outlays on schools has been limited to the largest single expense head - Teachers' Salaries. Do other recurrent expenses e.g. heating, cleaning, repairs, educational equipment, text-books, auxiliary teaching staff show similar economies of scale?

Maintenance expenditure per pupil, including heating, lighting, cleaning and repairs is subject to several variables. It is worth while listing these here.

(A) Mode of heating; oil, coal, gas, electricity. If schools of different sizes [9] are to be compared, then the mode of heating should be the same, alternatively it should be explicitly taken into account.

(B)/

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[9] The unit in which heating costs are most appropriately compared is sq.ft. and not pupils. Thus 'size' is the total sq.ft. of the building and the not the roll.

(B) Area per pupil. This is closely tied to the age of the school (the older the school, the less the space per pupil). In general, the greater the area per pupil, the greater the heating outlays per pupil and repairs and maintenance outlays per pupil.

(C) Cleaning procedures. Outlays on cleaning will depend on (B) to some extent. In addition, where machines have replaced some of the human cleaners, some savings in labour costs should be evident.

(D) Use by outside bodies. Schools which are intensively used outside school hours may have higher maintenance outlays due to e.g. double cleaning, additional wear and tear on property, lighting. Normally some heating would be maintained after hours whether or not facilities were being used so that additional heating outlays may be less significant. Unless a policy of allocation of these joint cost outlays between school time and non-school, say Adult Education, time is adopted by the authority, then all of the additional outlays will be absorbed in the school accounts. Some income is received from these outside lets.

(E) Numbers of pupils. A school with a roll lower than full capacity will probably incur those outlays which are appropriate to the maximum roll. Unit outlays (per pupil) on maintenance will be higher than if the same school were completely occupied. A more common situation at the moment is the school which is over-crowded and thus will have lower unit outlays (per pupil) on maintenance than if it had only the "maximum" roll.

In short, maintenance expenditure, M, depends on at least 5 variables in a complex fashion, expressed mathematically as -

M = f(A.B.C.D.E.Z.) (Equation 5.17)

where A.B.C.D.E. are as above and Z is an additional variable introduced to take account of other factors including possible regional variations in price.

No attempt was made to gather all the various pieces of information necessary to express the model equation 5.17 in an explicit form. For a secondary school (roll 560) the outlay per pupil on Janitors'/Cleaners' Wages was £7.20, while for a school (roll 1100) it was £6.01. No substantial economies of scale are evident for secondary departments.

In Chapter 3 Report 5, economies of scale in primaries were observed for Repairs, and Janitors'/Cleaners" Wages also show some variation with size. In one and two teacher primaries these were £4.43 per pupil; in One Stream or 'Viable' primaries they were £3.27 per pupil; in Two Stream Primaries, £3.71 per pupil; and in large Three Stream Primaries they were £2.98 per pupil /Appendix 3A/.

Employment of non-teaching staff in secondary school - secretarial help, laboratory technicians, auxiliary teachers - has been increasing since the early 1960's. Authorities often link their policy of appointment to these posts to the size and type of school, e.g. a policy of 1 lab technician to every 6 science staff will mean that schools with less than 6 science staff may have zero unit outlay on lab technicians. Secretarial help was found in all the secondary schools studied. Outlay per pupil on wages of secretarial help varied from £0.96 (roll 560) to £0.60 (roll 1100). Nothing other than the order of magnitude of such expenditures can be drawn from these figures.

Most Scottish authorities have adopted a per capita allocation system for textbooks and other minor items of educational expenditure. Higher per capita quotas are given in respect of older pupils and, in one authority, in respect of pupils following academic courses. They vary considerably between authorities perhaps because this is one area where control of outlays lies in local hands. However, all equipment does not come from the per capita quota system. Durable and expensive items - say over £25 - are more likely to be allocated separately. Since no stock of educational equipment and apparatus is required to be taken by individual schools, no evidence could be obtained regarding the stock of these durable items. It is the writer's impression that education authorities have a policy - conscious or otherwise - of supplying proportionally more major items of educational equipment to large schools than to small schools. The basis for this policy may be on the dual assumptions that, in small schools, equipment will be used less often, and that it is better used in large schools. An extreme case is the provision of a swimming pool (capital expenditure but incurring current outlays) at large schools but not at small ones.

Presumably, the smaller school would not make 'good' use of it. Only tentative observations of this type can be made in this area of expenditure. One possible inference is that large schools may provide a wider and "better" educational service than small schools. Higher unit outlays in some areas of expenditure in the former are then explicable.

Economies of Scale in Administrative Units

The question of unit outlays in the administrative unit, e.g. education authority, school district, geographical area, is pursued at length in Chapter 3. The evidence on economies of scale in individual schools presented in this chapter enables us to probe more deeply the disparity in unit outlays found in different administrative units.

Small units with a dispersed population tend to have numerous small schools. If such a unit offers an educational service equivalent to that of a larger unit, the unit outlays will inevitably be higher. In the more expensive sector of secondary education, unit outlays in these rural areas will be extremely high, since small districts often cannot have a school of an 'efficient' size because of the demographic nature of the area or the unwillingness of local communities to send their young people long distances to school. In a country which operates a centrally financed system of education the 'cost' of having these small and 'inefficient' districts is not shouldered locally but is spread over the nation. The present Rate Support Grant system operated in U.K. is weighted to help those areas where unit outlays are high because of demographic or demographic-geographic reasons.

But it is not just the remote corners of this island where administrative units are too small; Vaizey (1968) has dismissed the outer London Boroughs as being too small. The impending re-organisation of administrative units in U.K. will reduce the number of L.E.A.'s in England and Wales and E.A.'s in Scotland by between 40 and 60%. This step should give the opportunity of reducing administrative overheads, of removing some transfer payments between authorities, and of re-zoning some catchment areas so that larger schools are possible, thus allowing, we hope, unit outlays to be reduced.

Conclusions

This aspect of the study of educational costs has aimed at deriving statistical means to help decision makers plan the sizes of their schools. It is apt that the conclusions should, at least partly, take the form of illustrative exercises using the research findings.

Planning Exercises

Primary Schools - Centralisation problem

Consider the situation in which there are three village schools of eighteen pupils in each, all within three miles of a stretch of main road. Ignoring the educational and social facets of the problem, what economies can be expected on centralisation in one building of all three schools? The exercise must be further simplified by assuming that all three single teacher schools are due to be replaced and that the question is one of the current outlays on one new school compared with those on three new schools. Further reduction of the problem entails ignoring any transport expenditures which might, because of the organisation, devolve on the authority and not the parents. Also capital costs are ignored in this example.

Fig 5.5 shows how, on the basis of equation 5.5 economies of scale can be effected by increasing the size of school. For a school three times the size of another, we see that the unit outlay in the larger school is in the region of 75% of that in smaller schools. This results from a combination of factors.

I. Larger schools have, in general, larger classes. This factor is more important when the class size is approaching the legal maximum. In a larger school it is possible to absorb more pupils, without requiring an additional teacher.

II. One teacher schools tend to be staffed by better paid teachers - due to both qualifications and experience. A three teacher school may have a spread of both qualifications and experience.

III. One school requires only one responsibility payment for the head teacher; three schools require three such payments.

It is suggested then, other things being equal, that centralisation of the present 3 schools into one would result in a saving of 25% in current outlays each year. On the basis of present numbers, (3x18=54), of course, there is unlikely to be vast savings. But with the maximum class size of 35 in a 3-teacher school (See Appendix 5/A) possible savings are considerable. The point of this reminder is that planning is, of necessity, related to the future, and educational planning must be allied to demography if it is to work. In the exercise above, it should be clear that in the case of re-organisation of schools the nature of the school population in the coming years must be studied before deciding on size and siting of school.

Pupil-teacher ratio problem

What are the implications for per pupil outlays if the size of class in a primary school were to be reduced from, say, 30 to 25?

This boils down to calculating the unit outlays by equation 5.13 relating unit outlays to P.T.R.

$$Y^*_c = -3.27X + 153.83 \text{ (Equation 5.13)}$$

where Y^*_c is per pupil outlay on Total Current Expenditure (unit Current Outlay), X is the P.T.R.

When $X = 30$; $Y^*_c = £55.73$ and when

$X = 25$; $Y^*_c = £72.08$. At 1965 prices.

The lower size of class means that the unit current outlay would be increased to 129% of its old level. Calculations of this simple type bring sharply into focus the implications of the demand to lower class size. Not only are more teachers required (unless there is a fall off in school population) but further demands are placed on national resources in terms of % of G.N.P. for education. Some sceptics may ask if the benefits from the reduction of class size are 129% or more of their old level ! Are such questions really inappropriate? Anticipating the discussion of costs and quality in Chapter 7, questions regarding costs and benefits in education have two strands; first, can the costs of a policy or programme be identified? The straightforward answer to this is that they can provided detailed cost data is available. Secondly, can the objectives of such a policy be stated in such a way as to generate valid measures of attainment? It is at this second question that we become stuck and we shall have to take this up in the final paragraphs to this present chapter.

Summary

A summary of the research findings is as follows:

1) For primary schools, there were found quantifiable relationships between unit outlays on Teachers' Salaries and unit outlays on Total Costs on the one hand and the school roll and pupil-teacher ratio on the other.

2) For primary schools, the relationship between the two unit costs and roll was a decay-type curve, covering a sample of schools between roll 10 and 650 pupils.

3) For primary schools, two best-fit lines can be computed one for each of 'Small' and 'Large' schools, using unit cost and roll data.

4) For primary schools, a further two best-fit lines can be computed one for each of 'Small' and 'Large' schools using unit cost and reciprocal values of school roll data.

5) For secondary schools, there is no discernible mathematical relationship between per pupil outlays on Teachers' Salaries and school roll.

6) For secondary schools, a high degree of the variation in total costs can be ascribed to the relationship between total costs and roll.

7) For both primary and secondary schools, a linear relationship exists between unit costs and P.T.R.

This chapter has remained firmly rooted in attempts to quantify relationships between unit costs and roll. Nevertheless, there are other factors which must be weighed up, however difficult it may be to measure their importance against direct cost considerations. Many American school superintendents, in reply to the question: What size of school enrolment do you think is best?, replied that distance rather than roll should determine school size (Iwamoto, 1963). Such opinions are often prompted by the fact that the school is often the centre of social life in small communities. 'Small' rural schools within easy reach of many of the pupils are regarded by many people as also more appropriate for young children than larger schools to which travel might be arduous. Another question which arises in connection with secondary education mainly, concerns the leadership opportunities for pupils in schools of different sizes: These questions might have bearing on the economic and social vitality of local communities. More

directly,/

directly, what is the effect of centralising secondary schooling in rural areas on the life styles and aspirations of the school children? Fears that their village or town might die through lack of young people are very real to Highland communities faced with closure of <u>their</u> local secondary department.

The issues raised in the above paragraph are merely indicators of wide social implications (which may or may not have costs) of school planning. There is more to planning the size of a school than obtaining the 'best' education for the children at least direct cost. A little planned inefficiency may well be necessary to take account of local conditions.

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CHAPTER 6

PLANNING, FORECASTING, PROJECTING

"........ we must not forget that investment and productivity are after all not ends in themselves, but means to a better and fuller life" (O.E.C.D., 1962)

INTRODUCTION

This Chapter might have had a sub-title "The Art of Crystal-ball Gazing".

To plan requires objectives, If these could be stated precisely enough, e.g., that all children born between 1/8/58 and 31/7/59 shall have an additional year of primary schooling, then the extra call on resources could be forecasted provided the relevant demographic, building, manpower, and cost statistics were available. Where educational aims are of a less exact nature, for instance, that all pupils who have the ability and inclination should be encouraged to remain at school beyond the statutory school leaving age, then, even if accurate statistics are available, some guess-work is necessary to forecast the resource needs and costs of such a programme. For, who knows in 1969 what the opportunity costs of schooling for a 17 year old youth will be in 5 years time? Who can say what the relative influences of peer group pressures, teachers, wage markets, on-the-job training will be in the future? Will the country be able to afford such a broad aim? Will there be sufficient teachers of the right quality to fulfil the aim? Will our standards of educational provision (e.g. the size of classes, the amount of space per pupil, the amount of recreational provision) be the same?

PART I - THE NEED FOR PLANNING

The Growth of Educational Spending

One element of the notion of planning is the assessment of future resource implications of current decisions by linking profiles of future conditions to budgeting data and programme objectives. [1]

Even if the methodology of this kind of planning or resource projection were completely established - and it is far from being so - the accuracy of the forecasts would be in doubt because of uncertainty about the future and the continuing rising standards of expectations. The standards of expectation which society sets as the minimum acceptable level in its social provision are often referred to as the <u>social minimum</u>. This notion arises from policy decisions of governments which are regarded as fundamental to the political and social life of the country.

The social minimum of education in U.K. has risen continuously since the war. In certain aspects - such as the financial support of students in tertiary education - it is higher than in other countries at a comparable stage of economic development. Now that the economy has been slowed down there is an increasing criticism of such a high level of social provision of education. More precisely, the rapid rate of growth of educational expenditure in U.K. (about 80% in real terms from 1959/60 - 1967/8), is now being regarded as too fast in comparison with our general rate of economic growth (Maclure, 1968). The pronouncements of Enoch Powell (Powell, 1969) and the philosophy in the Black Paper (Cox, 1969) take the line that these high expenditures are not giving "a fair return for money" anyway. While this latter point of criticism will be answered only when reliable and valid calculations of the relationship between education and economic growth are available, it is with the future rate of growth of educational expenditures that we must be concerned in the following argument.

An observer might be excused for being so naive as to ask why it is that since finance controls the "what can be done" in any economic activity [2], the educational system should have apparently run out of control. Retrospective economic analysis has led to the conclusion that, in the general growth process, education tends to attract an increasing share of total national resources (Harris, 1966).

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[1] Budgeting by programme is the specific allocation of resources for the support of instructional programs. More generally, programmes, according to Hartley (1968) are the activities of an organisation that are based on desired outcomes.

[2] This applies in a situation of plenty; that is where the human and material resources are available. If these latter are not available no finance can help in the short term.

Only right-wing elements would suggest today that cuts should be made in the real value of public educational spending. But the government policy of limiting growth of expenditure by education authorities (L.E.A.s in England and Wales) to 3½% per annum in real terms will be almost as difficult to bear and may lead to cuts in educational provision. The actual spenders of public moneys - the L.E.A. and E.A. - must adopt publicly acceptable strategies for "saving" money. While postponing the replacement of worn-out furniture will save money for one year, such measures are hardly more than stop-gap. Staffing, being the largest element in the total, is the most obvious place on which to save money; yet can authorities turn away teachers,many of whom have been trained at government expense and some of whom have been attracted to teaching by government schemes from other occupations? At this stage there will be presented a schema in terms of which the control of expenditure on Education may be discussed. The two systems or policies presented here are the polar positions. In actual systems some compromise operates and probably should always operate.

Control Schema

First,there is what we might call the central control system. By this is meant the allocation of national resources to services such as education for the short, medium and long term. In other words, the national cake would be sliced up for some years ahead, presumably on some grand development plan. Within each service, the total would then be allocated to various programmes. What could be done in educational terms - how many pupils could remain at school beyond 15, what % increase in salaries could be allowed, what number of university places could be set as the maximum - would then be determined by the total allocation to each particular programme. Such a system would require sharp instruments for selection of pupils and students, very full and reliable statistics and would put the onus for obtaining the most out of resources on the persons in charge of each programme budget. But the social minimum would be under control and held by the reins of finance.

Secondly, there is the self-control or internal momentum system. The general approach would be to allow the total expenditure to be controlled by the individual programmes. It would rely heavily on the ability of each budget maker to control growth of their own programmes, e.g., the further education sector should not demand more than its share of skilled manpower or take more than its share of expenditure. Briefly, this system would mean that expenditure would grow at a rate which would be the average of the rates of growth of the individual programmes. The social minimum would then be the result of a host of social, economic, political and educational pressures. Both forms of planning require decisions concerning the 'right' share of resources. While these will be taken at the top - by Government - in the central control system, they may fall to a much lower level of decision making under a self-control system. Although central Government has considerable influence on local educational decisions through statutory regulations, national agreements on salary scales and less clearly through circulars, memoranda and the inspectorate, situations may arise where local political pressure decides on the 'right' share of resources without regard to national plans, educational values or social need.

Comparing the polar policies it will be appreciated that the first policy lays emphasis on a grand overall plan while the second relies on what has been termed the social demand for education. Major decisions are made at government and ministry level in the first policy while responsibility for use of resources can spread well down the hierarchy. Adoption of the second policy leaves major decisions - especially for the medium and long term - to the forces of social demand, while responsibility is diffused (in a complex fashion) throughout the system. To illustrate these points, let us consider the problem of what should be the relative inputs to the three levels of education. While adoption of the first policy enables one to set inputs in relation to factors such as population growth, demand for manpower and the rising social minimum of education, the inputs to the three levels of education resulting from the second policy are largely the result of pressures from within the individual levels and may not be consistent or even compatible with manpower needs or overall economic plans. At present the unit costs of education in the three sectors in this country are roughly in the ratio of 1:2:10. (Richmond, 1969) The writer suggests that these relative levels of input are largely fortuitous and not the

the result of some overall guiding system which sets inputs per student to universities at ten times the level in primary and those in secondaries at twice the primary level. Some support for this premise is presented in the last part of this chapter.

This suggestion implies that the policy mode in this country is nearer to that of self-control than central control. In saying this, it is not meant to imply that the central control system is necessarily appropriate or desirable either politically or economically. But, if it is the case that planning is based more on a self-control policy, the process of planning and forecasting is made even more risky.

Forecasting, Planning

It really makes no sense to forecast educational resource requirements solely from the studies of past patterns of expenditure and resource utilisation. Such studies are unlikely to reveal the workings of educational or other policies, but rather might show trends of expenditure in relation to some factor such as population, a trend which was not "planned". Thus, an examination of unit costs in English County Boroughs for the years 1960 - 1968 shows that the ratio of unit costs in secondary to that in primary schools decreased as the ratio of the secondary to primary school populations increased. In making forecasts the question arises of whether a trend such as that should be "built-in" to future estimates or whether it should be purposely ignored and some other policy adopted(in the case in point a policy regarding the relative level of inputs to primary and secondary education). Perhaps, both sets of calculations should be done and the choice of method left to those who are in a position to affect national educational expenditure.

Planning: The Reasons

But why forecast? Why plan? The most direct answer is that there is general agreement that societies should aim at development and development (social and economic) requires planning. An additional reason why educational planning may be held to be necessary by society is that education is provided out of public expenditure. If the Government is to plan its expenditure relative to prospective national income trends, it must also plan educational spending. It is the translation of the desired aims of society to numerical targets which is the real preserve of the planner. Parnes (1962) considers it necessary for educational planning to take place in the light of targets for economic and social development and he adds that

> "This is true for all societies, irrespective of the type of economic system and the degrees to which general economic planning is accepted".

He elaborates two methods of planning 1) the manpower requirements approach, 2) the cultural approach. The former is akin to what we loosely termed a central-control policy, while the latter is closer to the self-control policy. Phillips (1964) sets out five approaches to educational planning, including the above manpower and cultural approaches and adding three more variations on the manpower requirements approach. The trend in educational planning exemplified in the Mediterranean Regional Project (O.E.C.D., 1965), in O.E.C.D., works such as Educational Policy and Planning - Austria (O.E.C.D., 1968), Educational Policy and Planning - Sweden (O.E.C.D.,1967), and in the Study on Teachers in 10 countries [3] (O.E.C.D.,1968), is towards very detailed considerations of the future environments under alternative assumptions and a translation of these future conditions, in the light of societal aims, into resource and cost targets.

Whichever approach is used to planning, the following four functions are the planners' responsibility:

1) The setting of objectives,
2) forecasts of future environments,
3) determination of the alternatives that can fulfil the objectives in the future environment and with consideration to existing constraints,
4) determination of a preferred course of action considering the objectives, the possibilities and the constraints. This might necessitate a reformulation of the objectives. (Schwarz, 1968)

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[3] Switzerland, Yugoslavia, Denmark, Italy, Luxemburg Austria, Greece, Sweden, Netherlands, Portugal.

Some people would have the planners' activities limited to 2) and 3), leavingthe broad aims and the choice of course to politics, or at least to governments. It all depends on how wide a definition one adopts. In effect, decisions on (1) and(4) are likely to be taken by the politicians, probably, we would hope, in the light of (2) and (3) in so far as data is available on these. Certainly, items (2) and(3), are the most time consuming and also those which require most skill or art, because planning - especially of the long term variety - involves not only application of scientific principle but also a good deal of crystal gazing. That most important long range forecasting is done at least partly on intuition has support (Fisher, 1966 and Quade, 1966). Both Fisher and Quade suggest that the main function of cost analysis is to sharpen judgement !

Planning At The Sub-National Level

So far discussion has centred round planning and forecasting at national level. Yet it need not be confined to that level. The real spenders of money, e.g., the Local Education Authorities in England and Wales, The Education Authorities in Scotland, the Universities, and even individual schools, should be planning at their own level, i.e., they should be setting objectives, assessing the future environment, looking for alternative methods of reaching goals, and along with the ultimate raiser of funds (the government) choosing courses of action. What this boils down to is the need for allocations of funds to be made to specific educational programmes. It has been suggested that,

> "a partition of the appropriations according to programmes and perhaps, a further partition of programmes into sub-programmes and programme elements with decision makers responsible for each programme (and perhaps each sub-programme) creates an incentive to investigate and propose (or decide) the best resource allocation within the programme. (Shwarz , 1968 p 129)

In other words, there is an incentive for efficiency if some planning functions are delegated to the spenders of money, instead of being confined to the highest level of the (educational) system. The existing practice in education is for the seat of decision to be far removed from the actual spenders. How many headmasters ask, let alone know how much their school costs to run? At school level, the

the situation is one where the headmaster, as a manager, is responsible for spending the money yet has little control over the way (i.e. to what heads of expenditure) he allocates it. There is, in this system, no incentive for him to allocate the funds in any way, let alone in the way most effective to the fulfilment of the objectives which he has been set by society, his education authority or which he has set for himself.

In this connection it is worth drawing attention to the method of educational finance adopted in Yugoslavia where responsibility for budgeting control lies with the school (O.E.C.D., 1968). By their work teachers - members of the school working collective - earn an income which they later distribute according to principles and criteria they have established themselves. What would a Scottish headmaster of a comprehensive do if he were given £150,000 as his earnings to be divided between Teachers' Salaries and other running expenses? Would he allocate 75% to salaries then "buy" 50 teachers at £2,000 each (Cumming, 1969). Would he "save" some money on Teachers' Salaries by increasing the average number of weekly pupil-contacts each teacher makes by cutting out a few subject options, by employing lecture methods and reducing his staff numbers? Then he might buy a few videotape recorders, overhead projectors and teaching machines. The Yugoslav report is not too precise about the actual ranges of salaries paid, but the basis for arriving at the level of remuneration of a teacher seems to possess features of our own infamous payment-by-results system as well as of the more recent proposals by Mr. Aubrey Jones' P.I.B., report on University teachers' salaries. But could we learn anything from this method of finance?

Planning And Time Scale

Before embarking on a survey of the methods of cost projection it is timely to introduce a note on what short, medium and long term mean as far as planning and forecasting go. Parnes (1962) declares that effective educational planning requires an assessment of needs at least ten, fifteen or perhaps even twenty, years into the future. Both communist and non-communist countries have gone in for five year economic plans, which might be seen as intermediate to some longer term goals. While in the long term, the Mediterranean Regional Project for Greece, based estimates for 1974 salary costs on 1961 data (Hollister, 1967).

Schwarz (1968) states:

"1) Long-range plans usually cover more than 5 or 7 years.

2) Medium-range plans cover up to 3 or 5 years.

3) Short-range plans are only concerned with the nearest year".

It would seem that Schwarz's convention is reasonable and more or less consistent with the examples given above. The terms will be used in the sense she suggests.

What follows is an attempt to formulate precisely some approaches to projecting educational costs together with some sample calculations.

PART II - METHODS OF PROJECTION OF EDUCATIONAL COSTS

Attention is concentrated on current expenditure throughout the remaining parts of the chapter.

Method A. Using Teachers and Teachers' Salaries

Teachers' Salaries are the largest single item of expenditure in the education budget. They are also a relatively stable proportion of total education expenditure (see row (4) Appendix 6/A). The principle of projection of educational costs using this method is:

(a) estimate the number of teachers in the forecast year (n);

(b) multiply this estimate by the assumed salary figure;

(c) modify the product of stages (a) and (b) by a factor relating total educational expenditure to expenditure on Teachers' Salaries alone.

Fig 6.1 Fig 6.1

Symbols for Mathematical Treatment

Symbol	Meaning
E_n	Total current expenditure in a year n
E_a	" " " " " on Teachers' Salaries
E_b	" " " " " on Other Services and Goods.
T_n	number of teachers in year n.
P_n	average Teachers'Salary in year n.
K	ratio of Teachers' Salaries to total = E_a/E_n
S_n	number of pupils (students) in year n.
R_n	pupil/teacher ratio in year n. (Edding, 1966A)

Since $\frac{E_a}{E_n} = K$; $E_n = \frac{E_a}{K}$. Therefore, applying (c) we have:

$$E_n = T_n \cdot P_n \cdot \frac{1}{K} \qquad \text{Equation 6.1}$$

This is the simplest method of projection, and the results it gives are subject to significant errors. It would only be really useful in a situation if (i) the period covered were short (ii) the number of teachers could be accurately predicted, (iii) the salary level were tied to some factor, such as growth of national income per head, which itself was reliably predictable, and (iv) if the value of K were 'controlled'.

Sample Calculations using Equation 6.1

The total current expenditure on education by Scottish Education Authorities in 1974/5 will be calculated using equation 6.1 and on the basis of assumptions concerning teachers, Teachers' Salaries, and the ratio of Teachers' Salaries to Total Educational Expenditure.

(i) TEACHERS - Prediction of numbers

The number of teachers predicted is either

(a) The number based on demand or requirements for teachers. The demand number of teachers is in essence derived from predicted number of pupils (S_n) and the desired or agreed pupil/teacher ratio (R_n). The pupil/teacher ratio is a function of the social minimum of education. Thus,

Demand number = $T_n = S_n/R_n$.

or (b) The number based on the probable supply position taking account of present supply, wastage rate, retirement and death, recruitment from colleges (and ultimately the number of places in the colleges and the probable number of qualified applicants).

Supply number $= T^s_n$

Other more subtle factors are also at work in determining T^s_n, such as the effect of the salary rates on the supply of teachers. (Hansen,1962)

(ii) SALARIES - assumptions on growth.

(a) Salaries (or Cost per Teacher) will continue to rise at the rate (in current prices) suggested by a retrospective study of compound growth rates of salaries.

or (b) Salaries (or Cost per Teacher) will grow at the desired rate, e.g., $2\frac{1}{2}\%$ per annum in real terms.(In order to make an estimate of costs based on this assumption comparable with an estimate based on assumption (a), some projection of the average rate of inflation would have to be made).

(iii) RATIO OF SALARIES TO TOTAL COSTS (K) - assumptions

(a) K will have the value for the latest available year - K latest.

or (b) K will continue to decrease, as it has since the 1920's, at a rate indicated by a retrospective study of the value of K-trends K trends.

NOTE. The rates of growth in the following calculations are based on the 'compound interest' formula:

Suppose P_o is the cost per teacher in base year 0, then, assuming a compound growth rate of i% over t years, the estimated cost per teacher [4] in year n, P_n, will be given by

$P_n = P_o\ (1+i)^t$ or

$\log P_n = \log P_o + t \log (1+i)$ Equation 6.2

METHOD A

(i) T_n^s = 54,000 Supply

T_n = 51,000 Demand (S.E.D., 1967)

(ii) P_n : (a) based on a compound rate of growth of 6.5%,(See Appendix 6/A)

P_n = £2,580.

(b) setting the desired rate of growth of salaries at $2\frac{1}{2}\%$,

P_n = £1,9000.

(iii) (a) K_{latest} = 0.465

(b) K based on the continuance of the trend of the observed 1.3% decrease per year over 1959/60 - 1966/67 (See Appendix 6/A)

K_{trends} = 0.420.

---

[4] The Cost per Teacher is calculated from the ratio of the total of Teachers' Salaries to the number of teachers. Teachers'Salary has the same meaning as in previous chapters,viz., the total of all expenditure incurred by the employer in connection with each teacher (gross salary, authority's contributions to superannuation,G.P.,N.I.).Clearly, the Cost per Teacher is crude in that it cannot take into account possible changes in salary structure, or changes in the mix of teachers on the maximum of their scale to those on incremental salaries, or of changes in superannuation,G.P., and N.I. contributions.

Fig 6.2

Fig 6.2

Cost Projections Using Equation $E_n = T_n . P_n . \frac{1}{K}$ for Scotland

	Col.1	Col.2	Col.3	Col.4
	Demand P_n=£2580	Supply P_n=£2580	Demand P_n=£1900	Supply P_n=£1900
K = 0.465	£282.967m.	£299.612m.	£208.387m.	£220.645m.
K = 0.420	£313.295m.	£331.714m.	£230.714m.	£244.285m.

The four forecasts in columns 3 and 4 are forecasts of expenditure at 1966/7 price levels with a 2½% real growth in average teacher cost allowed[5]. In contrast, the other four projections are at current prices assuming inflation will behave as in the past 8 years (i.e. 1959/60 - 1966/67). Of the eight estimates the most likely - if we take it that the "excessive" amount of teachers will fail to materialise - are to be found in Col. 4.

We may conclude that this crude method of estimating costs suggests that total current expenditure by Scottish education authorities in 1974/5 will be in the region of £ 220m. to £244m. at 1966/7 prices and allowing for a 2½% annual growth of average expenditure per teacher.

MODIFICATION TO METHOD A

Expenditure patterns and particularly salaries vary considerably between levels of education. Normally, therefore, more accurate forecasts will result from an estimation of outlay by level of education, provided, that is, the relevant statistics are available.

[5] No attempt is made to project some average rate of inflation, as suggested should be done under (ii) (a).

Projections of values of P_n, T_n, should offer no more difficulty than in the above method. Values of K, however, could cause difficulty unless accounts are kept referenced to both economic activity and level of education. The values of K will usually be greatest for primary, less for secondary, and least for technical and higher education, since these latter are the most intensive users of plant and teaching apparatus.

$E_n = E^p + E^s + E^t$ (p; Primary : s; Secondary : t; Tertiary)

Each of E^p, E^s, E^t might then be determined by application of equation 6.1. However, all outlays are not allocable directly to a particular level. There are certain joint costs such as loan charges (although with care this might be allocated back to individual institutions), health, recreational, library facilities, together with the administration of the system at national and local level. To a first approximation, and in the absence of educational programme budgeting, these joint costs might be considered as a constant (over time) proportion of the total; or the sum of the "allocable" expenditures might be regarded as a constant proportion of the total i.e.

$$\frac{E^p + E^s + E^t}{E_n} = C$$

Therefore $$E_n = \frac{E^p + E^s + E^t}{C} \qquad \text{Equation 6.3}$$

While the cost per teacher for all teachers in the Scottish Education Authorities was found by dividing total expenditure on Teachers' Salaries by the number of teachers, the cost per primary and cost per secondary teacher cannot be found by parallel sets of calculations. This is so because until the financial year 1968/9 financial data collected by the Accountant for Scotland from Education Authorities did not differentiate between primary and secondary education. At an estimate [6] the average salary of secondary teachers in 1966/7 was £1770 and that of primary teachers, £1360.

[6] See Appendix 6/B for details.

It is emphasised here that these figures are required only for demonstration purposes. Calculations of separate primary and secondary expenditures for 1974/5 are therefore based on the assumptions that

(i) The number of teachers will be the predicted supply number, T^s_n, i.e., 31,000 primary; 23,000 Secondary. (S.E.D., 1968)

(ii) The average Cost per Teacher will grow at a rate of 2½% per annum, thus making P_n for Primary = £1660; P_n for Secondary = £2160, by 1974/5

(iii) In the absence of any data relating salary costs to total costs for primary and secondary schools (the ratio of salary costs to total allocable costs obtained in the S.E.C.P. (see Chapter 3, Fig 3.24) is rather too limited for projections at national level) the value of K for primary schooling will be arbitrarily set at level of 1966/7, i.e. $K_{latest} = 0.465$, while that for secondary schooling be set at $K_{trends} = 0.420$

Then $E^p_n = T^s_n . P_n . \frac{1}{K\ latest}$

$\therefore\ E^p_n = 31{,}000 \times 1660 \times \frac{1}{0.465}$

$\therefore\ E^p_n = £111m.$

and

$E^s_n = T^s_n . P_n . \frac{1}{K\ trends}$

$\therefore\ E^s_n = 23{,}000 \times 2160 \times \frac{1}{0.420}$

$\therefore\ E^s_n = £118m.$

This rough calculation indicates that total current expenditure by Scottish Education Authorities will reach £229m. in 1974/5 in 1966/7 money terms and allowing for a growth of 2½% per annum in the Cost per Teacher. This compares well with the forecasts on the more direct approach above - expenditure projected as £220m. to £244m.

METHOD B USING UNIT COSTS

Briefly, the principle of projecting costs by this method is that total costs will rise in proportion to the number of pupils; the rise in total costs may then be negative if the school population should decrease. The projection equation is formulated as follows:

Where E_o = total expenditure in year o

E_n = total expenditure in year n

S_o = number of pupils in year o

S_n = number of pupils in year n

then, the unit cost in base year, $U_o = E_o / S_o$, hence

$$E_n = S_n . U_o \qquad \text{Equation 6.4}$$

The projections can be approached by disaggregating total expenditure into, say, m different levels or institutions or programmes, then

$$E_n = \sum_{i=1}^{m} S_n^i \, . \, U_o^i \qquad \text{Equation 6.5}$$

Application of equation 6.5 to national or other macro levels of expenditure should reveal where and perhaps why unit costs change. For instance, the breakdown by programme could be

(a) into primary, secondary, tertiary education,

(b) into all or each of these by region ,

(c) disaggregating into (a) and for (b), then into size,

(d) disaggregating into (a) and/or (b) and/or (c), then into type of curriculum offered.

Revealing comparisons of unit costs in a host of different forms might then be made.

Sample Calculation using equation 6.4

Given that the base year unit cost, U_o, is £158.6 (Appendix 3/C row 7) and that the estimated school population, S_n, in the Scottish Education Authorities in 1974/5 is 1.030m. pupils, application of equation 6.4 gives E_n as £163m. Such an estimate is at constant prices and allows for no increase in salaries nor does it take account of the increasing proportion of educational expenditure on items other than Teachers' Salaries. In this form, it is hardly a very useful approach.

Disaggregating expenditure into primary and secondary levels should reveal the affects of increasing numbers of children staying on beyond fifteen years old on overall expanditure. Actual unit costs are not available separately for primary and secondary pupils for Scotland (though English L.E.A.'s can supply this data). However, it will be recalled that from Chapter 3 it was concluded that each secondary pupil cost 2.25 times as much as each primary pupil. On this basis, the unit costs in primary and secondary can be calculated from 1966/7 data (see Appendix 6/A) as follows:

U^p_o = Unit Cost in primary schools in 1966/7

U^s_o = " " " secondary " "

S^p = Number of pupils in primary schools in 1966/7

S^s_o = " " " " secondary " " "

E_o = Total expenditure in year o

then $U^p_o = \dfrac{E_o}{S^p_o + 2.25.S^s_o}$, Equation 6.6

and $U^s_o = 2.25\ U^p$;

i.e., the unit cost of a primary pupil is the ratio of total expenditure on all pupils to the number of primary pupil-equivalents, calculated on the basis of a weighting of each secondary pupil as 2.25 primary pupils.

E_o = £141.160m.

S^p_o = 0.6039m.

S^s_o = 0.2859m. (S.E.D., 1968 Adjusted [7])

Using equation 6.6, we have U^p_o = £133 therefore U^s_o = £254.25 per pupil

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[7] Figures adjusted to bring them into line with total pupils shown in Appendix 6/A.

Projections of expenditure for 1974/5 on the basis of these unit costs are as follows:

$E_n^p = S_n^p U_o^p$; $E_n^s = S_n^s U_o^s$

E_n^p turns out to be £72m. and E_n^s = £101m. so that E_n at £173m. is some £10m. higher than the estimate made above on the basis of overall unit costs [8]. It is worthwhile pointing out that total expenditure on secondary schools will outstrip that on primary schools if present input levels per pupil are maintained.

Before leaving methods of projection based on unit costs, we shall indicate another possible disaggregation. the calculations of Chapter 3, Part III showed that pupils in years IV,V and VI of secondary school should count as 1.5 cost units compared with those pupils in years I-III. In connection with this ratio the following points must be made.

1) The ratio was obtained for the year 1964/5 for only 2 areas in Scotland.

2) The estimate was made when only 20% of the child population aged 15 - 18 and over remained at school, the same schooling rate statistic was 22% in 1966/7 and is forecast to be 42% in 1974/5 after the S.L.A. has risen.

3) If we regard the obtained ratio as not the result of deliberate policy making (of the type suggested under Central Control) but rather a result of such factors as non-optimum organisation of courses, smaller classes than there need be, lack of demand by pupils for certain curricula, then there might be considerable "slack" in the use of teachers in the upper school. For instance, if the average size of science classes in years I-III is 20, whereas in years IV-VI the average is only 10, the effect of increasing the S.L.A. and/or the trend to remain at school beyond the statutory leaving age should be to increase the class sizes from 10, notwithstanding the counter-economic tendency to increase the number of teaching units to accommodate the multiplicity of options desired by pupils.

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[8] Estimated number of primary pupils (in 1974/5) is 635.4 thou., secondary pupils (in 1974/5) is 394.6 thou., Education In Scotland 1967 Cmnd 3549 Edinburgh HMSO p 68

In view of these remarks, consideration should be given to the adoption of policies to reduce the ratio of unit costs in the upper and lower halves of secondary schools, otherwise the doubling of the proportion of pupils staying on at school between 1966/7 and 1974/5 will put a much greater strain on financial (and human) resources than there need be with more efficient organisation of resources in the schools. That is to say that in future, class sizes in the final years of secondary school may have to be nearer the present norm for the earlier years. We must come to terms with the fact that classes will be more or less (within the limits of the Schools (Scotland) Code) the same size all through the school, and that size will be nearer to the average size at present in operation in the lower forms of secondary schools.

Anticipating the discussion of the final part of this chapter, it is clear that the unit cost method is limited in application because of the assumption that the unit costs are constant within each level of education over time. There is evidence that unit costs move according to fluctuations in rolls.

METHOD C 'COMBINATION OF INDICES' METHOD

This is clearly related to Method A but involves two simplifying assumptions:

(a) Expenditure per teacher (in constant prices) will rise in the same proportion as the expected real increase in G.N.P. per head of the employed population.

(b) The number of teachers will increase at the same rate as the number of pupils, (assuming a policy of a constant P.T.R.). In the event of the pupil roll falling, by virtue of the fact that the P.T.R. is to be held constant, the number of teachers will decrease.

P_n , P_o as above

I_t^S ; the number of pupils t years hence, referred to index 100 in base year

I_t^{GNP} ; the G.N.P. per capita t years hence, referred to index 100 in base year.

Fig 6.3

Fig 6.3

Derivation Of Formula For Projection Of Costs On A 'Combination Of Indices' Method

	Base year	Projection year
G.N.P. per capita	x_o	x_t
Index (1)	100	I_t^{GNP}
Number of pupils	S_o	S_n
Index (2)	100	I_t^s
Index (1)xIndex (2)x100^{-1}	100	$I_t^{GNP} . I_t^s . 100^{-1}$
Total Expenditure on Salaries	P_o	$P_o^{Tot} . I_t^{GNP} . I_t^s . 100^{-2}$

or $P_n^{Tot} = P_o^{Tot} . I_t^{GNP} . I_t^s . 100^{-2}$ - Equation 6.7

x_t is given by $\log x_t = \log x_o + t \log (1 + i)$ - Equation 6.8

P_n^{Tot} , P_o^{Tot} = Total expenditure on Teachers' Salaries in years n & o.

There are no separate estimates of G.N.P. per capita for Scotland, neither for the current year (1966/7)nor for future years. As a substitute for actual figures, suppose that the value of x_o in Fig 6.3 is 100 and x_t for 1974/5 is given by equation 6.8 where $i = 2\frac{1}{2}\%$ - a conservative, if not pessimistic, view. Then we have:

$$P_n^{Tot} = P_o^{Tot} . I_t^{GNP} . I_t^s . 100^{-2} \quad \text{- Equation 6.7}$$

$$= P_o^{Tot} . x_t . I_t^s . 100^{-2} (x_t = I_t^{GNP})$$

$$= £65.714 \quad 122. \quad 133.100^{-2}m.$$

therefore

P_n^{Tot} = £90.593m. or using the symbols of Method A

$E_n^a \doteqdot$ £91m.

Suppose $\frac{E_n^a}{E_n} = 0.420 = K_{trends}$ then

$E_n \doteqdot £216m.$

Thus, allowing for the growth in the proportion of costs other than Teachers' Salaries, i.e. using K_{trends}, the forecast of total current expenditure by Scottish Education Authorities is £216m. by 1974/5 in 1966/7 money terms and allowing for a growth of 2½% per annum in the total Teachers' Salary bill.

METHOD D TEACHERS' SALARIES AND UNIT COSTS OF NON-TEACHING EXPENDITURE

Essentially this is a combination of Methods A and B. Estimates are made of the total expenditure on Teachers' Salaries by means of the most realistic assumptions, namely 1) the supply number of teachers (preferably estimated by level of education), 2) a constant average Cost per Teacher. While this latter assumption may seem out of place in view of all the arguments put forward under Method A, the rate of growth of salaries is just not predictable, whereas figures for the supply (and demand) of teachers are available for some years ahead. Non-teacher costs are, with some exceptions, more directly related to the number of pupils and/or school buildings. Therefore, projections of non-teacher costs might be made by multiplying present unit costs by future enrolments. It is, however, a policy to allow non-teacher costs to improve at a certain rate, we might call it the development factor, say, i^d% per annum [9].

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[9] As discussed in Chapter 3, there are features of buildings which reflect the rising social minimum of education and inevitably cause an increase in maintenance costs. So, as well as a policy of allowing non-teacher costs to rise there are "built in" factors directing cost increases. These latter could be ignored only by allowing the standards of provision to fall.

(i) The average Cost per Teacher in base year $= E^a_o / T_o$;

Thus, the total expenditure on Teachers' Salaries $E^a_n = T^s_n . E^a_o / T_o$

By level of education, say m levels; $E^a_n = \sum_1^m (T^m_n . E^{am}_o / T^m_o)$

Equation 6.9

(ii) The average Non-teacher Costs per Pupil $= E^b_o / S_o$

In t years, at a compound growth rate of i^d%, these costs will have become $\log \left[E^b_n / S_n \right] = \log E^b_o / S_o + t \log (1 + i)$ Equation 6.10

$\therefore \quad \log \left[E^b_n / S_n \right] = \left[U^b_n \right]$ projected (for short)

But, in year n, there will be S_n pupils, therefore

$E^b_n = S_n \left[U^b_n \right]$ projected Equation 6.11

Estimation of 1974/5 salary costs has already been done under alternative assumptions in Method A. Where this approach differs is in making no allowances for increases in Costs per Teacher, on the premise that these cannot be reliably forecasted. Clearly, the forecasts must be modified at each pay increase up to 1974/5. The average Cost per Teacher was £1557 in 1966/7 and on that basis E^a_n will be £84m. (using the predicted supply number of teachers - 54,000).

Calculation of non-teacher costs.

Average non-teacher costs in 1966/7 $= \dfrac{£75.446 \text{ m}}{0.8898 \text{ m}}$ per pupil
$= £84.789$

Equation 6.10 enables us to project this figure forward to 1974/5 on the basis of a compound rate of growth of 2½% per annum. $\left[U^b_n \right]$ projected, turns out to be £103; and the total expenditure on Non-teacher Costs is therefore £106m.

Since E_n^a = £84m. and E_n^b = £106m., it follows that this method forecasts total current expenditure as £190m. in 1974/5 at 1966/7 prices, remembering that no allowance has been made for increases in Teachers' Salaries.

SUMMARY

To summarise this section on the methods of projection of educational costs, we can say:

1) in the attempts to estimate future expenditure on education by Scottish Education Authorities, numerous gaps in the available data were revealed;

2) the crucial position of teachers as the main item of expenditure is made more evident in forecasts which are based almost entirely on teacher costs;

3) the treatment of non-teacher costs as one entity is probably grossly off-beam since non-teacher costs subsume such a heterogeneous body of items all growing (or declining) at different rates.

In order to find out more about the way input levels change over time, a discussion of the unit costs at school level will follow.

PART III A LONGITUDINAL STUDY OF COSTS AT SCHOOL LEVEL

Fig 6.4 Fig 6.4

Salary Costs Per Pupil Over Years 1961/2, 1964/5, 1967/8

Sample of 9 primary and 5 secondary schools. Current prices.

Head	61/2	64/5	67/8
Teachers' Salaries	£	£	£
Primary	31.65	36.46	46.98
Secondary	69.97	104.16	137.92
Janitors'/Cleaners' Salaries	£	£	£
Primary	2.86	3.33	6.03
Secondary	3.80	5.81	8.57

Source: See Appendix 6/C

Comparison Of Inputs

Over the period, secondary Teachers' Salaries per pupil rose by 51% (1961/2 - 1964/5) and by a further 48% (1964/5 - 1967/8) whereas the input per primary pupil as measured by Teachers' Salaries rose by only 15% over the first period and a further 33% in the second period. To account for the noticeable increases in expenditure per pupil at least two explanations might be put forward:

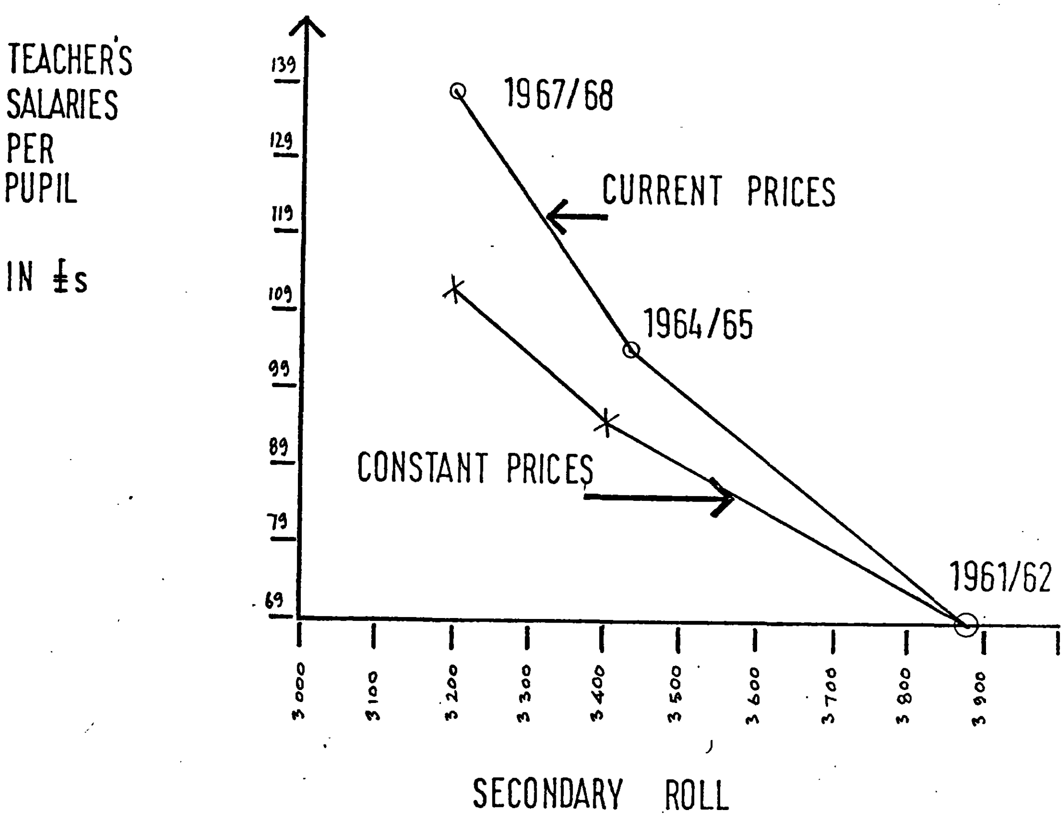
1) falling enrolments were not matched by staff cuts;
2) rise in average cost of a teacher reflecting inflation, real increase in their qualifications and experience, and perhaps, also, an increase in society's value of teachers in relation to other professional groups. In this process, secondary teachers may have done better than their primary colleagues.

The total roll of the 9 primary departments did indeed fall (by 7%) and that in secondary schools by 18% in the 6 year period.

Whether these falls were the results of a decision to decrease rolls and class sizes (as part of a centrally controlled policy) or the effects of population changes and other less controllable factors, one cannot say without some detailed case studies. That kind of study lies outwith the scope of this work since it would entail examination of the decision-making apparatus in local government. Fig 6.5 shows the rise in unit costs relative to fall in secondary roll for the three years in question [10].

Fig 6.5 Fig 6.5

Unit Costs Related To School Population



source: appendix 6c

[10] This figure and a similar one below are not graphs. The lines joining the points are not meant to represent a continuity, but rather to represent diagrammatically the trend shown by the figures in the tables in Appendix 6/C.

With regard to the increase in Teachers' Salaries caused by a combination of inflation and an amount representing the added "value" of experience and qualifications, it was felt that only the Index of Final Goods and Services Sold on the Home Market, crude though it be, should be used since the difficulty in collecting all the data required to construct an index of Teachers' Salaries in Scotland would not be repaid in the benefits.

Inputs At Constant Prices

Some attempt to take inflation into account must be made if inputs over time are to be compared meaningfully and if trends observed are to be used for cost projection. Application of a general cost of living index will deflate the general price level but, probably understate the inflation in educational process since education, like other services, is heavily weighted with labour, and salary/wage rates have apparently risen faster than prices of goods over the last decade or so. Admitting this limitation on the application of a general price index, the current price figures in Fig 6.4 were deflated using the index of Final Goods and Services Sold on the Home Market.

Fig 6.6 Fig 6.6.

Salary Costs Per Pupil Over Years 1961/2,1964/5,1967/8 In Constant 1961 Prices

HEAD	61/2	64/5	67/8
Teachers' Salaries	£	£	£
Primary	31.65	33.3	38.2
Secondary	69.97	95.1	112.3
Janitors'/Cleaners' Salaries			
Primary	2.86	3.04	4.91
Secondary	3.80	5.31	6.98

Source: Appendix 6/D

The growth rate [11] of inputs per pupil has been 3.1% per annum for primary and 8.2% per annum for secondary pupils for the six year period 1961/2 - 1967/8. This observed growth has not been smooth by any means, and what is more intriguing, at a time when secondary inputs were galloping ahead, 1961/2 - 1964/5 primary inputs were increasing very slowly and when primary input were accelerated in the second period (1964/5 - 1967/8) secondary inputs continued to grow but at just over half their previous rate. Thus, the primary growth rate of 3.1% per annum went in two stages, 1.6% per annum (1961/2 - 1964/5) and 4.4% per annum (1964/5 - 1967/8); secondary growth rate was 8.2% per annum overall, 10.8% (1961/2 - 1964/5) and 5.6% (1964/5 - 1967/8). An obvious cause, though not necessarily the main one, is the relative roll movement in primary and secondary departments. (The relationship of unit costs to rolls will be pursued in a later section).

Further Estimate of Scottish Education Expenditure

These estimates of the growth of unit costs at "reasonably" constant prices provide the basis for another projection of educational costs. The method is based on unit costs and is consequently a modification of Method B. Briefly, after disaggregating overall expenditure into a) primary b) secondary, we project the unit costs forward on the basis of trends observed by retrospective analysis. The product of the projected value of the unit cost and estimated school population gives the total expenditure (by level). Rounding the growth rates to 3% and 8% per annum for primary and secondary schools respectively, and given base year unit costs are U_o^p = £113 and U_o^s = £254, the projected unit costs for 1974/5 and U^p = £143 and U_o^s = £470. Total expenditures in primary education E_n^p = £91m and on secondary education E_n^s = £185m. [8] Thus, if input levels to primary and secondary education were to follow that trend of Teachers' Salaries over the period 1961/2 - 1967/8 observed in a sample of schools in a 'progressive' education authority, total expenditure on the secondary sector would be double that in the primary sector even though there were only 62% as many pupils in secondary departments as there were in primary departments.

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[11] Calculated by the "compound interest" formula, see Part II Method A Note.

Of course, the large increases in per pupil expenditures could be defended if, for instance, (in 1961/2) the schools in question had been either overcrowded and understaffed, or staffed by teachers of lower qualifications and less experience than demanded by the education authority. But, are the outlays in 1967/8 now at their optimum level? How much further will rolls be allowed to drop without a corresponding fall in the number of teaching staff? These questions are raised not because the writer feels he can answer them but rather in the hope that those who influence decisions regarding school staffing will ask them before setting out policy statements regarding national staffing standards or standards in individual schools.

Before leaving Fig 6.4 and Fig 6.6 it is worthwhile comparing both the absolute level of per pupil outlays on Teachers' Salaries and Janitors'/Cleaners' wages and their relative growth rates. In 1961/2 primary Janitors'/Cleaners' wages were 5.8% of unit expenditures on Teachers' Salaries but were 10.8% in 1967/8. The increase was not as marked in secondary departments. In both departments, unit outlays on Janitors'/Cleaners' Wages increased faster than outlays on Teachers' Salaries: primary schools, 48% increase in Teachers' Salaries but 110% increase in Janitors'/Cleaners" Wages; secondary schools, 99% increase in Teachers' Salaries and 125% increase in Janitors'/Cleaners' Wages. The increases in terms of constant 1961/2 prices were as follows: primary schools, 20% increase in per pupil outlays on Teachers' Salaries but 72% increase on Janitors'/Cleaners' wages; secondary schools, 61% increase in per pupil outlays on Teachers' Salaries but 83% increase on Janitors'/Cleaners' Wages. Perhaps, the number of cleaning staff is more a function of buildings and less easily variable with change in roll than the number of teachers. The fact remains, however, that the increasing social minimum of education calls for more non-teaching staff so that we can anticipate yet more significant increases in outlays per pupil on non-teaching staff - secretaries, auxiliaries as well as janitors /cleaners.

Secondary,Primary Inputs Compared Over Time

No consistent policy is evident with regard to the relative inputs to primary and secondary departments. Fig 6.7 is derived directly from Fig 6.4

Fig 6.7 Fig 6.7

Secondary : Primary Unit Cost Ratios 1961/2 - 1967/8

	1961/2	1964/5	1967/8
Secondary:primary Teachers' Salaries ratio	2.17	2.85	2.93
Secondary:primary Janitors'/Cleaners' Wages ratio	1.32	1.74	1.42
Secondary:primary All Salaries/Wages ratio	2.10	2.76	2.76

Source: Appendix 6/C Part III

The differential in inputs of Teachers' Salaries per pupil between secondary and primary pupils became greater, 31% increase from 1961/2 to 1964/5 and a further 4% from 1964/5 - 1967/8. It remains that, whereas in 1961/2 secondary pupils were consuming just over twice the resources (in expenditure terms) of primary pupils, by 1967/8 they were using roughly 2.¾ times. Such a study suggests that in recent years the trend in the ratio has been upwards (further evidence below) but, of course, does not point to how much should be spent relatively on the two levels.

UNIT COST PATTERNS In Individual Schools

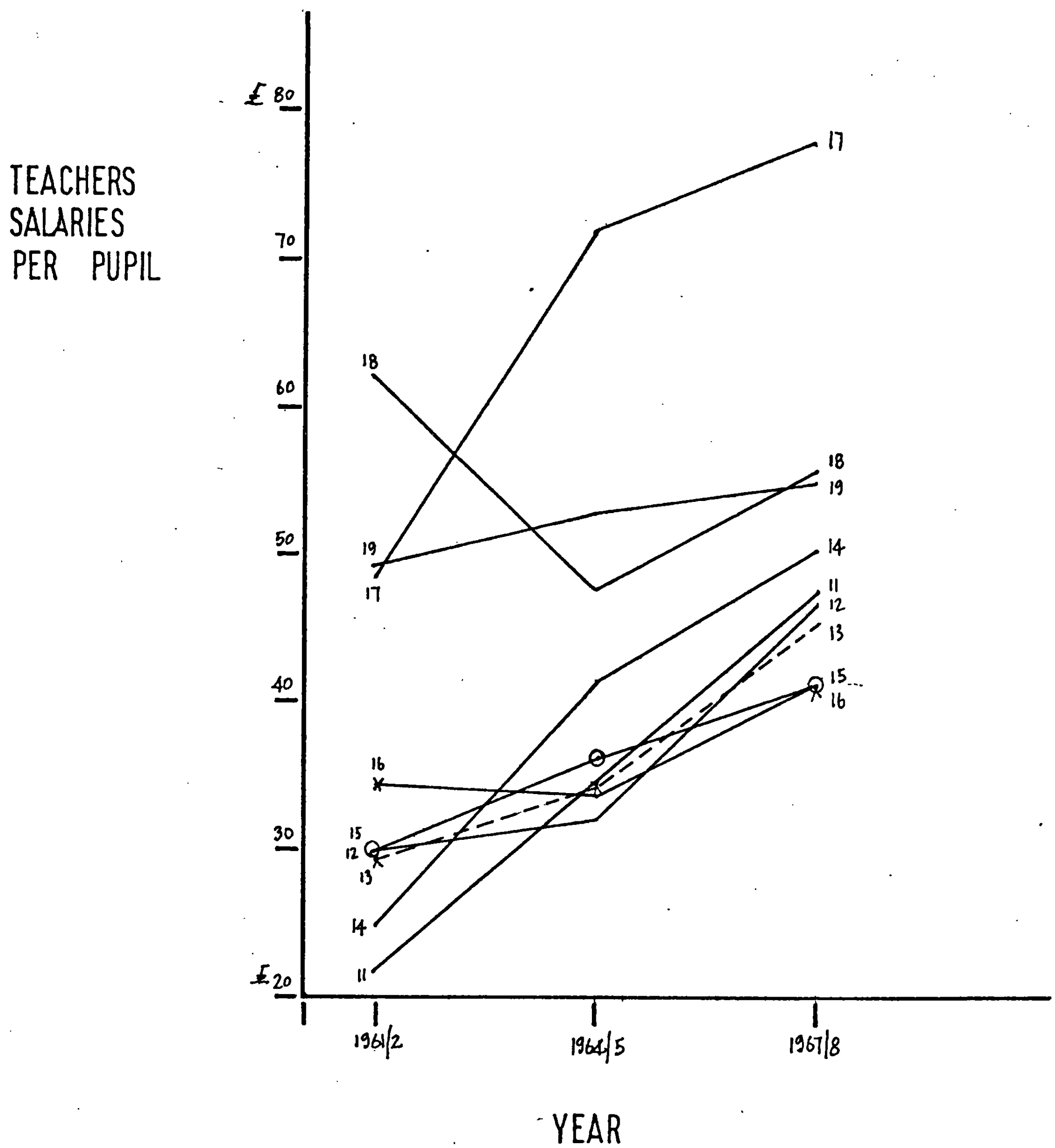
A) PRIMARY

The diagram in Fig 6.8 shows that, 1) small (3 teacher) primary schools (17,18,19) have consistently larger unit costs than the bigger schools, 2) the fluctuations in unit costs across time are wider in these small schools due to changes in roll and the age/qualifications mix of staff having a greater influence on unit costs. Two schools defy the upward trend in unit costs and they do it for different reasons. An increase in roll at school 16 resulted in a small drop (in current terms at least) in unit cost, while at school 18 the large fall was brought about by a change in staffing from a relatively experienced and well qualified trio in 1961/2 to an inexperienced trio in 1964/5. School 17, which had the same roll as school 18 in 1964/5, shows the more 'normal' level of inputs for that year.

Fig 6.8 Fig 6.8

UNIT COST Patterns For Individual (Primary) Schools

Current Prices



source: appendix 6c part I

B) SECONDARY

Fig 6.9 Fig 6.9

Teachers' Salaries Per Pupil And Rolls For 5 Secondary Schools

1961/2, 1964/5, 1967/8 Current Prices

SCHOOL CODE	ROLLS			UNIT COSTS		
	61/2	64/5	67/8	61/2	64/5	67/8
61	1345	1124	919	£72.57	£104.92	£158.29
62	660	610	500	86.25	113.57	163.04
63	618	661	727	65.17	109 .69	126.84
64	466	471	520	50.16	71.05	90.70
65	799	565	531	62.53	113.58	140.44

Source: Appendix 6/C Part II

In contrast to the sample of 9 primary schools, no school displays increasing unit costs over the two 3 year periods. Two substantial drops in roll for school 61 (a senior secondary) are partly responsible for that school having more than double the unit costs in 1967/8 compared with 1961/2. The background to this observation is that the opening of another school to ease the pressure on school 61 was not followed by any systematic reduction of staff in school 61. We can only conjecture how much of the 1967/8 level of input per pupil reflects a justified increase over 1961/2, how much general inflation, how much an excess of resources "required". School 65 falls into roughly the same category as school 61, a decrease of 33% in the roll over the 6 years was accompanied by an increase of 122% in the unit cost of Teachers' Salaries. School 63, on the other hand, has been altering its structure in the 6 years. In 1961/2 it was a 3 year junior secondary housed in an old building. In that year about 9% of the roll were in the 4th year, while in 1967/8 the proportion was 14% [12].

[12] Brunton type pre-vocational courses were also in evidence by 1967/8, the school having moved to a new building in 1964.

Some of the increase in unit costs here could be put down to the policy of increasing diversification of courses, which policy required more and better qualified teachers.

Summary

We can gather from the above study that

1) In constant prices, the inputs in terms of Teachers' Salaries per pupil rose 20% in the primary schools and 61% in secondary schools in the period 1961/2 to 1967/8.
2) Consequently, the differential in overall labour unit costs between secondary and primary pupils rose from just over 2 in 1961/2 to 2.¾ in 1967/8.
3) Substantial drops in rolls of some schools over the 6 year period seem to be one factor in contributing to the large increases in unit costs.

A suggestion which at first sight is almost too trivial to set down but yet might save both human and financial resources is for those controlling the day-to-day running of schools to adjust staffing requirements as roll falls. (Chapter 3 Part III dealt with the difficulties of doing just this in rural schools). As Edding (1966B) has pointed out, the possibilities of lowering unit costs have been neglected in education. The act of lowering unit costs is equivalent to increasing income for it enables one to do more with available money. At this juncture it is not intended to digress into a discussion of the comparative benefits of different sizes of class or quality of teachers, a topic which inevitably comes up when mention is made of cutting staff or increasing the P.T.R.

This brief study at a micro-economic level has served to emphasis the importance of Salaries - both Teachers' and Janitors'/Cleaners' - in determining overall costs. In fact, capitation allowances (covering educational equipment, textbooks etc.,) for the 9 primary and 5 secondary schools for those years were so low in comparison to salaries as not to interfere with the trend set by the Teachers' Salaries. Heating and lighting costs were examined for the 14 schools for 1964/5 in Chapter 3; these costs, although larger than educational equipment, books and stationery, are still somewhat low compared to Salaries.

PART IV STUDY OF RELATIVE COSTS OF PRIMARY AND SECONDARY EDUCATION

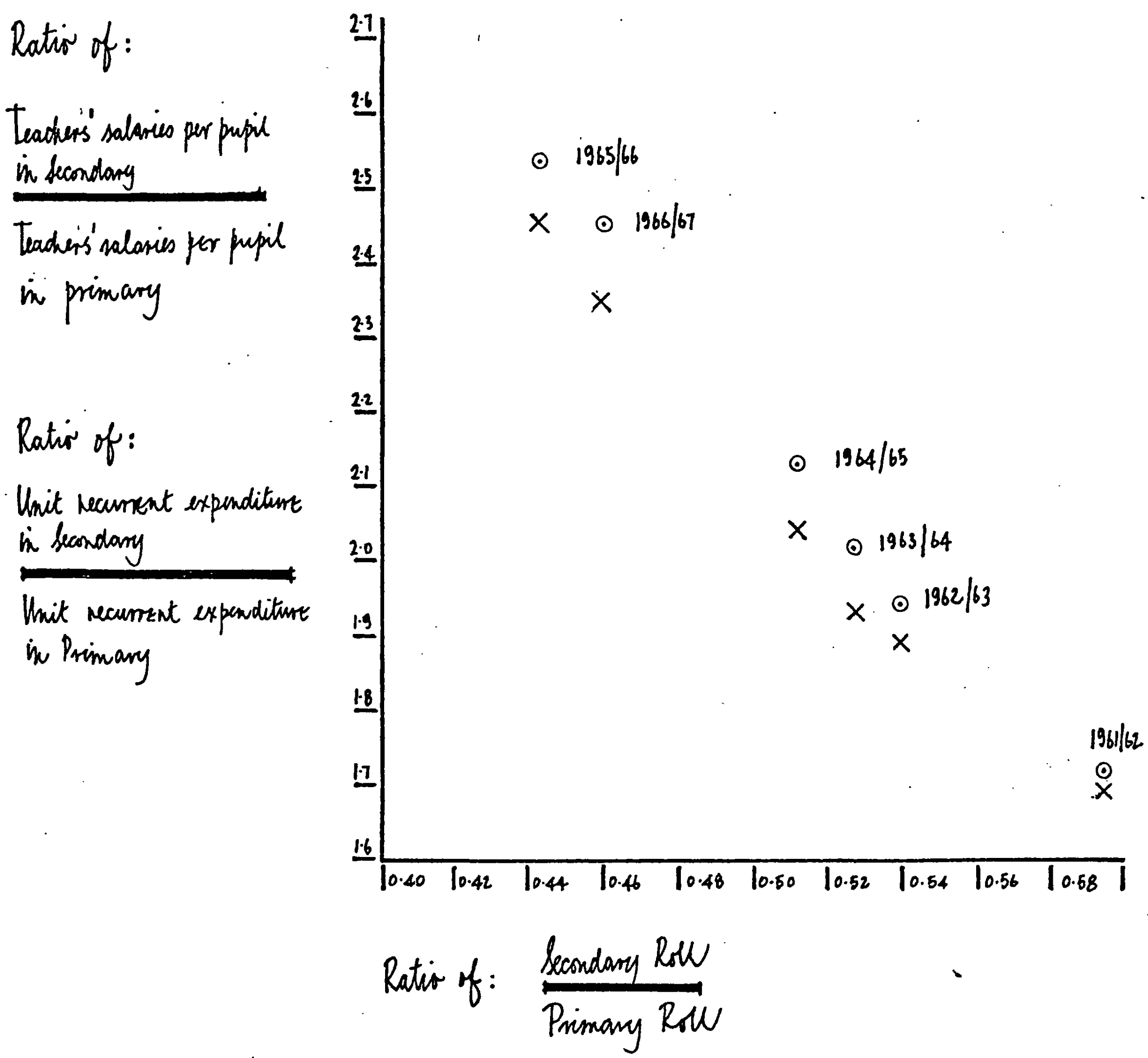
There was some evidence that the ratio of inputs per pupil in secondary schools to that in primary schools had risen. More than academic interest attaches to the trend in this ratio because, 1) the traditional types of primary and secondary education are so different in both resource utilization patterns and pervading philosophy that realistic assessments of future resource needs must take account of the levels separately, 2) studies of the ratio in relation to school population should reveal something about the allocation of resources in relation to demographic trends. It is hoped also that the following study will contribute to a discussion of the effect of 'policies' and 'constraints' on educational expenditure (see also Chapter 3 Part II)

Scottish City Data

Through the agency of the S.E.D., data on unit costs in primary and secondary schools, collected by a Scottish city was made available to the writer. Fig 6.10 shows that the differential in inputs per pupil between secondary and primary had been increasing almost linearly with the fall in the ratio of secondary pupils to primary pupils. (There is an almost perfect negative correlation between the two ratios (-0.9962). The regression equation calculated from the six pairs of observations is $Y = 5.3133X + 4.7883$, where Y is the secondary:primary unit cost ratio and X is the secondary:primary roll ratio). During the period in question, the secondary roll had been shrinking (by 16% in 6 years) while the primary roll, had been increasing (by 8% in the same period). It seems unlikely that there was a <u>central-control</u> policy operating throughout this period directing that more and more should be put into secondary education, while primary education stood still, relatively speaking. On the other hand, it might well be that the observed trend is the by-product of such factors as the development of 'O' grade courses (the examinations for which began in 1962), increasing emphasis given to teaching of maths and science (including the appointment of separate heads of department for chemistry, physics, biology), the uptake of secondary teachers from colleges of education perhaps growing faster than that of primary teachers. The trend to remain at school pushes up the requirements for teachers, accommodation, and apparatus (see Chapter 3). In a sense, the trend in the unit cost ratio is <u>self-controlled</u>, i.e. the educational decisions and demographic fluctuations give rise to a costs momentum.

Fig 6.10 Fig 6.10

Relationship Of Ratio Of Unit Costs In Secondary And Primary Schools To the Ratio Of Rolls In Secondary and Primary Schools.Data for One Scottish City



x denotes observations of sum of Teachers' Salaries and Maintenance expenditure and roll ratio.

⊙ denotes observation of expenditure on Teachers' Salaries and roll ratio

Source: Appendix 6/E

In the diagram Fig.6.10, the observations are related to the year of the observation. This simple procedure provides evidence that the marked linearity of the relationship is not a time series,in other words the trend of increasing secondary:primary unit cost ratio is not following time. If it were so, then the observation for 1966/7 would not have 'fallen back' into the line but would have been well out of the trend (probably at about 2.6). Further, the position of the observation for 1966/7 indicates that there is no 'policy' [13] working to increase the input of resources in secondary relative to primary. The whole trend in the cost ratio seems to be set by the varying numbers of pupils at the two levels of schooling. It would appear that, as in the above study of schools in Area B, there is a tendency to allow school rolls to vary while staffing remains unadjusted. As the roll statistics for the Scottish City in question show (see Appendix 6/E) the secondary roll fell steadily over the period, allowing class sizes to fall no doubt. Since the city finds no difficulty in teacher supply; the actual number of teachers in secondary schools did not fall - the following Fig 6.11 shows this.

Fig 6.11 Fig 6.11

Numbers of Certificated Teachers In the Scottish City 1961/2 - 1966/7

	1961/2	1962/3	1963/4	1964/5	1965/6	1966/7
Primary	807	807	821	843	800	829
Secondary	632	652	670	690	694	709

In primary schools, the roll rose over the six year period with no compensating increase in staff. Indeed, the modest increase in unit cost of Teachers' Salaries of £10 per pupil over six years, once inflation is accounted for, might lead one to conclude that primary standards fell back during the period.

Inelasticity of Teacher Supply

All these comments on Fig 6.10 may be summarised as follows: there is a surprising inelasticity of supply of teachers with change in school roll. Further light on this finding would be shed by a parallel study of unit cost ratios as a function of roll ratio in areas

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[13] No consistent policy, that is. It would still be possible for a policy to operate such that unit costs fluctuated and were planned to do so.

like Lanarkshire, Glasgow and Renfrew where, as was pointed out in Chapter 3, part II, demand for teachers outstrips supply. Management of teacher resources there might take into account varying rolls. The question of the management of teacher resources is most complex. The fact is that until very recently (i.e. until some authorities were saturated with primary teachers) authorities had a policy of employing as many teachers as they could get. In these circumstances, the finding from Fig 6.10 might reflect the relative proportions of secondary and primary teachers produced by the Colleges of Education over the period in question and mopped up by the Authority. Also, the possibilities for adjusting the supply of teachers both in absolute numbers and in terms of varying proportions of primary and secondary teachers is limited. First, the absolute number of teachers is not sensitive to short term measures. Plans must be made five to ten years in advance if absolute numbers are to increase in order to build the necessary extra places in colleges (assuming that they are at full capacity already) and universities. Secondly, the nature of primary school teacher training is very occupation-specific, only the graduates [14] who have opted initially for primary work are able to transfer to secondary school. These considerations lead one to the conclusion that in the short term or more precisely, at the level of the education authority in the short term, there is little possibility of managing teacher resources in response to roll fluctuations unless, of course, the teacher market is tending towards a surplus[15]. In the latter event, demand for teachers would no doubt be raised again by lowering class sizes or diversifying the curriculum still further to mop up the surplus (i.e. raising the social minimum of education). We thus come full circle in deciding that the observed linear relationship between the secondary : primary unit cost ratio and the roll ratio may be largely constrained in the short run.

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[14] Also a few diploma holders in Art, Music, P.E.

[15] A redistribution of existing resources between schools in the same area might be a first stage and a 'possible' stage at which to begin management of teacher resources.

Quantification Of Observed Trend

An attempt is now made to quantify the linear relationship between the secondary:primary unit cost ratio and the secondary:primary roll ratio (observed for a Scottish City), using some English statistics. The data is drawn from roughly 80 English County Boroughs and 45 Counties in England and Wales. The average unit cost in primary and secondary schools in both County Boroughs and Counties is available from the annual publications of the Institute of Municipal Treasurers and Accountants (IMTA, 1968). Sixteen pairs of observations of secondary:primary unit cost ratio and secondary: primary roll ratio were made from 1960/1 to 1967/8 (8 for County Boroughs and 8 for Counties).

Regression equations of Y (secondary : primary unit cost ratio) on X (secondary : primary roll ratio) were computed as follows:

For Counties; $Y = -2.0000X + 3.1882$ ($r = -0.8697$**):

For County Boroughs; $Y = -3.4000X + 4.0582$ ($r = -0.7335$*).

Considering the two sets of data as samples from the same population, the regression equation for the 16 pairs of observations is

$$Y = -1.8174X + 3.0448 \quad (r = -0.6302^{**})$$

For Counties, there is a strong relationship between the unit cost ratio and the roll ratio. 75.64% (r^2) of the variability in the unit cost ratio can be accounted for by the relationship between that ratio (Y) and the roll ratio (X). The regression equation suggests that for an increase of one unit in the secondary:primary roll ratio we should expect the unit cost ratio on the average to fall by 2. For County Boroughs, the relationship is weaker, the correlation coefficient being significant at only the 0.05 level. Only 53.80% of the variability in the unit cost ratio can be accounted for by the relationship between the unit cost ratio (Y) and the roll ratio (X). To this second regression equation there attends a larger standard error of the estimate $S_Y(e) = 0.0755$, compared with $S_Y(e) = 0.0346$ for the first regression equation. Thus, there is more risk in using the second equation as a predictor or, to put that another way, the 95% prediction limits are breader when using the second regression equation than when using the first.

** significant at 0.01 level

* significant at 0.05 level

It is reasonable to suppose that the two sets of observations can be combined to give the best fit relationship for 16 pairs of observations. This third regression equation indicates that only 39.71% of the variability in the secondary:primary unit cost ratio can be accounted for by the relationship between that ratio, Y, and the roll ratio X. The third regression equation suggests that for an increase of one unit in the secondary : primary roll ratio, we should expect the unit cost ratio, on the average, to fall by 1.8174.

We may conclude then, that other things being equal, if we wish to project running costs of schools at all accurately we must examine the demographic distribution for the required year in relation to previous years. More specifically, we should estimate the ratio of secondary:primary school population, and use a regression equation such as the three above to predict what the unit cost ratio is likely to be on the average. That, in short, is the methodology. Much more accuracy could be obtained by taking a longer time span for observations and examining the trends over a number of regions and countries. Such a comparative approach might reveal that the ratio moves in quite different ways, according to what stage the region/country/county/L.E.A. has reached in educational development.

General Discussion of Educational Planning

The observation of a relatively simple relationship between educational costs and a demographic function raises several questions. First, can we accept the relationship as normal and build it into a methodology of cost projection? Secondly can we isolate the factors which control the levels of unit expenditures in primary and secondary schools, then set about interfering with them so as to bring the unit cost ratio under some central control or policy? Thirdly, what guidelines do we have for setting the level of inputs at the two levels so as to maximise efficient use of resources? These are in the main economic questions. Consideration should also be given to the educational side of the equation, i.e. to the benefits obtained from varying the relative inputs to the two levels of school education. This last question is still unanswerable in the absence of evidence about costs/quality relationships in education. Planning and its relation to quality is taken up in Chapter 7.

The possible answers to the first three questions depend on how much planning, as such, is to be done. An uncompromising centrally controlled plan could set the unit cost ratio at a particular level, thereby allocating finance and real resources for the planned period. Within that allocation, further allocations to programmes such as R.S.L.A., or to items such as Teachers' Salaries, are required to be made. Without pursuing this line of planning too far, it is clear that having fixed the allocation by level (or programme) just to stick to those budgets while allowing some flexibility at lower levels (or to sub-programmes) would require very full financial, manpower and cost data. The more resources are carved up, the greater the need for reliable information on resource utilization at the micro level. Also, as the budget centres become finer, there should be a stimulus to those who are responsible for the budget centre to allocate their resources efficiently. As long as most countries do not have the fine or detailed information nor the necessary methodology of cost accounting in education, the adoption of total central control planning in education is inadvisable. (The political/philosophical question of whether there should be such severe controls is omitted here, as the argument is concerned with practical problems of planning, not the desirability of it).

However, to adopt the present or observed trend as 'normal' is the very antithesis of planning; for planning must involve consideration of alternative means of attaining objectives. To allow a trend (even one which follows a parameter like population) to continue into the future without either understanding and accepting the forces which are at its root, or understanding and attempting to bring them under control, is weak administration. The above studies at a micro level and in a Scottish Education Authority and in English Counties/ County Boroughs showed that a close watch should be kept on staffing in those schools where rolls are falling. This is just one way of saying that the standards of provision (the social minimum) in the shape of the P.T.R. should be planned rather than merely arise. Hansen (1962) points out that the opposite of what is suggested here can also occur.

Speaking of the supply/demand equation for teachers, he states that projections of teacher supply often impose new quality dimensions on the supply side of the equation so that the shortage of qualified teachers according to the new standard looks much larger than it would if based on the existing standard.

Planning for the Unknown

Uncertainty is a major feature in most long-range planning problems. But it can be reduced by making alternative sets of assumptions about the future, i.e.,by making forecasts of future resource requirements of alternative plans. One technique used to tackle uncertainty is sensitivity analysis. It amounts to varying parameters, variables, or assumptions and forecasting the sensitivity of final estimates to those variations. It can furthermore be regarded as a crude substitute for cost-benefit or cost-effectiveness analysis. For instance, calculations showed that the lowering of the pupil/ reacher ratio from 28 to 24 in Greek secondary education (the variation of the critical parameter) accounted for 15% of the total current costs in 1974 based on 1961 data (Hollister, 1967). Even if we could accept that a lower P.T.R. meant a higher quality of education, it would be wise to consider the resource implications of such an increase in quality before building the higher quality into the plan.

Applying the techniques of sensitivity analysis to alternative assumptions concerning the P.T.R. for Scotland in two future years, we discover that if staffing standards were maintained at their 1965/6 level (P.T.R. 27.9 in primary, 14.0 in secondary schools) then 22,100 primary and 23,200 secondary teachers would be needed in 1970/71 and 21,500 primary and 28,500 secondary teachers by 1975/76; while if staffing standards were set (arbitrarily) at P.T.R. 25.0 in primary and 12.0 in secondary schools, then 24,700 primary and 27,000 secondary teachers would be needed in 1970/71 and 24,000 primary and 33,300 secondary by 1975/76. (See Appendix 6/F) The higher standards of provision demand roughly 12% more primary staff and 16% more secondary staff for each target year. The effects on overall expenditure are twofold.

First, the account head Teachers' Salaries would be increased by roughly 12% in the primary education and 16% in secondary education [16]. Secondly, an "unknown quantity" of new provision in the form of schools, classrooms, heavy equipment, would require capital expenditure the increased amount of which would be felt through repayment of and interest on loans for the following 50 or 60 years. To these two direct effects on expenditure there must be added the indirect effect of the provision of new places, i.e. maintenance and running of the fabric. Fig 6.4 indicated that primary Janitors'/Cleaners' Wages varied from 5.8% of unit expenditure on Teachers' Salaries in 1961/2 to 10.8% in 1967/8, while in secondaries they were roughly 5.5% - 6.2% over the same period. The figures quoted for 1964/5 for the costs analysis in Area A Part III indicate very similar orders of magnitude, 7.9% for primary, 5.7% for secondary schools. Also from Chapter 3 we have found that Heating and Lighting costs are roughly 4.5% (in primary) and 3.2% (in secondary) of Teachers' Salaries. If these two cost heads (small though they are compared to Teachers' Salaries) depend more on the number and type of buildings than on the number of pupils, then the higher standards of provision of teachers will indirectly cause total expenditure to rise in these areas, always supposing the extra teachers cannot be accommodated within the present school buildings.

Other minor heads such as apparatus, textbooks, etc., should not be affected greatly by having more teachers, since these heads should relate to the number of pupils (through the capitation allowance scheme). The increase of teaching units (both schools and classrooms) does, however, necessitate an increase in the more expensive capital-type of educational equipment, e.g., audio visual aids, language labs, science and technical equipment. Forecasting of needs for resources of this type should be done by school with consideration given to the following points.

1)/

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[16] Assuming that total expenditure increases in proportion (roughly) to the number of additional teachers, i.e., that the cost per teacher is roughly constant within the limits of the increases in numbers forecast.

1) What are the present standards of provision, i.e., how many pupils to one T.V. and questions of that kind.
2) How well utilized are these major items of equipment?
3) Are there possibilities of more than one school using equipment? Would a central store of some items of equipment be more appropriate?
4) What requirements will future curricular developments make in equipment?

Forecasting of the national position from the returns of schools and education authorities should make for more realistic assessments than are possible without the degree of disaggregation suggested here. Sensitivity analysis, applied to what are thought to be the critical parameters and backed up by reliable retrospective data, is one tool for quantifying the uncertainty of the future.

Conclusions

1) The greatest dilemma in educational planning is knowing what standards are to prevail in the future. There are also the gnawing questions of a) the availability of suitable statistical data on which to plan and b) of choosing the appropriate techniques for converting present-year plans into future-year estimates. These problems are encountered in the above study of the secondary:primary unit cost ratio.

2) The question of priorities arising from different views of planning- on the one hand budget first, plan second, on the other hand plan first and cost implications/budget second - can be resolved (in theory anyway) by proposing that educational planning be oriented to the furnishing of data relevant to budgeting decisions, while budgeting structures and procedures should involve revisions being in line with current policy objectives.

This chapter began with an exposition of the role of planning, projecting and forecasting in an overall development plan. There followed a formal setting out of the mathematical tools for projecting costs together with examples which illustrated the kind of decisions which face planners when they take a long term view. The above studies at school level and at authority and national level sought to isolate trends in unit costs. Before discussing further the future costs of education it should be noted that there is a conceptual distinction between projections and forecasts (Sheehan,1968). The former imply the continuation of some already existing trend, e.g., the estimation of future total costs of education on the basis of the observed trend in the secondary:primary unit cost ratio would be a projection. The latter term involves decisions or assumptions about the future pattern of education; these forecasts, then, may or may not mean a divergence from observed trends[17].

[17] In the process of doing forecasts and projections there is, however, some overlap in methodology. Often forecasts will be made on the basis of trends and some other information; trends will be modified by intuition or guesswork.

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CHAPTER 7

PLANNING AND THE QUESTION OF QUALITY

Overview

The middle four chapters of this work have occasionally raised issues concerning what might loosely be termed the 'quality' of education. The untidy appearance of many of the conclusions must now be removed. This chapter attempts to pursue the question of quality or output in education, first as a topic in its own right, then as a concept integrally linked to costs and inputs. Four case studies of cost-effectiveness analysis are investigated in the light of a suggested mode of interpretation concerning educational quality put forward in the earlier part of the chapter. Finally, a blue-print for cost-effectiveness studies is introduced together with some suggestions for its application.

Introduction

It is predictable that innovators in education are more ready and able than chalk - and - talk teachers to discuss the <u>success</u> of their pet ventures. Sometimes, for instance in the field of programmed instruction, they mention scores on pre- and post-tests as proof of the quality of a programme. They look for such facts because, perhaps unfairly, they are challenged to prove that <u>their</u> teaching systems work and that they work as well as the conventional methods. Some hard headed critics may request the costs of the innovation as well. This harrying of innovators is slightly unfair in a sense because few conventional teachers are asked to justify <u>their</u> existence in terms of the <u>effectiveness</u> of their teaching, in terms of the <u>efficiency</u> with which they deploy their resources (human and material), or in terms of productivity.

The habit of critically appraising their <u>output</u> is not at all well cultivated in teachers. Nor, for that matter, do the electorate worry themselves unduly about the question of quality. They are preoccupied with the rising costs of the inputs as reflected in local rates and national taxes. Occasionally, wild sorties against this or that educational change appear in the press. "Progressive primary teaching methods are the root cause of teenage delinquency, lower standards of reading, poor numeracy". Burt (1969), re-entering the educational scene after a long absence, has come out against the lack of discipline and the free-play methods of modern primary education, contending that they reduce scores on standard tests.

Basic Terminology

It is almost trendy in academic educational circles to speak of cost/effectiveness analysis, input/output budgets, programme budgeting etc. For the record, here is a list of current terminology. We talk about input, cost, resource, or outlay, as compared with output benefits, effectiveness, efficiency, quality or returns. That these terms can be used in the same breath as educational terms is owed to the recent and growing influence of economics on education. A scrutiny of these economic terms will serve as an introduction to their application in education.

Cost-benefit analysis is "a technique of appraising those public investment projects that compete, at least in part, with similar projects in the private sector". (Blaug, 1968A) The benefits are, therefore, normally computable in money terms with the result that a cost-benefit analysis should elicit a single ratio, since both numerator and denominator are in similar units.

Cost-effectiveness analysis contrasts with cost-benefit analysis in that it pertains "to public investment projects which are *sui generis*"; (Blaug, 1968 ibid) there is, therefore, no market in which the output can be priced with the result that the benefits/output cannot be priced in monetary units. Cost-effectiveness analysis may yield a number of criteria on different definitions of the objectives of the project.

Programme budgeting, performance budgeting, output budgeting are synonymous with cost-effectiveness analysis. Formally these three terms refer to the reshaping of the accounts in such a way that the entire budget is distributed among a number of different programmes; a programme being defined as an activity that has a unique objective.

Input and cost are equivalent terms. Input in the education industry is hours of student and staff time, acres of land, sq.ft. of buildings, reams of paper, units of electricity etc. The sheer impossibility of adding such a mixture of units forces us to use the cost of these inputs as the common denominator.

A distinction is held between benefits and effectiveness in so far as benefits are measurable in money units (called returns) while effectiveness is not measurable in money units but is some criterion of the aims of the programme, or project. Output, performance and quality are used interchangeably with effectiveness. Quality is taken here in its evaluative rather than its descriptive sense: that is to say, it refers to the "goodness" of something rather than to its special character.

Two commonly used terms refer to the relationship of input to output. These are efficiency and productivity and they are not the same thing. Efficiency is defined as the optimal combination of inputs to produce a given output i.e. producing the output at least cost. The productivity of a worker is the average hourly or annual output per worker; or productivity referred to units of capital is the ratio of total output to the number of units of capital employed." Efficiency can be defined at one point in time in the context of the existing level of technical knowledge whereas productivity is almost always measured between two calendar dates". (Blaug,1968B) Productivity may rise continuously yet the economic activity may be conducted inefficiently at all points in time. This situation may arise, for instance, when technological innovations occur in the field. Also, an activity may be conducted efficiently at every point in time yet fail to show productivity increases.

'Quality' in Terms of Objectives

In the attempt to decide whether cost-benefit or cost-effectiveness analyses are appropriate to education, a seemingly intractable problem is encountered. It is simply that no-one can agree on the objectives of education. The dilemma exists as much for the individual as it does for the State. Individuals, teachers, taxpayers, employers, pupils, all give varying weights to what might be called the conventional aims of education. Among these might be listed:

a) That every child should have education according to his or her age, aptitude and ability.

b) That there should be a sufficient vocational element in the education to ensure the required numbers of skilled people for industry business, services.

c) That there should be sufficient education to ensure that all pupils make the most of their talents.

These are only three of a host of aims which are held to be important for the present education system in the U.K. In general, a society will subscribe to a set of aims which are a consensus of views. But some societies have aims more or less imposed by particular pressure groups. Three overlapping groups of considerations are normally responsible for the adopted aims.

1) Educational considerations, the consensus of opinion of what constitutes an educated man.

2) Economic considerations; what skills, knowledge, abilities, society requires for the economy to work optimally.

3) Political considerations; what values society holds as 'good' e.g. the democratic value premise.

Broad, unspecific aims are of little use for quantitative studies. More precise objectives are required. Yet the more exact they are the more people tend to disagree with them. For instance, if a precise objective of Scottish education were that all children born between 1/1/60 and 31/12/60 should have a six month period of residential instruction from 1/1/74 to 30/6/74 all kinds of objections arise[1]. Why these children? Why six months? Why residential? etc..

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[1] Some purists might argue that this is not an edueational objective but rather an administrative or legislative objective. These latter species, of which this is one, are generated by politicians and administrators faced with considerations of educational philosophy, economic and general development plans of nation, political tenets. Educational is applied rather loosely here indicating that the objective applies to the education sector.

The programme of events set in motion to accomplish this objective is, however, much more easily costed and the objective is more easily assessed than the vague aims a) b) c) above.

Whatever the list (and order) of aims put forward for education, few of these aims are going to be such that the criterion of attainment can be expressed in monetary units. Hence, cost-effectiveness analysis is indicated as the more appropriate technique. The educational aims held by most people are just not expressible in money terms because there is no market in which the benefits, output etc., can be priced. But the education system can be regarded as selling part of its output in the labour market; the payments , of course, accrue not to the system but to the individual. Side-stepping the issue of whether the 'prices' correspond to the value added by education, there is some possibility that the earnings of the educated persons might be used to price the output of the educational system. If the vocational goal were the only aim of education, then educational projects could be appraised by cost-benefit techniques. Where cost-benefit analysis of education has been attempted it has been termed rate-of-return analysis. This technique involves the computation of the discount rate which equates the present value of extra lifetime earnings attributable to a certain quantum of additional education. Some of these studies have already been mentioned in Chapters 1 and 4.

We consider now quality of education in relation to the objectives set for education. The objectives of education are manifold. Priority of the vocational objective is by no means assured so that assessment of educational projects on the basis of a rate-of-return analysis is but part of the story. The outcome of any educational programme must be viewed from other points of view. In other words, there are several dimensions in which objectives may be found and quality may be evaluated. Three problems arise in considering quality in a multi-dimensional system. They are: 1)/

1) the identification of the aims and objectives,

2) the recognition of some priority list among the chosen aims and objectives,

3) the validity and reliability of the measures used to assess the attainment of the aims and objectives.

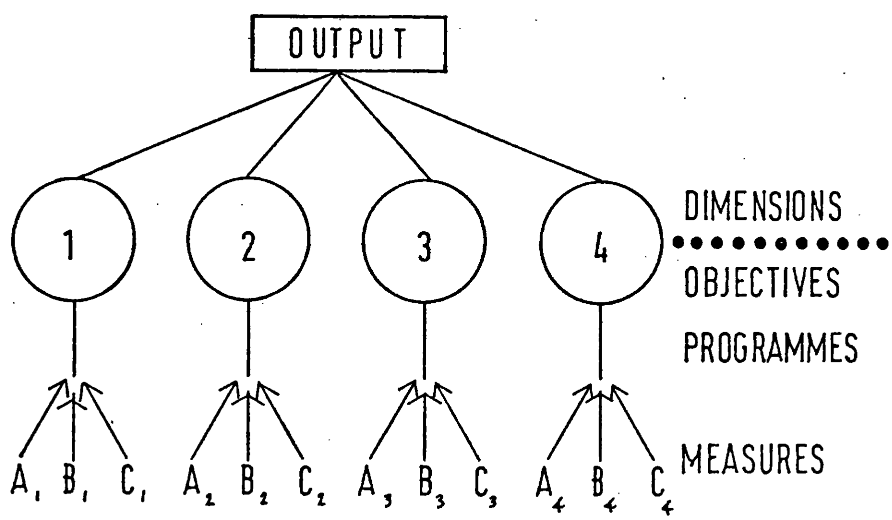
When measurements are possible, they are normally taken after some educational programme, i.e., the measurements are taken of the means to the ends. This mechanistic view of education as a means-end process may well distort a fundamental feature of the educational process, namely, the all-through-life influence of some of what goes on in education. Measurement of an educational programme may indicate that the programme was ineffective, yet the effects of the programme may be latent for many years.

Quality; A suggested Mode Of Interpretation

We move on now from a consideration of the various aspects of quality of education to what the writer regards as the most useful way of dealing with the concept of quality whenever it is linked up with inputs. Quality is to be interpreted as an assessment or measure of an objective in one of the educational dimensions to which a value, relative to the other dimensions, has been given. This mode of interpretation may be illustrated by the following schema and examples.

Fig 7.1 Fig 7.1

Quality : A Suggested Mode Of Interpretation



Where do the following conventional sayings fit in the above schema? "He is a poor teacher". "The conditions in that school are bad". "That county has a progressive education policy". "Today's school leaver is more sophisticated than his counterpart 20 years ago". "This year's sixth form is better than last years ". All of these are referring to evaluations of the quality of education in terms of what the speakers think are educational considerations. Another set of apparently educational clichés are in fact, influenced more by social, economic and political considerations. Thus "we are making better use of our childrens' brains now than we did before the War". "Classics is a waste of time". "Comprehensive education gives the manual working class better educational opportunities".

Value judgements of these kinds abound in education. Often it is implicit in these judgements that the academic dimension is the most important and that results on external examinations are <u>the</u> measures of academic achievement. Few people would argue that for most types of school, one of the objectives should centre on the learning of the students. Whether this objective should over-ride all other objectives is another matter. Also, performance in external exams is only one measure, say measure A_1 of the objective (1). Another measure, measure B_1 might be an internal assessment of the pupil's performance in certain curricular areas. In the extreme case, it would be quite possible for a school to satisfy the 'academic objective' without subjecting itself or its pupils to external assessment. We see that there may be several indices put forward for one educational aim. All of these indices may not point in the same direction. Whenever indices conflict, doubt is expressed about the validity of particular indices. For instance, some people may object to a school, which is successful in external exams, being judged as 'good' on the grounds that external exams are not a valid measure of 'goodness' in academic achievement.

Within any hierarchy of aims there might be two or more which are incompatible. For instance, suppose that one objective is to maintain a considerable flexibility of curricula and that this requires, in a particular school, a pupil/teacher ratio of 12:1. Another objective is to retain <u>all</u> 15 year olds for a further year of voluntary education. If/

If staff numbers and accommodation are fixed, an impasse is reached for both objectives cannot be simultaneously attained.

Summarising the argument so far; even though a set of educational objectives could be agreed upon and stated in a precise form, there would be doubt concerning the order of priority of these objectives, there may exist incompatibilities among them and there may exist a number of measures of their attainment not all of which point in the same direction.

A most obvious point not made yet is that for some objectives there are apparently no available measures [2]. This <u>may</u> be the fault of the objectives being maintained on too rarified a level. For instance, one aim of education concerns the social awareness of children, by which aim we might mean the extent of their involvement in the community, how well they integrate with their fellows. In the language of programmed instruction, this objective is non-behavioural i.e. it is not stated in such a way that terminal behaviour is explicit. To put that another way, we do not know what it is we want the pupils to be able to do after they have pursued the given aim. Programmes of social education involve visits to old people and nursery schools, working with handicapped children, running events for charity. How does one judge the success of these programmes? Is there a measure of the success of a 'jumble sale'? How far do such educational programmes bear upon the 'social awareness of children'? One might be forgiven for asking what 'social awareness' is !

Returning to the theme of <u>measures</u>, another problem concerns the long-term nature of the effects of education. In economic terms there is a time lag between investing and reaping the returns. Most of the conventional measures used in education are short term, e.g., exam results, percentage graduating, scores on standard tests.

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[2] Strictly speaking, these are not objectives but aims. Properly stated objectives generate measures of attainment.

Except for rate-of-return analysis, which does encompass measures of the future prospects of students, conventional measures of success can clearly only catch part of reality in their conceptual butterfly nets. To take a specific case, three 'A' levels reflect some attainment at school, but further success, say, at university, is seldom attributed to the school. It is attributed instead to the university. It is always easier to assess a pupil's proficiency in skills that can be measured in the short run than judge the effectivenss of a programme or stage in education that should appropriately be referred to long-run consequences. For instance, one may propose that the measurement of success of a programme of primary mathematics should not be limited to scores of tests in primary maths but should relate to performance of students in secondary and further education in the subject. Also, it is too simple to refer the value of the output (measured by rate-of-return analysis) from one level to that level only. As discussed in Chapter 1, there is good reason to believe that socio-economic background as well as previous education very much affect the value added at each stage of education.

The complementary issue also crops up, viz., the 'potentially' high quality course or programme which never leads to the expected long-run consequences because of lack of follow-up. Much general education, even if judged by short-run techniques as 'good' may lie dormant through early-leaving or lack of on-the-job training. Such an occurrence is an example of something being judged on educational criteria as good but, on economic criteria, such education is wasteful and therefore bad. Further, although educational objectives may have been attained the broad aims of education (the consensus from educational, economic and political considerations) are not realised.

Beeby (1966) sums up the frustration of those who ponder the quality of education.

> "There is no reason to expect that, in any ultimate sense, men are any more likely to come to an agreement on what constitutes good education than they are on the good life".

Statistical Measures of Quality

The highly complex nature of the quality of education has led economists and educational planners to adopt proxy measures of quality. Among these are;

1) the ratio of pupils to teachers, P.T.R.,
2) the schooling rate at different levels of education,
3) the drop-out and repeat rates.

1) Quality related to P.T.R.

There is a common belief in education circles according to which the smaller the class, the better the quality of teaching. There is a plausible argument in favour of small classes, based on individual attention, knowing the pupils, identifying learning blocks, aiding the weak, better discipline etc.

A systematic study of this quality v P.T.R. involves two considerations;

a) the relationship of P.T.R. to class size,
b) statistical measures of quality related to class size as available from empirical studies.

a) The relationship of P.T.R. to class size. Only at the primary stage of education is this relationship relatively straightforward. At later stages the numerical value of the P.T.R. is hardly worth quoting if class size is being considered, because there is a wide variation in class sizes even within one institution. The P.T.R. denotes the ratio of the total number of pupils to the total number of teachers. A P.T.R. of 10 indicates that there are ten pupils for each teacher. A primary school with a P.T.R. of 25 will have classes on the average larger than 25 if one of the 'teachers' is a 'non-teaching' headteacher. The present P.T.R. in universities is 8:1 which low figure is due to the amount of non-teaching time of most staff. Classes vary in size from 1 to 300. The modal class size (which may be more appropriate than the mean class size) may lie around 45. But, there are too many 'mays' and 'mights'. About the only point which is certain is that the P.T.R. is only a rough guide to actual class size.

b) <u>Quality and class size : empirical studies</u>. An exhaustive list of all studies pertaining to class size and quality would do little to clarify the problem. The results of the studies discussed below illustrate the many facets of the problem.

(i) Goodlad (1954) concludes that studies of class size before 1925 sought to relate class size to measureable pupil achievement and the overall impression is that there is nothing to show that 'large' clasees materially affected attainment in subject matter under teaching techniques considered typical of that time. He goes on to suggest that certain peripheral research into the effects of teachers on pupil socialisation, peer group formation, etc., may be more significant for the problem than seemingly more direct studies.

(ii) One of the pre-1925 studies went further than correlating class size with grades. Davies (1923) investigated how 1100 teachers spent their time in school and what size of class they liked teaching, and concluded that if teachers could be relieved of some of the added clerical duties caused by large classes (more than 30 pupils) greater numbers would prefer to teach large classes. Typical of the early researchers in this field, Davies uses a very crude experimental procedure and it is hardly surprising that, in the absence of multi-variate analysis techniques, he fails to show a direct relationship between grades and class size, even if there were one.

(iii) Spitzer (1954) adopted a more rigorous methodology when he administered the Iowa Every-Pupil Tests of Basic Skills to 179 elementary school classes, divided into 'large' (more than 30 pupils) and 'small' (26 or fewer pupils) classes. He concludes:

> ".... pupils in 'small' classes have no advantage over those in 'large' classes in acquiring the kind of achievement measured by the Iowa Every-Pupil Tests of Basic Skills".

(iv) A national study in U.S.A. of educational attainment -"Project Talent" - indicated that neither school size nor class size correlated with output as measured by scores on tests of "in-school" and "out -of-school" learning (Dailey,1964).

(v) An English study concentrated on relating 'O' and 'A' level results as well as Open Awards to Oxford and Cambridge with school size. The finding was that small schools are not producing such good results as the large. No data is given by the author of this study on class sizes. (Lynn, 1959).

(vi) One of the few investigations into university teaching methods - The Hale Committee Report - reports a study of success ratios and size of tutorial group at the Chemistry Department of Edinburgh University. The conclusion to the study was that

> "There is clearly no measurable advantage in reducing the size of the group below 12 students". (Cottrell, 1964)

(vii) A comparison of the attainments of pupils from different sizes of primary schools in terms of scores in English and arithmetic found that pupils from one-teacher schools reached the same standards as those attained by pupils in schools with more than six teachers. (S.C.R.E., 1963) But the same study yielded no clear conclusions when the effects of class size on attainments were analysed.

All of the above studies may be examined in terms of the suggested mode of interpretation of quality put forward earlier. First, all the studies by concentrating on one dimension of educational quality- the academic one- imply that the optimum size of class should be set on the basis of academic or sholastic attainments. Secondly with the exception of study (vii), little trouble is taken to identify and control all the variables which might affect what it is that is being measured. Almost as an afterthought the author of the study of English exam results asks if the fact that the large schools in his study were of generally agreed higher status and therefore "attract better teachers" might affect his results. The university study involved a number of different tutors teaching groups of different sizes. The writer, having been one of the students involved in that experiment, knows something of the range of teaching ability and/or the level of interest in teaching of the different tutors. It would have been a miracle if any differences in scores between groups had been found in that study since so little work was done and so little time spent in those tutorial sessions. The authors of the S.C.R.E./

study did, however, conclude that the only way to obtain information on the optimum size of class in a primary school would be to set up an experiment expressly designed for the purpose.

Even when a rigorous research methodology is adopted and sophisticated statistical techniques applied to the results, no convincing evidence appears to support a causative relationship between class size and quality. Such a study, carried out in Sweden, made 281 comparisons of attainment between pupils in larger and smaller classes; 37 comparisons favoured larger classes 22 the smaller and in the 222 remaining comparisons the differences were not significant (Marklund,1964). Marklund qualifies his results by adding that "although it cannot be said that class size lacks relevance for the achievement of pupils, these investigations have shown that differences fail to appear even when such factors as level and homogeneity of intelligence, standard scores and social pattern etc., are controlled".

Glib assertions of the superiority of 'small' classes over 'large' [3] classes may well arise from an unquestioned assumption that what the teacher teaches is distributed to each individual in the class, with the result that the larger the class the lower the unit quantity of knowledge imparted. In other words, teachers (and others too) believe that the pupils in a class share among them what is communicated. But knowledge or teaching is not a good like that [4]; the amount of either imparted to one pupil does not necessarily reduce the amount imparted to another.

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[3] 'Small' and 'large' are relative not absolute terms. While a class of 40 may call for more effort from the teacher than a class of 20 in the same subject, does a class of 20 require proportionally the same extra effort compared with a class of 10? At what increase in size should one look for differences in attainment (supposing these exist)?

[4] Knowledge and teaching are not synonomous. However, a large part of what a teacher does comes down to the imparting of knowledge and the giving of skills. The teaching of some skills, e.g. playing the violin is normally regarded as requiring one teacher for each learner. There are other skills e.g. the interpretation of rain fall maps which can be taught by a teacher to a large number of learners.

Teachers do observe, however, that large classes, as a rule,

(i) are more difficult to discipline,

(ii) are more difficult to organise for groupwork,

(iii) take up more time in administration,

(iv) reduce the amount of space per child,

(v) require more time for correcting of exercises.

In a sense, larger classes require the teacher to work harder for the same output in terms of what it is he does when he teaches. The clumsiness of this last phrase emphasises the difficulty we have in discussing the job of a teacher. We would suggest that only some of the tasks carried out in a routine day are likely to have an effect on attainment, as measured by some exam or test, of the pupils. Other things that a teacher does might aid the attainment of other objectives. Thus, one may predict that in large classes less time is devoted to informal conversations with or counselling of pupils. If one aim of that teacher or school is to help the pupils with their personal problems via informal teacher-pupil contacts, then a reduction in such contacts may lead to a lower quality in that dimension.

Finally, on this topic of quality and class size, the evidence of empirical studies and the above considerations of the multi-dimensional nature of education suggest that there is little to be gained by further investigations of narrow attainment scores in relation to class size [5]. Analysis of the teacher's task and how it is related to educational objectives by work study methods seems more appropriate now. Specifically, we would want to know how different class sizes bear upon the job content and what might be done to redistribute some of the jobs to other forms of labour. Such a research study would certainly be based on cost-effectiveness analysis. A hypothetical example of this kind of analysis occurs in Appendix 4/A.

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[5] Even this tentative statement must be qualified by saying that the size of classes considered seems always to have been less than 45. It is certainly worth pointing out that no-one has come forward with evidence regarding relative attainments of pupils in classes of, say, 20 and 100.

Quality and the Schooling Rate at Different Levels of Education

Another index of quality is the schooling rate statistic. The schooling rate statistic is the ratio of school population to that of child population for the same years e.g. the schooling rate for primary education in U.K. is roughly 99%,that for pupils aged 15 - 18 years old was just over 25% in Scotland in 1969. In thekeeping up with the Joneses game - played at international level - schooling rates for different countries are employed by planners as quality indicators. Although these schooling rate figures may be more accurately termed quantity rather than quality indicators, on the basis of the suggested mode of interpretation of quality, if a national educational objective is to extend primary education to all children of appropriate age, then the relevant quality index is the schooling rate.

3) Quality and Drop-Out and Repeat Rates

In a country with a large wastage rate in education "the cost per graduate will be higher than it would have been if all students had been automatically promoted from one grade to the next higher one" (Werdlin,1966). If an output dimension is 'qualified' school graduates and if a measure of this dimension is given by the wastage rate, then a high wastage rate does indicate a low quality and vice versa. The wastage rate statistic is again but one measure of one dimension of quality. Drop-outs and repeaters are the result of a host of social and economic influences as well as what actually goes on in the classroom.

Quality and Costs

The first two quality indices - P.T.R. and schooling rate - cause unit expenditures to increase, if a higher quality is planned, i.e., a lower P.T.R. and a higher schooling rate. (A higher schooling rate is nowadays associated with increasing the numbers of pupils/students in the non-primary levels of education. Secondary and tertiary level unit costs are generally greater than those at the primary level so that an increase in the schooling rate causes the average unit cost to increase). From the analyses of educational costs in Chapters 3,4 and 5 it is evident that P.T.R. and Schooling Rate are two of the main factors which make for high unit costs in education.

Indeed, high unit costs have been mentioned by some economists (usually in relation to income per head figures or proportion of G.N.P. spent on education) as pro$_{xy}$ indicators of the quality of an educational system. Statements of that kind make little sense unless one knows what is done with the money, how the costs are divided between the various levels of education, what salaries teachers receive relative to other workers, what kind of qualifications and training the teachers receive. Unit costs can never be taken seriously as indices of output.

But how does quality in any of its aspects relate to the inputs of education ?

Cost/Quality Relationships in Education

The suggested mode of interpretation of quality is now used to interpret four case studies of cost/quality relationships in education. A blue-print for possible cost-effectiveness studies is subsequently presented.

Case Study 1 Payment-By-Results

The Payment-By-Return system of education linked the income of schools to the results obtained by pupils in tests. It had, therefore, potential for increasing efficiency and productivity in the narrow range of attainments covered. It was instituted after the 1861 Newcastle Commission had reported adversely on teaching, and had recommended, as the only way of increasing efficiency, the institution of an examination in the three R's of every child in every school to which grants were made. The system was introduced into England by Robert Lowe in the Revised Code of 1862. The Code's terms were strict - an annual grant of 4/- for each child in average attendance and 8/- for passes in tests of reading, writing and arithmetic. It was not until 1890 that the system was abolished from Scottish primary schools [6]. An example may give some of the flavour of the scheme.

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[6] Scottish schools were exempted in 1864 from the revised code, but the system continued to operate until after the Scotch Education Department was formed in 1885; subsequently a Scottish code was laid down in 1886.

The letter which follows refers to a year long wrangle over the publication in 1887 by Greenock School Board of a list showing the order of merit of the headmasters of 11 public schools with respect to the passes and grants earned. The Board also announced the transfer of the headmasters of the lowly schools 9 and 11 to other schools.

> "Are promotion and degradation in school service in the case of two teachers of schools both well up to the mark to turn upon the consideration that one of them makes a little higher grant than the other? The inspectors themselves have repeatedly declared that such a test is entirely fallacious. They affirm that the efforts of teachers to reach what is called a "clean sheet" is the bane of school examination. But school boards will persist in laying stress on high percentages and teachers accordingly struggle to please their employers though they are aware of the folly of it. It is school management made easy to go by the tabulated passes. Not even in Greenock can the play of human feeling be regulated by arithmetical results". (Herald,1888)

Cooper (1968) commenting on the affair of the demoted headmasters says :

> "It was not unnatural that under a system of payment-by-results the ability and worth of a teacher or headteacher should be judged largely by the amount of grant earned by the pupils".

The case illustrates the actual workings of the system. Output was seen in terms of a single objective or dimension, viz., attainment in reading, writing and arithmetic. Unitary measures of this dimension, applied by inspectors, established quality. Here is a cost-effectiveness study which puts the cart before the horse, the effectiveness of performance determining the total income of the school, thus controlling costs.

Case Study 2 Scientific Management in American Education (1910-30)

Indiscriminate application in American education of the principles and methods of Taylor's system of Scientific Management led to a situation where quality was synonomous with low costs. A leading educational administrator of the time held that;

> "Comparison of the costs of the unit under different conditions is, perhaps, the best starting point for a campaign to reduce unit costs or to improve the quality of units of service". (Quoted in Callahan, 1962).

Efficiency, defined as a maximum of service at a minimum of cost in every school and every subject, was evaluated by means of school surveys, and enhanced by a platoon-school organisation. The aims of the surveys were to establish:

1) what returns the community received from its investment in schools;
2) how the investment might be made to yield greater returns.

Some trappings of the system were rating scales, inventories of teacher effectiveness/efficiency and "zone of safety" costs.

The platoon school or factory system aimed at intensive use of plant by enrolling 10 - 70% more children than there were seats for in the classrooms. If it is recalled that current building standards allow for 1.5 places per child in a secondary school, it is clear just how much standards of educational provision, as we judge them now, were depressed. Of course, unit overhead costs and staffing costs were also cut drastically by the platoon school system. Had quality in some shape or form remained constant, then productivity would have been increased under the platoon school system. The hasty retreat from the system indicates that some people believed that quality had fallen too far. As an offshoot of the platoon schools, monster high schools of 6,000 made their appearance.

In the light of current trends in cost-effectiveness analysis, the Scientific Management movement did isolate some important problems. Among these were;

1) the attempt to set definite and clear aims in education,
2) the search for an internal school organisation capable of attaining these aims,
3) the realisation that a new genus of teacher-administrator was required to organise schools.

The proponents of the system failed, however, to grasp that education is a multi-dimensional concept. No single easily administered instrument exists, or is likely to exist, for measuring the quality of education.

Successive generations of educational administrators may fall into the trap of thinking they have found the philosopher's stone of education in the true measure of efficiency. A post-war text on efficiency in American education had some influence in U.S.A. because of a league table for the 48 States of "efficiency in the expenditure of public school funds" (Hughes,1946). The measure of efficiency chosen was the relationship of the predicted level of accomplishment of a state, in terms of enrollment ratios and wastage rates (x), to the expenditures per child on education (e). A neat curvilinear relationship was found, indicating that, beyond a certain point, increased expenditures on education tend to bring diminishing returns in terms of increased accomplishment. The formula was $x = 9.6 + 1.23e - 0.0056e^2$ (sic !).

Case Study 3 Productivity Trends in British Secondary Education 1950-63

Blaug and Woodhall (1968) studied the trend in total-factor-productivity in terms of a time series of output per unit of combined inputs. The inputs were 1) income forgone by pupils, 2) salaries of teachers and other staff, 3) services of buildings and materials as measured through imputed rents and expenditure on materials. The inputs, on the one hand were aggregated to give a weighted index of inputs. Output, on the other hand, was disaggregated. In other words, output was viewed as multi-dimensional and measure(s) of the different notions of effectiveness taken. Three dimensions were considered:

1) Length of Schooling : 2 measures were taken -

   (a) number of pupils completing a school course,

   (b) number completing course weighted for length of course.

2) Academic Attainment : a single measure of this incorporated an arbitrary weighting system for the number of 'qualified' leavers related to their success in 'O' and 'A' levels.

3) Economic Potential : a single measure formed from the number of leavers with different earning capacities as revealed by age-education-earning data, students with relatively higher earning potential being regarded as more output.

The change in productivity was taken as the difference in the ratios of each of the four measures of output to input (aggregated) calculated at the terminal years. They found that whatever measure of the index of output is used and however much allowance is made for errors in calculating the input, there has been a decline in total-factor-productivity or effectiveness per unit of costs from 25%-35%.

over a 12 year period for secondary schools.

Blaug,himself, in a discussion of these findings points to one of the more obvious criticisms of them : it is possible that

> "it can be shown that there are objectives of education that can be scaled which we have ignored, or that there are improvements of quality that can be quantified which we have failed to introduce into our argument ......" (Blaug, 1968A)

Yet, in the paper itself there is little or no mention of the other objectives which cannot, as yet, be measured. If one of the objectives of our education system is that the pupils and students should be 'happy' while at school, and should leave reluctantly rather than gladly, how has the attainment of this aim changed over the years? It might be that the pupils who were educated in secondary schools in the sixties were both 'happier' in school and more positively inclined to education than their counterparts a decade earlier. The time-lag effect in education may operate in such a way that it will be the offspring of those educated in the sixties who will benefit from the additional educational inputs noted by Blaug and Woodhall: for these children should be nurtured in a home environment more positively oriented to education. According to the evidence relating home background to academic performance, the attainment of these 'better nurtured' children should be increased [7]. If much of this reasoning appears far-stretched, it may be because the educational process is a complex business and not readily susceptible to neat analysis in terms of clear cut cause - effect relationships.

Another aim of our education system, and the stimulus to comprehensivation, is the equalising of educational opportunity and the merging of social clasees. Evidence available in this and other countries suggests that the rates of participation of the social classes in upper secondary and higher edcuation have not moved much in the past few decades (O.E.C.D., 1967).

[7] The Plowden Committee reported that about 50% of the variance in student performance can be accounted for by the home, of which more than half is accounted for by such variables as the literacy of the home and the aspirations of parents for the childrens' education. Plowden (1967).

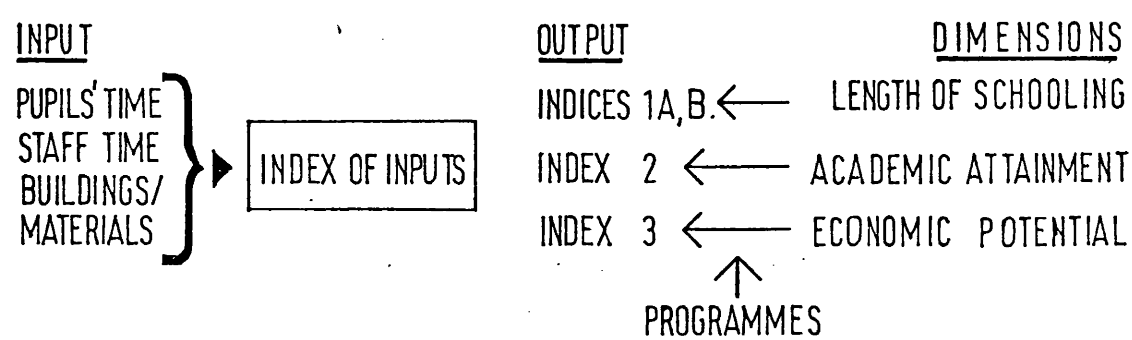
But Woodhall and Blaug made no attempt to assess any subtle movements in participation rates over the period studied 1950 - 1963.

A clear aim of modern secondary education is to enhance the child's appreciation of his environment; towards this end there has been a noticeable increase in courses in art, music, physical and recreational activities. This aim is in line with a societal preoccupation with using leisure purposefully and filling it with what society regards as 'valuable' activities. In addition, there is increasing acceptance of the view that man works harder if he has a full and creative leisure time.

However woolly, and unquantifiable these three aims are, they do exist. They are the cause of expenditures. By concentrating on what they could measure and assigning all costs to the three output indices, Blaug and Woodhall made a miscalculation. They ascribe the whole rise in inputs to the traditional categories of school output, whereas they should have acknowledged the limitations of their output measures and adjusted the estimates of input accordingly. Moreover, the aggregation of input hides the heterogeneity of the make-up of costs of education. One might well ask how much the vastly increased inputs in terms of equipment, furniture, administrative staff and maintenance have to do with the three dimensions of output chosen for quantification. The present writer takes the view that Blaug and Woodhall, in arriving at the input/output ratios, adopted a faulty measure of inputs. The reasoning behind this criticism will be illustrated with reference to the input-output schema below.

Fig 7.2 Fig 7.2

The Input - Output Schema



The basic assumption behind Blaug and Woodhall's calculations is that the index of inputs (total inputs to all secondary education) is directly relatable to the four chosen indices of output and, what is more, the input index is relatable to only those four. In other words, they are assuming that the total input to secondary education causes the level of attainment observed in the four indices chosen. Clearly anything else which is produced in secondary education is produced at zero cost, for all costs have already been allocated. In an ideal cost-effectiveness study one would allocate total inputs to the whole range of programmes, courses or functions. For instance, one would insist on isolating all the costs of providing courses which lead to O and A levels. However, as it has been pointed out already (Chapters 1 and 4) the economic activity of education is not one where the effects of particular expenditures can be observed nor can one easily trace the costs of particular educational effects. These problems of input-output relationships are especially knotty at a macro level where, traditionally, expenditures are not allocated to functions or programmes but rather to broad accounting categories. With the case in point it is not possible to say with complete certainty what programmes or activities in education are relevant to the attainment of objectives in any of the three dimensions. As the state of cost statistics stands, it would not be possible to say what a particular programme did cost even if we could isolate the programme from all the other educational activities. (We shall return shortly to the problem of applying cost-effectiveness techniques in education).

In essence, what is wrong with the cost-effectiveness study of British Secondary Education is that the objectives chosen for study were too ill-defined. As a result, a) it is not possible to identify the true costs of educational programmes or courses and b) the single measure of input is hard to justify and difficult to understand when it is tied to separate indices of output. While this conceptual difficulty as to which inputs refer to which outputs is the most important limitation to the approach, there is a further limitation caused by an insufficient exploration of the measures of output which were chosen.

Case Study 4 Self Instructional Materials in Medical Education

An experiment in Glasgow University involved a group of students being taught part of a course in Endocrinology by programmed slide/tape presentation (Dunn etal., 1970). The programmes proved to be more effective than conventional instruction; that is, in terms of one dimension of the output and of a single measure (the normal term examination). The students who followed the self-instruction presentation had a mean score of 75%, while those who followed the conventional lectures had a mean score of 48%. On account of the educational implications of their work, the authors assessed the cost implications of teaching the entire fourth year of Medicine by programmed methods. Two self instructional systems were considered and alternative assumptions concerning the number of student users were made. The conclusion was that if there were 275 users [8] the cost per student-hour of one of the systems (Kindermann) was comparable to present unit costs for pre-clinical medical education. Cautiously optimistic about the experiment, they conclude:

> "... the problem in implementing either of the self-instructional systems ..... is to avoid the cost of educational technology simply being added to the costs of conventioanl instruction".

Of the four cases examined above only the last one has any claim to be a cost-effectiveness study, for only in that study is it possible for a decision maker to choose among several 'feasible' alternatives on the basis of their costs and performance in attaining the objectives. To put that another way, only in the micro-level case study is it possible to tie up the costs of the instructional programme with some measures of its effectiveness.

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[8] 275 is the maximum number considered for that is the size of the intake of students per year recommended for Glasgow in The Royal Commission in Medical Education (p.155).

Blue-Print For A Cost-Effectiveness Study In Educational Technology

Without overstating the case, it appears that if cost-effectiveness analysis has applicability in education, then, until such times as there exist agreed aims for education and behaviourally explicit objectives, their main use will be at the micro-level of education [9]. It is proposed that quality should be limited, in these micro-level studies, to the form in which one or more measures of a quality dimension can be made. By the micro-level we mean the school or some sub-part of the school or even some part of the curriculum in one or more schools. There is support for this view that it is on quality at the micro-level that research should be ooncentrated:

> ".. it is conceivable that progress in the education does not wait upon either (1) the identification of the contribution of educational services to economic productivity generally or (2) the measurement of broad changes in educational productivity itself. Rather, progress in the efficient allocation of resources in school systems may well result from a more pedestrian task: the careful observation of sepcific classroom practices to the end that hypotheses of the learning process may be tested and refined". (Benson, 1961)

The strength of the cost-effectiveness technique used at the micro-level lies in the relatively unambiguous nature of the results. As the analysis of Blaugh and Woodhall's work showed, conclusions of macro studies may be subject to so many qualifications that their value (or applicability) is doubtful. To pursue the comparison between the macro and micro approaches in cost-effectiveness analysis a shade further, let us look at the nature of input-output relations at both levels. Repeatedly it has been emphasised that the inputs to education are heterogenous — people's time, buildings, land, equipment-and outputs are also many sided.

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[9] Aims are non-operational general statements which require sub-statements of objectives. Objectives are, ideally, stated in behaviourally explicit terms, are used to generate means and are incorporated in measures of progress towards aims.

If the assessment of the quality of education is confined to educational or intrinsic consdierations [10], a reasonable division of inputs would be in terms of those with definite educational effects, those with possible educational effects and those with no educational effects. In the first category we may put expenditures on teachers; in the second category we may put expenditures on the school buildings; in the last category we may put expenditures on the interest on borrowed capital. But these are tentative allocations of expenditures because we have no firm evidence about which inputs have educational effects; nor do we know how measurable these effects are where they do exist. Until such times as the nature of the relationship between inputs and quality is understood, cost-effectiveness studies at a national or other macro level will be of minimal value since the costs quoted will not refer to the measurable educational effects only but to all three kinds of effects. In contrast, new and alternative ways of giving instruction in some area of the curriculum in one institution are much more readily costed and indices of quality more readily obtainable. The alternative systems can be costed as one-off exercises and, from these costs, forecasts made of required budgets in relatinn to predicted output. We shall return to this scheme below.

To sum up the discussion of cost-effectiveness studies at the micro level in education:

1) It should be possible to cost the programmes, because most of the costs are identifiable and allocable.
2) Measures of the quality, or one dimension of it, should be available.
3) The possible dangers of sub-optimisation must be guarded against.

A word on this last point is in order. To take the case of the medical project, it is evident that the aim of lectures in fourth year medicine must be derived from the aim of the whole course in medicine, which latter aim is tied to the current and future national needs for doctors.

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[10] The question of educational quality looked at by educators rests on assumptions concerning the ideal of an educated man and on what constitutes good educational practices. These are assessments derived from <u>intrinsic</u> considerations. But one can assess quality of education in terms of <u>extrinsic</u> considerations e.g. how schools produce the required skilled manpower or how well schools contribute to a political ideal of, say, a classless society. The two considerations can clearly be out of step as when society maintains an ideal of the educated man which ignores manpower considerations (Peters, 1969).

No matter how efficient the fourth year lectures are (in cost-effectiveness terms say) if the higher order aims are astray, the efficiency of the fourth year course counts for naught. An equally possible danger is that fourth year medicine will be efficient at the expense of other programmes, so reducing overall efficiency. While warning of these pitfalls, it is necessary to balance the scales by saying that it is of course possible for overall efficiency to be increased by increasing the efficiency of each sub-system. In an economic activity such as education, where so little work has been done in identifying aims and investigating alternative means to objectives, it is maintained here that cost-effectiveness studies at a micro level are potentially very useful.

Cost-effectiveness analysis is a particular type of investment-appraisal activity. Provided the limitations of the output measures are understood, it should be the aim of every educational innovator and administrator to support the claims of his particular learning system with data in cost-effectiveness terms. It is suggested that where no measures of any output dimension are presently identifiable, cost data should be related to 'through-put' e.g. number of pupils, required teacher-hours, programme-hours, space-per-pupil. But the essence of all cost-effectiveness studies must be the presentation to the decision maker of alternatives. What follows is a continuation of the planning theme of Chapter 6. It sets out the lines of approach for planning on alternative assumptions.

Blue-Print for a cost effectiveness study in educational technology

The outline presented should be applicable, with modifications, to programmed instruction, language laboratories, E.T.V., and some forms of curricular design. [11]

[11] The lay-out of the costs schema owes something to the discussion of possible programme budgeting structures in Chapter 7 of Educational Manning - Programming - Budgeting (Hartley, 1968).

A division of costs is made between a) production b) transmission/ reception. In practice the assignment of outlays in this way is not always possible, for instance, when a tape-recorder is used for producing and transmitting some part of a curriculum.

Fig 7.3

Fig 7.3

PRODUCTION COSTS SCHEMA

	SCHEME A FOR (STUDENTS)			SCHEME B FOR (STUDENTS)	
Head of Expenditure	100	500	700	50	1500
A Direct : Allocable					
(1) Professional Salaries					
(2) Support Personnel					
(3) Capital Equipment					
(4) Consumable supplies					
(5) Library/learning materials					
B Indirect : Joint					
(6) Administration					
(a) Salaries					
(b) Other					
(7) Repair & Maintenance					
(8) Capital Charges					

Fig 7.4

Fig 7.4

TRANSMISSION COSTS SCHEMA

Heads of Expenditure	SCHEME A for (STUDENTS) 100	500	700	SCHEME B for (STUDENTS) 50	1500
A Direct : Allocable					
(9) Professional Salaries					
(10)Support Personnel					
(11)Capital Equipment					
(12)Consumable Supplies					
(13)Library/learning materials					
B Indirect : Joint					
(14)Administration					
(a) Salaries					
(b) Others					
(15)Repair and Maintenance					
(16)Capital Charges					

First,let us consider the production costs. Production costs cover all the activities in bringing together the hardware and software so as to make a learning package. Some attention will now be given to the meaning of the heads of expenditure in the above Fig 7.4.

(1) Professional Salaries: the time of teaching staff, curriculum designers, psychologists etc., involved in producing the first oopy (i.e. before"Mass" publication). This will be the most substantial element in the production costs.

(2) Support Personnel: time of technical help, both during the production of first copy and in the mass production stage.

(3) Capital Equipment: deferred costs on durable equipment, or rental charges.

(4) Consumable Supplies: audio and video tapes (joint with Transmission perhaps), paper, lettering and titling.

(5) Library/learning materials: books, film strips, newspapers, anything purchased for research and development stages of project.

All these are costs which are incurred directly as a result of the production of the new system . In this respect, they are direct or allocable costs. There are other costs which are often subsumed in overheads - these are indirect or joint costs - concerning which there are the problems of allocation discussed in Chapters 2 and 3.

(6) Administration (a) Salaries (b) Others : even though no increase in the number of administrative staff nor in accommodation, nor in equipment is made, some allocation of these actual costs should be made to the costs of production. This is particularly important when alternative schemes involving different numbers of potential users are put forward.

(7) Repair and Maintenance: referring to premises or rooms in which production occurs.

(8) Capital Charges: For construction of new premises and major improvements of existing premises there are two financial components, namely, the amortised (principal) cost and the annual financing (interest) cost. The separation of these costs from the school functions within the premises causes one to overlook the differential cost - space relationships that exist between different school functions. Space utilization should be a cost consideration.

Production costs are apt to be very heavy for the first copy and to increase very modestly for additional potential users. The following table of costs for the medical education project illustrates the advantages of making alternative plans.

Fig 7.5 Fig 7.5

Production Costs (Total And Unit) For Three Student Target Groups

		LOO Students	200 Students	275 Students
Production:	Copies required	14	25	35
	Cost for one year	£13,400	£16,700	£19,700
	Cost per student	134	83.5	71.6

Source: Adapted (Dunn etal., 1970) Table 5A

Now, we shall look at the so-called transmission/reception costs.

Transmission/reception costs cover all the activities necessary to bring the produced unit of instruction to the learner. These instructional units of learning packages vary from programmed textbooks to batteries of presentation devices, such as automatic slide projectors, audio-tape, reference books and demonstration apparatus.

(9) Professional Salaries; one view of learning packages is that they should be self-sufficient and not require highly paid professionals to transmit them. Another view is that learning will be aided by the presence of the teacher[12]. Clearly in E.T.V. a high bill for Transmission/Reception occurs because engineers/technicians transmit the programmes and teachers are normally present during the viewing period as well as in the preparation and follow-up sessions (and accordingly their time should be costed to the Transmission/Reception costs of programme).

(10) Support Personnel; wherever transmission/reception is via electric/electronic machines, skilled servicing engin-ers are required to deal with recurring faults.

(11) Capital Equipment; deferred costs or rental charges ; include such items as servicing contracts, repairs/maintenance.

(12) Consumable Supplies; student's work books, items not included under Production Costs.

(13) Library/learning materials; some overlap with (12), distinction is that these are reference items for reception e.g. library books, maps, models, demonstration apparatus.

(14) Administration; (a) Salaries (b) Other. Allocation of admin. costs at transmission centre (if E.T.V.) and reception centre on the basis of either (1) number of hours of transmission and number of student-hours of reception (assuming the admin. cost per student-hour is known for the institution) or (2) a cost allocation of administration expenses on the basis of actual work done.

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[12] Barrington (1965) and others have asserted that the learning from T.V. is rarely satisfactory without skilled "linkage" from a teacher. Against this there are claims for self-sufficient systems e.g. literacy programmes in developing countries.

(15) Repair and Maintenance; referring to the premises used for transmission/reception, allocation of costs will most easily be made on the basis of cost per sq.ft. for heating etc.

(16) Capital Charges; some attempt at allocation of the annual financing of capital projects on a basis of space-cost should be made.

The number of students shown in the costs schema is purely arbitrary, as is the restriction to two of the learning systems. How are these costs to be obtained? As in the case of projecting educational costs, some crystal-gazing comes into the methodology. Rough estimates of the number of programmer-hours necessary to produce one hour of a programme, calculations of the requirements for technical help for systems of different types and sizes, and notions of the number of hours of programme necessary to cover the material, are but three areas in which judgement, made on past experience and reports of other approaches, must be made. Normally in educational experiments, many costs are lost or go unobserved because innovators are anxious to see if their system works or not. Skilled persons do very unskilled work in order to speed up the experiment. Thus, where lecturers have undertaken work in mounting slides, the estimate of the costs of this activity in so far as the development stage is concerned, might be based on the costs of technicians' time rather than lecturers'.

Enough has been said about the determination of the costs of learning systems. It goes without saying that testing to see if the system works, i.e., the quality control, should precede the stage of cost estimation. In many cases, of which the Glasgow medical education project is an example, it will be the success of some new form of learning system which will stimulate interest in its expansion and, hence, in the resource requirements. Just to remind ourselves of what criteria we are willing to accept for quality let us recall the Blue-print statement above. We shall accept measures of the objectives of the schemes as indices of the quality of the schemes.

We appreciate also that the more valid and reliable these measures, and the more sound the objectives, the less will be the limitations of the measures as quality indices. Occasionally, when no quality measures are available the following procedure might be applied. Assume that the outputs of the several schemes are the same, if on the surface, they appear to be so, then choose the least cost scheme. Such a proposal is potentially dangerous if applied indiscriminately. Its application should be restricted to decisions concerning the use of resources in education in areas which have only a minimal influence on educational attainment [13]. For instance, some part of the teacher's task is to keep records of work, records of attendance and records of pupil's progress [14]. Assuming that there is no difference in the output of this task whether it is done by a teacher or some lesser qualified auxiliary, then the cost of this programme of record keeping will be less and, therefore, the efficiency will be higher if, it is performed by auxiliaries. Perhaps, no teacher could be saved by employment of auxiliaries but a redistribution of teachers' efforts in the direction of more skilled work should be possible.

What happens when no objective for an educational programme is available? Is there any need to cost the programme then? Perhaps education is not an activity of the means-end sort. It is contended that even if there is no explicit objective nor the possibility of a simplifying assumption such as the one discussed in the preceding paragraph, it is necessary for planners to know the cost implications (viz., future year costs) of their current decisions. This will be one theme of the concluding chapter. For the present we shall review the question of planning in relation to quality.

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[13] The words educational attainment are used here deliberately to mean those areas which could be assessed if only we had adequate objectives and measures. Bloom has isolated 6 such areas in the cognitive domain;knowledge,comprehension,application, analysis, synthesis, evaluation.It is appreciated that some part of the output of education which cannot be measured might be affected when educational attainment is not affected by some scheme such as the record-keeping programme outlined above.;

[14] A work study investigation carried out by the writer found that in a large comprehensive school a median time of 20 mins. per week per teacher was decoted to the registration process.A surprising finding was the range of times taken-from 5 mins. to 45 mins.- according to how often the task was tackled.

For the present we shall review the question of planning in relation to quality.

SUMMARY AND CONCLUSIONS

A prescription for educational quality in relation to inputs must rank as the philosopher's stone of the economics of education. No one is likely in the foreseeable future to state that an injection of such-and-such a quantity of resources will cure a particular educational ill or increase performance to some new record high. Chapters 3 and 4 revealed just how complex was the input to education; this chapter has probed the question of the output and found that it too is complex. It follows that input-output relationships must be subject to two main sets of questions;

1) those concerning the input - what units to measure in , which inputs are relevant to the input-output relationship;
2) those concerning the output - what units to measure in, are all the outputs quantifiable, which outputs are relevant to the input-output relationship.

The big question then, in the study of input-output relationships in education, is which input refers to which output. Also, there is a tendency for research workers to omit what is not quantifiable from their considerations and to be mesmerised by what is currently measurable without reflecting on the adequacy of the measures as indicators of quality. Mishan (1967) observes this same tendency among economic analysts:

> "There is a strong prejudice among research workers against admitting that the unmeasurable effects are likely to be more significant than the measureable ones, and that in such cases, therefore, any conclusions reached on the bases of the measureable effects only are unwarranted".

The specific conclusions concerning the application of cost-effectiveness analysis in education are as follows.

1) The area of study must be clearly defined.
2) The objectives of the educational programmes must be explicit in behavioural terms.
3) The cost of the programmes must be known, and alternative costs must be presented in accordance with varying assumptions

regardingthe nature of technology used and numbers of possible users.

4) Valid and reliable measures of the attainment of the objectives must be available. Within limitations these may be regarded as proxy quality measures.

5) The above four conditions are more likely to be satisfied at the micro level of education, i.e., at the level of a school, a particular curricular objective, alternative plans for presentation of a programmed text; than at the level of the country or education authority.

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CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

Introduction

Some types of research are convergent in that they identify a problem or area to be studied, then set about forming hypotheses, testing them, rejecting them, re-formulating them until a theory is produced or some solution found. Others are divergent: they go off in many directions in the process of studying a rather diffuse question - raking in the data soil uncovers more problems than answers. The present study is of this second type. Edding (1964) isolated the costs of education as one area in which research might be done to aid study of efficiency concepts in education. Studies in Educational Costs has taken up this challenge and emerged with some general conclusions, some more specific conclusions and recommendations, and a number of problems, some of which should lend themselves to a more convergent approach by future researchers.

Cost Problems In Perspective

The central 'required to prove' of Studies in Educational Costs was the derivation of methods for projecting educational costs. In tackling this problem, a large number of issues concerning the costs of education arose. Among these were the following:

1. The availability of cost and other statistical data;
2. The difficulties in compiling a multi-category cost accounting system from the traditional line-item accounting systems;
3. The relative weighting of the various elements comprising the total cost of education (as exemplified by expenditures of Scottish Education Authorities);
4. The trends in unit costs over an eight year period;
5. The factors causing variations in unit costs in different areas;
6. The division of cost-determining factors into those under some local policy control and those constrained by demography and geography or by the national manpower picture;

7. The direct cost effects of alternative organisations of schools and the economies of scale in education;

8. The direct cost effects of various curricula;

9. The meaning of various measures of teacher deployment, e.g., the pupil-teacher ratio, the teaching-minutes per pupil statistic;

10. The costs of education related to various values of the pupil-teacher ratio;

11. The relative costs of labour and material in schools;

12. The alternative methods of projecting educational costs;

13. The influence of demography on the relative resource inputs to primary and secondary schools;

14. The likelihood of being able to predict the nature and extent of the increase in educational quality from some given increase in inputs;

15. The techniques for appraising costs and 'quality' relationships in education;

16. The costing of plans for educational innovation;

17. The case for studying the costs of education, independently of irrespective of the possible educational effects of expenditures.

Extensive data collection and sifting produced quantified evidence on some of these questions with the result that tentative hypotheses can be formed regarding costs and critical parameters. For instance, a study of 74 primary schools, with rolls ranging from 11 to 640 pupils, indicated that, given two schools with pupil-teacher ratios which differed by only one, the costs would be £3.5/- per pupil per year higher (in 1964/5 prices) in the school with the lower pupil-teacher ratio. In contrast, the search for data often revealed that none was available in the form required to crack the particular problem. In this case the conclusion is a recommendation on the gathering and storing of information related to costs. For instance, it was frequently desirable to relate the money value of inputs to the real inputs involved, e.g., number of teachers (in full-time equivalents), number of non-teaching staff, numbers of pupils. Often the information was not available; more often it could only be obtained after laborious searchings through other records, e.g. timetables and salary cards. Thus, it is recommended that educational budgets and financial statements should be reported along with relevant manpower data. As well as the <u>specific</u> findings and <u>general</u> recommendations there are suggestions for further research.

For instance, it is recommended that some work should be done on the external diseconomies (social costs) of Centralisation of schools. For, the costs of schools of various sizes are not the only, or even the most important, consideration in the issue of centralisation. (An attempt to elucidate the social implications of centralisation of secondary schools has been made by Adam (1969)).

Resume Of The Outcome Of the Research Work

The outcome of the research may be summarised as follows:

(1) The opening up of a field of enquiry:specific problems unearthed, hypotheses formed;

(2) Possible ways of investigating cost problems in schools;

(3) The state of the information sources on costs and other relevant statistics in Scotland;

(4) A multi-category cost accounting coding system, and a modification to it;

(5) Regression equations (involving costs and critical parameters such as pupils, P.T.R.) revealing trends in the economies of scale in education and potential ways of lowering direct unit costs;

(6) The relative order of magnitude of the costs of different subjects;

(7) The relative costs of books, equipment, teachers, non-teaching staff;

(8) A formalisation of various methods of projecting costs, together with estimates of Scottish Educational Expenditure for 1975;

(9) The trends in secondary unit costs compared with primary unit costs;

(10) A critical examination of 'quality' and productivity in education, particularly as the terms are used by economists and educational planners.

The remainder of this chapter will be devoted to expanding on each of these ten points. Finally,there are some remarks on the place of economics as a feeder discipline to education.

(1) Further Research

The suggestions which follow form the largest single outcome of the research work for two reasons. To begin with, the kind of research which was undertaken left many more ends untied than tied.In addition, little space was devoted in the preceding chapters to the extension of the reserach results to a point where further questions arose.

(A) School Maintenance Costs and Pupil-Places

In Chapter 3 Part II, a roughly linear relationship was found to exist between the costs (per pupil) of School Maintenance and the number of new places provided. This result cannot, however, be interpreted as indicating that the new buildings cost more than old buildings to maintain in per pupil terms because (i) the expenditure figures used referred to all school buildings, (ii) the expenditure included all the sub-heads of School Maintenance (other than those sub-heads dealing with first-order educational equipment), (iii) a rough-and - ready price index was used to deflate expenditure at current prices. The aim of further research would be to ascertain in what way, if at all, the costs (at constant prices) of each of the sub-heads of maintenance are related to the number of pupil-places. Two approaches are suggested. First, a study of the maintenance costs of buildings X_1, of a selection of ages X_2, design X_3, size X_4, for one year. By holding two of the three independent variables constant, the relationship between maintenance costs per pupil (broken down to the component sub-heads) and the third variable may be probed. Multiple regression analysis may also be used to reveal how unit costs X_1 vary with all three parameters X_2, X_3 and X_4. Secondly, a study of unit costs of a sample of buildings over a number of years should be undertaken. The sample of buildings should be of the most recent design and also representative in size. Separate price indices for each of the subheads of maintenance expenditure should be constructed to deflate the current costs so as to ascertain the trends in real money inputs associated with maintenance of buildings. The information from both these studies should enable the budgeting of the School Maintenance head of expenditure to be carried out in the light of the knowledge of the cost characteristics of old and new buildings, the mix of which is constantly changing.

(B) Transport and Boarding Costs

Expenditures on these items fall under the Aid to Pupils head. While it is recognised that expenditure on this head is integrally bound up with the siting of schools and communication problems particular to landward areas, there is a case for a study of a cost-effectiveness type into the alternative ways of aiding pupils. This study could be quite separate from the broader issues of reorganisation of schools. The aim of the study would be to assess the costs (both direct and social) of the possible ways of aiding pupils. By means of studies on selected areas, the direct costs - both current and capital - of hostels could be compared with the costs of transport. The calculations would have to be performed for both present and probable future rolls of secondary schools. Attention should be given to the indirect effects of both ways of aiding pupils, e.g., the effects of removal of young people from village or town on the social and economic prospects of area, the effect of long journeys on both educational achievement and leisure time. And though it may appear idealistic, some attempt should be made to quantify or give weightings to these indirect effects. Then the alternative schemes of transporting and boarding could be discussed within a quantified framework.

(C) The Staying-On Rate And Opportunity Costs

The trend to remain at school beyond the school leaving age has been rising of late. The implications of this trend for national resources is a matter for central government concern. But the numbers remaining at school after the leaving age vary also from area to area (Chapter 3 Part II). There is a need for research the aim of which would be to uncover the causes of differential participation in extended secondary education. As a necessary step in and as a research project in itself, attempts would have to be made to assess the opportunity costs of education for 15,16,17 and 18 year-olds in Scotland. Data of this kind is completely lacking at present although it is quite basic in quantifying many socio-economic relationships. With a fuller understanding of the forces which act upon the participation rate parameter, estimates of local needs for educational resources should be more accurate.

(D) Study of the Supply of Secondary School Teachers

The position in Scotland with regard to teacher supply is roughly as below. While the supply of primary teachers is fast meeting the demands made by present educational standards (i.e. present notions of size of classes), a chronic absolute shortage and a deployment problem militate against any rapid easing of the staffing problem in secondary schools. There is on-going work on the criteria for assessing secondary school staffing standards by the S.E.D. themselves (S.E.D.,1969). But what is as urgently required is a projection of teacher numbers as part of a Scottish manpower study covering the major professions and trades. For, in the long term, the supply/demand position with respect to teachers cannot be considered in isolation from the broader issue of skilled manpower requirements in Scotland (or in any country). The aim of the study would be to project for some ten to fifteen years into the future, the supply of secondary school teachers both in absolute numbers and as a proportion of a) qualified school leavers b) graduates of colleges and universities. The supply of teachers would be considered under varying assumptions concerning a) qualified school leavers, b) proportions of school leavers entering universities and colleges, c) proportion of college and university graduates entering the various professions, d) the probable competing demands for graduates by industry, commerce and other professions, e.g., police, nursing, e) the effects of re-training and up-grading 'excess' primary teachers, f) varying criteria for assessing staffing requirements for individual schools. The outcome of such a study should be a list of the resource requirements, in human and material terms, for a series of alternative plans.

(E) Cost Accounting In Two Department Schools

A start was made in the study of costs in Area A to deal with the problem of the allocation of joint costs in those schools with more than one department [1]. Although the S.E.D. is probably wise at present to request financial data referred to those two department schools quite separately from those costs ascribed to primary or secondary schools, it would not require a great deal of work to extend the groundwork already laid in the present study. The aim would be to give the treasurer's department of the education authority some rough and ready rules for allocating joint costs. The outcome would be that a full analysis of the inputs to primary and secondary schools could then be done for Scotland. What is required is for the main joint costs - School Administration, Maintenance of Fabric, School Supplies (such as stationery) and Teaching Aids (such as radio, T.V.) - to be studied

[1] Department here refers to a primary or secondary department, not a subject department.

for a sample of two department schools with the aim of deriving, through accurate cost analysis, some indicators as to the proportions of such items which should properly be allocated to each department.

(F) Administrative Costs and Educational Programmes

In Area A, in 1964/5, roughly £155,000 or £10.5 per pupil was categorised as administration expenditure; yet much of this expenditure- at central and school level - cuts across curricular and other educational programmes. What is this activity administration? At school level, for convenience in allocation and for want of better information, all the responsibility element of Teachers' Salaries was allocated to School Administration. In effect, this procedure was equivalent to assuming that a) all those teachers with no responsibility element in their Salary did no administration, b) tasks of school administration occupied time in proportion to the ratio of fesponsibility element of Salary to the total Salary for those who did have a responsibility element. At the level of education authority administration (Central) all the Salary of all the employees was allocated to administration, although some of the staff are clearly running curricular activities (subject organisers) or remedial programmes (educational psychologists). Two studies of administrative costs are suggested.

(i) At school level:the identification of the various activities of teachers in their non-teaching time would facilitate the allocation of a) basic salary and b) responsibility allowance between functions such as "Teaching", Administration etc.

(ii) At central level:the identification of the various activities of the professional staff would facilitate the allocation of salary to function such as school transport, science teaching etc.

The outcome of each study should be a system for the rational assigning of administrative costs. As a spin-off the studies would provide valuable data on what administrators and teachers do.

(G) School Stock-Taking

Some feasibility studies will be necessary before stock-taking by schools can begin to be a feature of educational planning. The aim of the studies would be to establish which stocks of items can most valuably be monitored, and how, and by whom, this monitoring should be done. Consideration would be given to the problems of stock-taking by subject department, the probable life expectancy of items, the form of record-keeping, the possibilities of computerised stock control at education authority level, the problems of classification of items into spares, replacements and additions to stock. It is doubtful whether the present level of inputs in money terms and, in real resource terms, would justify an elaborate stock-taking system. The justification for some preliminary research is that future levels of materials should be much higher and also they should be planned.

(H) Measurement of Deployment of Teachers

The short answer to the question, "What statistical measures can be used to gauge the deployment of teachers?' , is that no satisfactory measure exists which includes an assessment of 1) the proportion of total hours in school spent teaching, 2) the number of pupils taught during a week. The pupil-teacher ratio (P.T.R.) for a school indicates how many pupils there are in a school for each teacher. The pupil-teacher contact ratio (P.T.C.R.) is defined as the weekly average number of pupil-contacts a teacher makes, i.e., the average number of pupils a teacher sees when he teaches (McIntosh, 1968). The teaching-minutes per pupil unit is derived from the ratio of the total time in minutes a teacher teaches in one week, to the total numbers of pupils he teaches. A school with a 'low' P.T.R. could well have a relatively 'high' P.T.C.R. if the proportion of time devoted to actual classroom teaching is 'low'. In that situation the teaching-minutes per pupil unit would be 'low'. If teachers in that school are asked to increase the amount of teaching (and thereby reduce their organisation, correction and study time) the P.T.C.R. parameter decreases and the teaching-minutes per pupil parameter increases, while the P.T.R. remains constant. It is proposed that an enquiry into the deployment of teachers should seek a unit - probably some function of the three mentioned above - which would enable planners to gauge how well individual schools and education authorities use their teaching resources An extension of this work might be to establish norms for a) each subject and b) each type of secondary school with respect to 1) the proportion of time a teacher should teach and 2) the number of pupils taught. This proposal is potentially dangerous if taken to mean that norms for the proportion of time in which the teacher has class contact and for the number of pupils in a class would be established without regard to educational factors.

All questions concerning the deployment of teachers must resolve two problems. First, with our present real and financial resources what are the possible norms. Secondly, with regard to evidence on educational 'quality', which norms must be dismissed as inimical to the achievement desired.

(I) Centralisation Studies

The investigation of the effects of size on costs was reasonably successful for primary schools in as much as one of the findings indicated that the difference in unit costs for two schools rolls 20 and 30 is such that the smaller school has unit costs17% higher, while for schools of size 60 and 70 the difference is only3½%. This does not mean that if the possibility of centralisation of small primaries exists, centralisation should be carried out on the sole justification of reducing the unit costs. A study of the centralisation of primary schooling would aim to establish a generally applicable methodology for planning the siting and re-organisation of primary schools. In Scotland 18% of primary schools have fewer than 24 pupils so that there is scope for case studies of the organisation of primary schooling in the rural areas. The studies would involve such factors as:

a) the compilation of present and projected demographic statistics, particularly with reference to the distribution of families in relation to communications;

b) the computation of the economies of scale of possible schemes of organisation of schools in relation to a)(on the basis of the results of Chapter 5);

c) estimation of transport and other related costs included under the Aid to Pupils account head,

d) attempts to quantify the social costs and benefits of alternative schemes of school organisations.

The village school is frequently both the physical and social centre of a village; the school teacher is often a powerful influence on the social and cultural ethos of a village.

Some model for considering all the issues which arise when centralisation is raised would be invaluable to planners and decision makers both here and in the developing countries.

A more complex set of issues pertains to the centralisation of secondary schools. First, in the present research no relationship could be found between unit costs and roll, though a linear relationship was established between unit cost and the P.T.R.parameter. The discussion of secondary costs is taken up again in the proposed research plan (J) below. But, even when this part of the problem has been solved, i.e., when the direct costs of secondary schools of different rolls are predictable, a great tangle of indirect costs - external diseconomies - must be dealt with. The social costs/benefits of particular sitings of secondary schools are important since secondary schooling, even more than primary, is closely linked in the social and economic viability of areas. By this is meant that in rural, and particularly in Highland, regions industry and commerce look to the secondary school for labour (in its broadest sense of skills, organisation, initiative, "brains"): also, the community expect the school leavers to propogate the traditions, lore, or 'culture' of the area. Fears of depopulation, dying communities and exiled young people are uppermost in the minds of local pressure groups when the planning of secondary schools is considered. It is often claimed that if secondary school children are boarded away from home and find it impossible to make regular home visits then there is more likelihood that they will look to a place other than their home area for a living when they leave school. Clearly a study of secondary schooling in the Highlands must be integrated with a broader economic and social development enquiry.

(J) Secondary School Staffing Costs

It is reasonable to concentrate on staffing costs when attempting to find the determinants of the running costs of secondary schools since staffing costs are such a large proportion of total costs. It would be interesting and useful to know what the staffing costs of 'all through" comprehensive schools are in relation to total roll and to the number of pupils in the post school-leaving age category. There should now be sufficient of the "all-through" schools in Scotland for the purposes of a statistical investigation. Unlike the heterogeneous 'sample' of secondary schools used in the S.E.C.P., the "all-through" comprehensive schools offer broadly similar ranges of courses with the result that they should be sufficiently alike to be compared as far as costs are concerned.

The aim of the study would be to establish whether there are economies of scale in secondary schools as they are now organised Some generalisations concerning unit costs and pupil numbers would be useful for the discussion of the centralisation problem.

(2) Research Methods in the Study of Educational Costs

The method of investigating costs adopted by the writer was a compromise between accurate cost accounting, as known to the cost accountant, and the cruder cost estimation as known to the economist/ educational planner. The struggle between the claims of the two approaches was not resolved until almost a year after the project had been under way when it was clear that the purist accountants' approach would be too time consuming to be of value in the pursuance of the broad aim of designing a methodology of cost projection by a study of present and past cost patterns.

In retrospect, the struggle might well have been avoided had the objectives of the enquiry been more precisely specified. If there is any single generalisation from the S.E.C.P., enquiry it is that multi-disciplinary teams must resolve, after discussion, conflicts of interest in the pursuit of some common end. To take a case in point - the degree of accuracy of data. For certain purposes, e.g., fiscal accountability, cost accounting to the nearest penny is appropriate. For other purposes rounding to the nearest pound sterling or nearest thousand may be more appropriate. Thus when investigating the expenditure on books by various schools one might deal in figures to the nearest pound, while in projecting national expenditure on these items over a five year period, the nearest thousand pounds or ten thousand pounds may be more appropriate. The appropriateness of one or other level of accuracy is not as clear when referring to all the items of expenditure. on a single school. Should repairs to audio visual equipment be costed more accurately than Teachers'Salaries,? What objective do we have in mind when we add salaries to the nearest penny? In short, the cost- accounting coding system on which so much time was spent in the design, revision, trial, second revision and final implementation stages may well have been valuable only in so far as the final product proved that multi-functional categorisation of expenditures was possible in education. It hardly was the most appropriate means for the second, but more important aim, of designing a methodology of cost projection. It is doubtful if future researchers should attempt to cover all the areas of expenditures in any one authority or in

one

school, for the volume of hack work is wearisome and the rewards incommensurate with the labour expended. In addition, there are some short cuts available. 1) In dealing with Teachers' Salaries, for broad projection purposes and for inter school comparisons or inter year comparisons of the same school, the necessity to count various entries on salary record cards could be obviated if the number of teachers on each salary scale were known and estimates of the standard cost (or median salary) for each scale were available. The product of the number of teachers on a particular scale and the standard cost (summated over all scales) would give a crude but useful estimate of the total salary bill for a school for a year.2) In analysing educational material costs by school, per capita quotas and extra per capita grants may be more accessible than the accounts. More will be said about this in the section on data availability. 3) Studies of repairs to fabric and equipment could be confined to Authorities which keep records of charges for repairs against each school, thereby obviating the necessity of searching all "repairs accounts" to establish costs of repairs of a particular school.

Moving on from methods of data collection to that of data processing, the problem of the transfer of data from the collection or, more accurately, storage stage to the processing stage is encountered. The procedure adopted in the project had, of necessity to involve the transfer of the collected cost data from the original sources - salary cards, invoices, priced requisitions and school charge sheets - to coding documents[2]. This time consuming operation could be dispensed with if the information from the source was punched directly on to cards or tapes. Alternatively, in a few cases where no multi-functional analysis is required, an adding machine may be adequate. In other words, instead of writing a coded version of information from the source on to some coding document (see Chapter 2), if the source data were punched or added directly, cost research could be done by using the original documents (or photo copies). The original documents would be required to be in a good state of preservation and such that they could be written on; many invoices were so full of numbers, letters, and various colours of ink that no space was available for annotation.

[2] In the study in Area A some 11,000 original cost documents were studied over a period of 10 months. The fact that these could only be removed for a short period from the education authority offices and that there were already many code numbers of the documents meant that new records had to be made so that cards could be punched.

These suggestions refer, of course, to one-off cost exercises. It is quite another story if the controlling authority build into their coding system facilities for doing the kind of cost analyses described in Area A. A good example of built-in facilities available for cost exercises and management accounting was found in Aberdeenshire. A few years ago a member of the education committee had requested that when a new computerised accounting system was installed, efforts should be made to cost individual schools. Accordingly, all expenses were charged against school codes. By the summer of 1969 when the author discovered this, no actual computer run had been done to produce this information which was, unlike another education authorities, available 'in store' if not in a processed form.

(3) Information Sources

(1) Financial and Resources Data

(a) Education Authority Data.

The period of the research, 1966-1969, coincided with the 'great leap forward' to a modern and useful form of financial returns incorporating manpower (teaching and other staff) statistics. The first request by the S.E.D. for these new statistics was made in 1968 when, for the first time, the financial officers of authorities were asked to separate expenditures on primary and secondary schools, a division which has been made in most industrialised countries for many years. However, because their accounting systems do not allow for it, few authorities will be able to make even this basic breakdown for some years or until they are reorganised into larger administrative units. Many authorities, including the pilot study Area A, have mechanised systems which have little flexibility as far as producing cross-classified totals is concerned. Mechanised systems are little more advanced conceptually than quick manual counting, which facility was adequate when education accounting was limited to a balancing of books operation, but totally inadequate for planning of resources.

(b) School Data.

Generally speaking most headteachers of schools have no way of saying how much their school costs. In only one area of expenditure - capitation allowances - is it normal procedure for the school itself to maintain records of expenses incurred so that the balance between 'income' (quota earned from product of school roll and per capita allowance) and expenditure is known. However, in one Authority the individual schools were not informed of how much their quota was, in case "they used it all up". Instead, an official in the treasurer's department monitored the balance between quota and expenditure for each school. This procedure resulted annually in some schools underspending (by as much as £1000) and others overspending. The level of overspending 'tolerated' seemed to depend on the overall balance between quotas for all schools and the total expenditures.

The county supplies officer in Area B pointed to savings he had effected by bulk ordering, by entering into contracts for re-surfacing school blackboards, and generally by controlling the supplies of educational apparatus, materials and books to individual schools. With the advent of larger authorities and the trend in some curriculum areas, e.g., chemistry, physics, maths, for the same books and apparatus to be used in all schools, some economies might be effected through adoption of bulk buying and arranging for larger discounts.

(2) Pupil Numbers, Curricular Choices

Data on school rolls for each primary school was obtained from the returns made to the authorities (normally twice per year). For secondary schools, both roll returns and timetables were used to ascertain the relative proportions of pupils in years I-III and IV-VI. The details of subject choices were obtained from timetables. The S.8 return - an official S.E.D. form - was available and used for Area A: an education authority timetable was used for Area B, since the S.8 returns had been destroyed. Neither of these very detailed returns seemed to be used by anyone apart from Her Majesty's Inspectors, who used to refer to the S.8 before arranging visits to schools.

In order that the costs of activities in school may be linked to those activities the cost, resource and pupil data should be integrated. For instance, a course or programme of Latin may have inputs amounting to £15,000 per annum, including 7.2 teachers (on salary scale 1), 6.8 classrooms, and throughputs (or outputs) of 145 pupils, of whom 30 are in years IV-VI. The linking of the budget to what is done with the budget - call it the programme - requires considerable extension of data collection and processing facilities. Until such time as full scale programme budgeting can be tried out, it would be relatively simple to include data on pupil numbers (disaggregated by year of study and a broad course division such as Arts/Science where appropriate) in the financial returns. Then unit costs of the various heads of expenditure could be produced. The derivation of unit costs would be most easily done as one feature of an automated analysis of returns or, with a little additional work, the same derivation could be performed as an optional extra on a calculating machine.

A warning must be given if total costs are divided by rolls, for total costs refer to expenditure over a 'year' while rolls, strictly speaking, are the number of pupils registered on one date in the 'year'. Because the school population fluctuates within a 'year', it is clear that the head count should be taken at a point in time during the financial year. To clarify this point: at present, the local authority financial year runs from May 16th to May 15th, while the school year is technically from August 1st to July 31st (though the school session starts at the end of August and runs to the beginning of July, as a rule). It is recommended that the head count date should satisfy the following conditions: 1) it should be taken after the start of the school session and before the end of the financial year, i.e., between September and early May; 2) it should be taken preferably at a time when rolls are near their maxima, for instance, before the earliest leaving date for secondary schools if the education authority allow of more than one leaving date. Presumably, school manpower and financial budgets, reflecting in part demands made by head teachers for staff and materials, are set in relation to the maximum number of pupils enrolled during the year [3].

(4) The Coding System

One-off exercises in cost analysis are one thing; regular system of cost analysis is another. Proposals for abstracting data of a financial and resource nature so that cost exercises may be performed with some speed and certainly more directly than those carried out in Areas A and B, have already been set out above at (2).

[3] If this is so, then, resources are temporarily underused when rolls drop below maximum. The alternative position is to set the demand for resources in relation to the minimum roll during a year. Clearly this results in overcrowding and overuse of resources when the roll reaches its maximum. Unfortunately we do not know enough about the measures of over and under use of school resources with the result that the choice of erring on the side of generosity has been made in setting the head count date.

What parts of the multi-category coding system would be most easily adopted by education authorities? What skills are required to code the financial records? What uses would cost analysis be put to? Are the costs of adopting a multi-category cost accounting system commensurate with the anticipated benefits? These are a few of the questions which arise in relation to any wide scale adoption of the multi-category cost accounting system by education authorities. A few general remarks will be necessary first of all. The value of the data derived from cost analysis is judged by how far the data aids decisions about future budgets, organisation, planning and most important policy. For instance, the justification for analysing expenditures to a category of expense such as "repair and maintenance of electrical equipment" may be that it enables planners to budget more accurately for that head for future years. The function of detailed cost analysis may have nothing to do with the measurable educational effects of expenditures. However, by distilling off those expenditures on education which have ostensibly nothing to do with measurable educational attainment, cost analysis may provide a service (by isolating the residual 'educational' inputs) to economists who seek relationships between 'growth' and 'education'.

So much for the benefits of cost analysis, what of the cost? In any data-processed accounting system each item of expense is coded with respect to a number of categories. Those authorities which already operate an accounting system based on automatic data-processing would incur additional expenditure in connection with the following.

a) The additional categories to be included in the existing authority categories:

b) Alterations in the computer programme which controls the "sorts" and analyses of cost data.

The costs of the system could be controlled by limiting the additional categories, and by limiting the computer runs. In other words, by cutting the time of clerical staff in coding documents and cutting the time on computer the overall cost can be controlled. Something will be said below about where to strike a balance between all the costs information desired and the cost of obtaining it.

Some more specific conclusions about the possible form of the accounting classifications can now be made.

1) Analysis by Type and Size of School

It was found in the project that expenses were for the most part allocable to schools[4]. Hence, if authorities are to cost individual schools, the cost of introducing the additional category should be reasonable in relation to the potential information. Also, since each school must have a unique code number this should incorporate at least the type and size of school [5]. Some authorities may wish to add another reference to denote a urban/rural division or some other geographic/demographic subdivision. Costing individual schools in this way would enable planners to monitor over a period the pattern of costs in individual schools.

a) Analysis by Subject

It was found in the project that only Teachers' Salaries and expenditure on educational equipment, apparatus and books was identifiable by subject. The long and involved process by which Teachers' Salaries were allocated, on a time basis, to one or more subjects would not be possible at the level of an education authority. The level of skill required to analyse timetables may be too high for the grade of clerical worker who, at present, is involved in the pre-processing stage of local authority finance work. Also, the potential use of cost statistics referenced to subject is not nearly as great as those referring to school because present policy formation, budgeting and planning is made at the education authority level. Were budget centres at school level, or at subject department level within school or within education authority, information showing costs of each subject would be essential. However, we seem far from this kind of micro-budgeting at present.

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[4] Of those expenses which related to school expenditure, most were identifiable as referring to a particular school.

[5] The D.E.S. have in recent years allocated a unique 6 digit code to all schools and colleges in England and Wales. The possibilities of undertaking a similar scheme in Scotland should be investigated.

3) Analyses of Class Expense

A rational modus operandi in allocating expenses to various classes or heads would be to make fine subdivisions for those classes of expenditure which are 'significant' in the overall budget while adopting a coarser division for those classes of expense which are 'insignificant' in the total. Thus, the cost of teachers may be broken down to basic salary, increments for experience, responsibility allowances, travelling expenses, authority's contribution to superannuation scheme, authority's N.I., and G.P., contributions. Some division between full-time and part-time teachers may also be made. In contrast, it may be sufficient to have only a two way analysis of the expenditure on "books" into textbooks and stationery. However, the complete range of desired subdivisions, even on the above basis, may be quite impossible to make if documents do not specify precisely and unambiguously the area of expense. For instance, an account "to repairs in Room 22" needs further detail for it to be coded to "repair and maintenance of furnishings" or "to repair and maintenance of fittings". No interpretation of accounts and other financial documents can reasonably be delegated to the finance department clerks. The accounts must be quite explicit to enable coding by reference to tables of codes . If this condition does not apply, then either the layout of all accounts and other financial documents must be redesigned or, taking the simpler way out, attempts to classify expenditures to such detailed subdivisions must be abandoned.

The summary of the specific conclusions about the multi-category coding system is (i) that expenses, should be, where possible allocated to a particular school whose unique code number incorporates both the size and type of school, (ii) that, at present, no attempt should be made to allocate secondary school expenses systematically to subjects, (iii) that considerable attention be given to the design of a class of expense list - the design should include as much detail as possible on the major items of expenditure and, where the low cost items in the budget are concerned, the cost of having them coded should be sought in relation to the use to which the information is to be put.

(5) The Outcome of the Application of Linear Regression Analysis Techniques.

The aim of applying regression techniques in the field of the costs of education is to establish quantitative relationships between costs (usually unit costs) and critical parameters. Then, given the particular value(s) of the parameter(s) the computed relationship can be used to say what value of the dependent variable - unit costs - is associated on the average with the value(s) of the parameter(s). In linear regression analysis, one independent variable (or a function of it), X, is related to the dependent variable (or a function of it), Y, be means of a straight line, the regression line [6]. In other words, the relationship is of the form $Y = bX + a$, where b is the slope of the line and a is the intercept of the line with X axis.

In Chapter 3, a relationship was established between the size of school population in an education authority, X, and the unit cost of education in that authority, Y. Its exact form was

$$\log Y = - 0.0991 \log X + 2.6035 \quad (r = - 0.6375)$$

This shows that economies of scale do operate in the provision of schooling in the various areas of Scotland such that 40% of the variability in log values of unit costs can be accounted for by the relationship between the log value of the unit cost and the log value of the school population. The relationship enables us to say that given two authorities, one of which has a school population exactly twice that of the other, the larger authority can expect to have on the average, unit costs 95% of the level of those in the smaller authority. In Chapter 4, a linear relationship was established between the unit cost, U, (cost of staffing per pupil-period) and the mean size of teaching group, M_{tg} (the average number of faces a teacher sees each period) [7], the observations coming from the cost analysis of school subjects.

[6] The regression line is the 'best' line which can be drawn through a system of points.

[7] Otherwise referred to as the pupil-teacher contact ratio.

The actual relationship was $U = -0.16\ M_{tg} + 5.15$ ($r = -0.69$). The surprising fact here is that only 47.6% of the variability in unit costs can be ascribed to the above relationship. Surprising, that is, until it is recalled that the observations were drawn from subjects all of which have distinct staffing patterns. Because of the relationship between initial qualifications and salary, the median salary of staff differs according to subject. Therefore, the differing mix of qualifications possessed by teachers of different subjects is partly responsible for the variability of unit costs.

In Chapter 5, a linear relationship was found between the unit costs of primary schools and rolls of schools.

$\log Y_c = -0.2624 \log X + 2.2418$ ($r = -0.8568$)

Y_c = unit outlay on Teachers' Salaries, X is the roll.

This relationship indicates that two schools, one of which is eight times the size of the other will have unit costs such that those in the larger will be 57.5% of those in the smaller school. The log/log relationship can be re-interpreted as indicating that between unit costs and roll there exists an exponential or "decay type" curve, i.e. a rapid fall off in unit costs with increasing roll to begin with, then a much slower decrease. The rapid fall off in unit cost occurs with the 'Small' schools (rolls less than 80). Further linear regression equations were established for the separate groups of 'Small' schools and 'Large' (rolls greater than 80) schools. It turned out that the best fitting function relating unit costs and school roll was a shallow curve for 'Small' schools and a straight line for 'Large' schools.

For both primary and secondary schools a linear relationship was found to exist between unit costs and pupil/teacher ratio.

For primaries the exact form was,

$Y^*_C = -3.27X + 158.83$ ($r = -0.83$)

For secondaries the exact form was,

$Y_c = -4.5781X + 165.4063$ ($r = -0.7044$).

where Y^*_c is the cost per pupil in £ of all expenditures allocable to the schools

Y_c is the cost per pupil in £ of Teachers' Salaries.

X is the pupil/teacher ratio.

As would be expected from the very different patterns of qualifications possessed by teachers in primary and secondary schools, there is a stronger [8] association of unit cost and P.T.R. for primary schools than for secondary schools such that 69% of the variability in unit costs in the case of primary schools and 50% in the case of secondary schools can be ascribed to the relationship between unit costs and P.T.R. The figures for secondary schools receive further support from the linear regression equation established in Chapter 4 between unit cost and mean size of teaching group, the latter being related to P.T.R. In addition, one may conclude that for primary schools, in 1964/5 prices, lowering the P.T.R. by one unit is associated with raising the cost by about £3.5/- per pupil on the average. For secondary schools, in 1964/5 prices, lowering the P.T.R. by one unit is associated with raising the cost by about £4.10/- per pupil on the average. Simple generalisations of this kind made from quantitative relationships, against which a known reliability can be set, are potentially valuable tools for educational planners.

(6) The Relative Order of Magnitude of Costs of Subjects

Chapter 4 revealed that different subjects cost different amounts. It appeared that with the pupil-period as the basic unit for comparison, there was a range of some 400% in unit costs between Classics (at the 'high' end) and modern studies andphysical education (at the'low' end). In accounting for the range in subject costs attention was focussed on two factors.

a) The organisation of subjects. Statutory regulations concerning the maximum size of classes in different subjects as well as pedagogic tradition result in patterns of organisation characteristic of the subject.

b) The qualifications of teachers. Generally speaking, the scholastic disciplines are staffed by higher paid teachers than the practical and aesthetic subjects.

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[8] The points are clustered more closely about the line, the closeness being measured by the correlation coefficient (R). The regression coefficient gives the average relationship between Y and given X's.

Not only do the costs of different subjects vary, but the unit cost of the same subject shows considerable variation over different schools. It is tempting to treat these variations by referring to the organisation of classes, and to the range of the qualifications and experience of teachers within these schools, and perhaps quantifying the relationship between unit cost and the organisation, qualifications/experience factors. But another view of the costs differential might be raised by economists interested in educational productivity. How much do the variations in unit costs of a subject between schools reflect differences in 'quality' of instruction? Are there underutilized resources in some schools and overutilized resources in others? How much do these variations in unit costs indicate 'fortuitous' factors such as temporary vacancies in staffing in one school, lower demand for a subject in one school than in another, peculiar qualifications/experience mix of teachers in one school? To give satisfactory replies on these subjects, we would have to set up cost norms for different subjects and an indication of how much dispersion from the norm would be tolerable. With the present state of knowledge of curricular aims and the state of data on teachers, this kind of planning cannot be undertaken. Social and political theorists may ask another series of questions concerning the existence of costs differentials between schools. On what basis is the level of inputs decided ? Is it socially just to have substantially higher inputs to senior secondary schools than comprehensive and junior secondary schools? Would a rationing system of teachers by the central government and by the education authority contribute towards equalising educational opportunities?

Summary:

The money value of inputs is different for various subjects. The money value of the inputs for any one subject is different for various schools. More sensitive instruments are required to probe the questions which arise in connection with these inequalities. More particularly, effort should be concentrated on establishing measures of the real value of the resources, i.e., teachers and "things", so that schools with different cost patterns may be compared with respect to real inputs.

(It must be said that the sheer volume of work required to produce subject costs will probably dictate that this particular type of costing is confined to the occasional one-off exercise).

(7) The Resource Mix In Education:Relative Costs of Books, Equipment Non-teachers, Teachers.

Whenever the terms 'more', 'higher proportion', 'increasing quantity' are used in any context, it is vital to state quite explicitly what frame of reference we have in mind, for these are relative terms. Thus, a statement to the effect that the proportion of costs related to labour has fallen over the past decade must be interpreted cautiously. First, a distinction must be made between teachers and non-teachers who constitute the labour, i.e., the numerator in the ratio may be a composite quantity with at least two divisions. Secondly, the total costs, of which labour-costs are part, may not be the same sum of quantities over the period in which they are compared. For instance, the total may or may not contain welfare expenditure, including student grants, meals and milk. In short, it is necessary to ensure that both the numerator and denominator are comparable quantities over any period of analysis.

Bearing that caveat in mind, broad conclusions about the resource mix in education were as follows.

a) Teacher costs dominated the total costs and this is true whether one refers to the micro levels - the school or subject - or the macro level, the county or nation.

b) Galloping interest rates, and increased capital provision resulting in a 40% increase over the period 1959-67 in the proportion of the total expenditure by Scottish Education Authorities taken up by loan charges, meant that the fall in the proportion of expenditure devoted to school Teachers' Salaries (47% to 43.4%) over the period is less significant for the discussion of the resource mix than it appears.

c) About twice as much was spent on heating, lighting, cleaning, as on more directly educational items such as books and equipment.

d) Less than 4% of all expenditure by education authorities was devoted to educational materials, books etc. The study in Area A put the level of expenditure on these items as 4.7% of expenditure on Teachers' Salaries; while in Area B, these items in secondary schools represented almost 6% of expenditure on Teachers' Salaries.
e) About 1/3 of all expenditure on educational items was on textbooks ; clearly the level of all expenditure on books, the teachers' main aid, was only about 1.^{1}/3% - a pitifully low amount for a "print dominated society".

(8) Projection of Costs.

A case was made out for the planning of education and, as part of that planning, for the estimation of the costs. Two series of distinctions are made. In the first place, it is argued that plans could be rather like central directives with policies formed, decisions taken, resources allocated at national or other macro level with some broad socio-political or economic end in view. In contrast to this centrally controlled plan is another type of planning which is the resultant of a host of factors - educational, political, social, economic - working at the micro level of, say, an educational institution or a particular level of education. This self-controlled or internal momentum planning need not have any overall aim in view and the dangers of suboptimisation are thus evident. Another distinction made is with regard to the meaning of projection and forecast. It is held that projection should be reserved for the planning on existing observed trends while forecast should imply planning which may not be in the light of trends but involves the departure from trends or the establishment of a new set of environmental conditions.

The most obvious problems in estimating future costs of current policies are the absence of a) data on which to base estimates and b) the appropriate techniques for accurate and reliable estimations using available data. But these issues are further complicated by the problems of whether to have a centrally-controlled plan or a self-control plan, and whether to project or forecast. The limitations of one of the methods of projecting costs based on teachers illustrates both these sets of problems in so far as the reliability of the available estimates of future supply of, and demand for, teachers is unknown, no satisfactory index of Teachers' Salaries is available and in the absence of a centrally-controlled plan, the trend in the ratio of expenditure on Teachers' Salaries to the expenditure on all education has to be projected. The various estimates of expenditure by Scottish Education Authorities for 1974/5 consist of a series of alternative assumptions concerning all the critical cost-determining factors and the related cost implications of these assumptions. The usefulness of the projections is in bringing attention to focus on the sensitivity of total costs to these cost-determining factors.

(9) Inputs by level, secondary and primary costs compared

In Chapter 3, it was established that secondary pupils cost about twice as much to educate per annum as primary pupils. Within the secondary school a further cost differential existed with respect to the upper and lower years, the former costing in the region of $1.\frac{1}{4}$ - $1.\frac{3}{4}$ as much as the latter. In Chapter 6, it was found that the secondary: primary unit cost ratio was not constant over time. Three studies of this ratio led to the conclusion that it was dependent on the fluctuations in the relative rolls of the two levels of education. A series of regression equations was established linking the secondary: primary unit cost ratio and secondary:primary roll ratio. It was concluded that teacher supply was somewhat inelastic in response to change of school rolls. Accordingly, it is recommended that a possible area for improved allocation of human resources would be the distribution of teachers between primary and secondary schools. The difficulties in doing this are a) the long term nature of the response of teacher supply to changes in demand, b) the occupation specificity (even within teaching) of many teachers (particularly primary teachers), c) the dangers and difficulties of setting up any one ratio of inputs as the appropriate one.

(10) 'Quality' and Cost-'Quality' in Education

A mode of interpretation of 'quality' was suggested. The main feature of the suggested mode is the requirement that quality be discussed with reference to a stated educational dimension and with respect to explicit objectives. Three such dimensions are educational (academic) socio-political and economic: each of these generates certain objectives.

A second feature of the mode is the requirement that measurements of the attainment of objectives be taken in each of the dimensions. Further, because each objective may have several measurements, ideally the validity and reliability of each measure with respect to the objective should be established. Lastly, there is the requirement that one dimension should be ranked with respect to the others.

With this mode of interpretation it is possible to consider various views of the quality of education in relation to the cost or inputs. The limitations of studies which evaluated quality of education with respect to a single measure, say, a score on a test and related this to 'inputs', say, size of class, are then evident in that no explicit references are made of the other dimensions, no ranking of dimensions occurs and there is no discussion of the possible validity and reliability of measures. A 'Blue-print' for cost-effectiveness studies in a limited field - that of educational technology - was developed. The main features of this 'Blue-print' are as follows.

1) The objective of the project, course, curriculum or programme must be stated in clear, objective, behavioural terms which are capable of being measured. (This does not rule out the possibility of multiple objectives or multiple measures of each objective).
2) In order to have wider applicability than as a one-off experiment the innovation must be at least as effective as the 'conventional' presentation or technology in terms of the agreed criteria.
3) On the basis of the allocable costs (current and capital, human and material) of the effective experimental exercise, the costs of expanding the application of the technology - giving more students the same amount of instruction or the same student-users increased quantities of instruction - must be estimated.
4) The outcome of the cost-effectiveness study should provide data to educators and other decision-makers on the estimated quality of the programme as taught or presented in different ways and on the allocable costs associated with the conventional and technological modes of presentation for various numbers of student-users.

It was concluded in the study of cost-quality relationships that rather than wait upon possible mathematical relationships between education and economic growth or pursue causal connections between education and lifetime earnings, educators should concentrate on optimising the use of resources at the class-room level, provided always that the aims of the classroom processes are compatible with societal aims.

Conclusion

There is a neurosis in Britain concerning the social services. Education is one service liable to the charge of failing to give a fair return for money because currently the huge sum of £2,000m. flows from public funds into our educational institutions and there appears to be little tangible proof that it is being well spent. Those who attack this high level of public expenditure recourse to sorties against "the falling standards in the 3 R's", the grants given to students, the long vacations for staff, the "palace-like" secondary schools and technical colleges, etc. At another level they lament the sagging economy and point an accusing finger at education. Their argument concerning the economy runs like this. "If there is a link between education and the G.N.P. (and we doubt this), then why does such a high level of expenditure - relative to past levels and relative to the proportions of G.N.P. devoted to education in other countries such as Germany - not result in a higher G.N.P. or wealth?" Doubts like these are not easily refuted in the short term. Long and arduous research lies ahead to elucidate the complex issue of expenditures on education in relation to G.N.P. More immediately and of more widespread concern is the widely held notion that, short of abrupt policy changes in the education sector, the costs of education are very much under their own momentum. Education authority treasurers, central government officials and not a few taxpayers regard the steady rise of educational costs as inevitable. One senior administrator, when asked what he thought of the rising costs of education, retreated behind his desk and uttered "Children are to be educated according to their age, aptitude and ability . Costs follow and we must find the money to pay."

Surely this is too passive a role for an educational administrator to play. The issue of rising unit costs must be attacked. It is contended that the study of the costs of education is a legitimate enquiry even in the absence of any considerations of the effectiveness of the educational process. In the act of counting the cost the broad picture of the heterogeneity of the total expenditure is revealed, the costs of alternative organisations of schools within an area are set out and much information is made available on which planning and decision-making can be based. In short, the writer is presenting a case for the intrusion of concepts form the discipline of economics into the education sector. Economics exist because of scarcity. Education faces just such a condition both with respect to real resources and money. There need be no fears of naive productivity experts dominating the teachers' work if the teacher and educationist take pains to learn more of economics than the economists know of education. Only when educationists are able to discuss the varied economic aspects of education in the same language as other planners, can we be assured that decision makers will give weight to educational aspects of social and development planning.

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APPENDIX 2/A

S.E.C.P.* Area A Pilot Project

GENERAL LAYOUT OF THE ACCOUNTING CODE SYSTEM

Each expense was coded separately on to a coding document from which a card was punched, 32 of the 80 columns on the card being utilized.

COLUMNS	DESCRIPTION	DETAILS IN APPENDIX
1 - 5	Reference number of expense	
7 - 8	School Type and Size	2/B
9 - 11	School Number	2/G
13- 14	School Subject	2/C
16- 18	Class of Expense	2/D
20	Whether inter or intra authority item or neither.	
22- 30	Value of Expenses in £.s.d.	
32	Debit or Credit	

*S.E.C.P.: Scottish Educational Costs Project

APPENDIX 2/B

S.E.C.P. Area A Pilot Project

Classification and Coding of Schools - Note 1

Code	School Type	Description	Size	Notes
10	Primary	Small, rural	1 & 2 teacher	2,3,4
11	Primary	Viable	3 - 7 teacher	2,3,5
12	Primary	Two Stream	8 -14 teacher	2,3,6
13	Primary	Three Stream	15+ teacher	2,3,7
21	Primary	One Stream attached to Secondary	3 - 7 teacher	2,3,8
28	Primary/Secondary	Joint Cost Items	All sizes	9
30	Secondary	3 Years Junior	$n < 200$ pupils	10,11
52	Secondary	6 Years Senior	$600 \leq n < 1000$	10,12
61	Secondary	6 Years Comprehensive	$200 \leq n < 600$	10,13
62	Secondary	6 Years Comprehensive	$600 \leq n < 1000$	10,13
70	Secondary	4 Years	$n < 200$	10,14
71	Secondary	4 Years	$200 \leq n < 600$	10,14
73	Secondary	4 Years	$n > 1000$	10,14
91	Nursery		All sizes	
92	Special Schools		All sizes	15
95	F.E.	Further Education College	All sizes	
97	Farm Schools	Residential	All sizes	
99	General	Unapportioned Items	All sizes	16

APPENDIX 2/C

S.E.C.P. Area A Pilot Project

Classification and Coding of Subjects - Note 17

Code	Subject	Additional Description	Note
11	English		
12	History		
13	Geography		
14	Modern Studies		18
19	General English Studies		
21	Mathematics and Arithmetic		
23	Physics		
24	Chemistry		19
25	Biology	Botany, Zoology Rural Science, Agriculture	19
29	General Science		19
31	Classics	Latin, Greek	
32	Modern Languages	German, French, Russian Spanish	20
39	General Languages	(Foreign)	
41	Art		
42	Music		
43	Physical Education		
51	Commercial		
52	Domestic Science		
53	Nursing Studies		
61	Technical Subjects	Metalwork, Woodwork, Engineering, Drawing	
71	Religious Instruction		
91	Primary Subjects		21
92	Secondary Subjects		22
99	Unallocable		23

APPENDIX 2/D (A)

S.E.C.P. Area A Pilot Project

Classification and Coding of Expenses - General Format

The coding of each expense is based on three digits, the first of which denotes the principal class or function of expense, and the second of which denotes the first sub-head under each of the principal classes of expense. The third digit is used to make a further sub-division of expenses into objects of expenditure.

First Digit: Principal Class/Main Functions	1	=	Teaching
	2	=	School Administration
	3	=	Central Administration
	4	=	Provision and Maintenance of School Buildings
	5	=	Transport and Accommodation
	6	=	School Meals and Milk
	9	=	General Provision
Second Digit: Other Classes/Other Functions	0	=	Wages,Salaries (inc. N.I.,G.P., Super-annuation)
	1	=	Capital Expenditure
	2	=	Repairs, maintenance
	3	=	Consumable Supplies
	5	=	Charges by Outside Contractors
	9	=	Sundries

APPENDIX 2/D (B)

S.E.C.P. Area A Pilot Project

Classification and Coding of Expenses - Principal Class 1 = Teaching

Code	Sub-head	Sub-division	Note
100	Salary	Primary Teacher Full-time (F.T.)	24,25,26,28
101	Salary	Primary Teacher Part-time (P.T.)	24,25,26,28
102	Salary	Secondary Teacher(F.T.)(Yrs.I-III)	24,25,27,28
103	Salary	Secondary Teacher(F.T.)(Yrs.IV-VI)	24,25,27,28
104	Salary	Secondary Teacher(P.T.)(Yrs.I-III)	24,25,27,28
105	Salary	Secondary Teacher(P.T.)(Yrs.IV-VI)	24,25,27,28
108	Salary	Nursery Assistants,Other Auxiliaries	29
109	Salary	Teacher in F.E. or A.E.	30
110	Capital	Classroom Furniture,fittings	31,32
111	Capital	Audiovisual Aids	31
112	Capital	Other Course Equipment	31
119	Capital	Other Capital Items	31
120	Repairs/Maintenance	Classroom Furniture,fittings	32
121	Repairs/Maintenance	Audiovisual Aids	
122	Repairs/Maintenance	Course Equipment	
129	Repairs/Maintenance	Other Repairs	
130	Consumable Supplies	Class Stationery	33
131	Consumable Supplies	Teaching Aids-Audiovisual	34
132	Consumable Supplies	Course Supplies	33
133	Consumable Supplies	Textbooks, Benchbooks, Charts	
139	Consumable Supplies	Sundry Supplies	
152	Charges by Outside Contractors	Sports Grounds Use of Swimming Pools,	35
190	Sundries	Teacher/Conferences/Courses	
191	Sundries	Laundry of Pupils' Clothes, Blankets	
199	Sundries	Unapportioned Items	

APPENDIX 2/D (C)

S.E.C.P. Area A Pilot Project

Classification and Coding of Expenses - Principal Class 2 = School Administration

Code	Sub-head	Sub-division	Note
201	Salary	Non-teaching Head teacher	36
202	Salary	Teacher Responsibility Allowance	37
203	Salary	Clerical Personnel	38
210	Capital	Office Furniture,fittings	
211	Capital	Office Equipment	
220	Repairs,Maintenance	Office Furniture,Fittings	
221	Repairs,Maintenance	Office Equipment	
230	Consumable Supplies	Stationery	39
231	Consumable Supplies	Office Equipment	
232	Consumable Supplies	Office Furniture e.g. Filing Cabinet	
290	Sundries	Telephone	
299	Sundries	Unapportioned items	

APPENDIX 2/D (D)

S.E.C.P. Area A Pilot Project

Classification and Coding of Expenses - Principal Class 3 = Central Administration

Code	Sub-head	Sub-division	Note
300	Salary	Administrator, Psychologist Subject Advisor	40,41
301	Salary	Clerical, Meals Supervisor	42
305	Salary	Cleaning Staff	
309	Salary	Attendance Officer	
311	Capital	Furniture, Fittings	
312	Capital	Equipment	
321	Repairs,Maintenence	Furniture,Fittings	
322	Repairs,Maintenance	Equipment	
330	Consumable Supplies	Stationery	
331	Consumable Supplies	Office Supplies	
332	Consumable Supplies	Office Equipment	
333	Consumable Supplies	Attendance Office Supplies	
339	Consumable Supplies	Other Supplies	
390	Sundries	Telephone	
391	Sundries	Advertising	
392	Sundries	Non-taxable Allowances	
399	Sundries	Unapportioned items	

APPENDIX 2/D (E)

S.E.C.P. Area A Pilot Project

Classification and Coding of Expenses - Principal Class 4 = Provision and Maintenance of Schools

Code	Sub-head	Sub-division	Note
400	Salary	Janitor,Cleaner	43
405	Salary	Gardener, Groundsman	
411	Capital	Buildings	44
412	Capital	Elec. Heat., Ventilation System	45
413	Capital	Fixtures, Fittings	
414	Capital	Cleaning Equipment	
415	Capital	For Gardens	
421	Repairs,Maintenance	Buildings	
422	Repairs,Maintenance	Elec. Heat., Ventilation System	
423/7	Repairs,Maintenance	Fixtures, Fittings	
424	Repairs,Maintenance	Cleaning Equipment	
425	Repairs,Maintenance	For Grounds	
429	Repairs,Maintenance	Rodent Control	
430	Consumable Supplies	Electricity	
431	Consumable Supplies	Gas	
432	Consumable Supplies	Oil	
433	Consumable Supplies	Solid Fuel	
434	Consumable Supplies	For Cleaning	
435	Consumable Supplies	For Grounds	
436	Consumable Supplies	Playground Equipment	
437	Consumable Supplies	Furniture	
438	Consumable Supplies	Water	
439	Consumable Supplies	Other Supplies e.g. Wood	
490	Sundries	Janitor's Uniform	
491	Sundries	Unapportioned Items	

APPENDIX 2/D (F)

S.E.C.P. Area A Pilot Project

Classification and Coding of Expenses - Principal Class 5 = Transport and Accommodation.

Code	Sub-head	Sub-division	Note
500 501	Salary Salary	Hostel Staff Medical Adviser	46
510 511	Capital Capital	Hostel Buildings for Transport	
520 521	Repairs,Maintenance Repairs,Maintenance	Hostel Buildings	
530	Consumable Supplies	Hostel Supplies	
550 551 553 554 559	Reimbursment of Expenses and Charges by Outside contractors " " " "	Pupils' Travel Expenses Teachers' Travel Expenses Sports Educational Visits, Camps Other Travel Expenses	47
590	Sundries		

APPENDIX 2/D (G)

S.E.C.P. Area A Pilot Project

Classification and Coding of Expenses - Principal Class 6 = School Meals and Milk

Code	Sub-head	Sub-division	Note
600	Salary	Cook,,D.R.A.	48
607	Salary	Schools Meals Transport	
610	Capital	Buildings	49
611	Capital	Equipment	
620	Repairs,Maintenance	Buildings	49
621	Repairs,Maintenance	Equipment	
622	Repairs,Maintenance	Electrical, Heating, Ventilation Systems	
623	Repairs,Maintenance		
633	Consumable Supplies	Electricity	50
634	Consumable Supplies	Oil	50
635	Consumable Supplies	Gas	50
636	Consumable Supplies	Solid Fuel	50
639	Consumable Supplies	Sundry Supplies	50
690	Sundries	Clothing	
691	Sundries	Laundry.	

D.R.A. Dining Room Attendants

APPENDIX 2/D (H)

Classification and Coding of Expenses - Principal Class 9 = General Provision

Code	Sub-head	Sub-division
900	Salary	Youth Leader
904	Salary	Dental Staff
905	Salary	Miscellaneous Manual Workers
908	Salary	Continuation Class
909	Salary	School Crossing Patrol
994	Sundries	Health Service, Nontaxable Allowances
995	Sundries	Children's Dept., Clothing
999	Sundries	Unallocable

NOTES

1. The decision to adopt the particular classification of schools was influenced by:

(a) The need to take account of the existing pattern of schools in Scotland.

(b) One of the project's aim was to derive total running costs for schools of varying sizes.

(c) Advice tendered by Mr. J. Brown, Depute Director of Education for Dumfries on schools in rural areas.

2. Primary schools in Scotland may be divided into 2 groups:

Group I - those which have no attached secondary department;
Group II- those which have an attached secondary department.

In 1964/5 the position with respect to "combined" primary/secondary schools for Scotland and Area A was

	*Total Schools	"Combined" Schools	Proportion of Combined Schools
Scotland	2977	422	14.1%
Area A	85	11	12.9%

Primary schools in Group I are coded 10,11,12,13, according to size. Those in Group II are coded 21 (see note 8).
* Excluding Nursery and Special Schools.

3. The classification of primary schools according to the number of teachers follows the procedure adopted by the S.E.D. in their annual reports "Education in Scotland". Since the basic teaching unit in a primary is a class of almost constant size for most subjects (except for certain classes in art, music, P.E., crafts), the number of teachers gives the number of classes in a school.

4. Primary : 'Small' rural.

In 1964/5 the position with respect to 'Small' schools, which for the purposes of this report, are defined as one and two teacher schools, for Scotland and Area A was

	Total Classes in Primary Depts.	Classes in One & Two Teacher Depts.	Proportion of One & Two teacher Depts.
Scotland	18,053	1491	8.2%
Area A	343	61	17.7%

The majority of such 'Small' schools are to be found in rural areas; the rural nature of Area A is illustrated by the fact that it has more than twice the national proportion of classes in 'Small' schools.

The policy of both the S.E.D. and the Area A Education Authority has been to close these 'Small' rural schools if the pupils could be readily schooled centrally.

5. Primary : 'Viable'

Area A has followed a policy in recent years of building three-teacher schools to replace 'Small' rural schools. In a three-teacher school a tripartite division of pupils into Infants, Juniors, Seniors is normally made. Such a division is felt to be more satisfactory, educationally, than single classes of a wide age range. It is hypothesised that schools with three to seven teachers are more likely than 'Small' schools to be 'viable' economic and educational units.

A seven teacher primary, with one class per year group, is sometimes referred to as a One Stream Primary.

6. Primary : Two Stream

Schools with eight to fourteen teachers are classified as two stream primaries.

7. Primary : Three Stream

Schools with fifteen to twenty-one teachers are classified as three stream primaries.

8. Primary : One Stream Attached to Secondary

There are eleven schools in Area A which have primary and secondary departments combined under one headmaster, viz. 11 Group II schools. Ten of these are 'Viable' primaries and the eleventh has eleven teachers. All are coded 21 to emphasise their single type.

9. Primary/Secondary : Joint Costs

Where primary and secondary departments share one building, one headmaster, certain teachers, service personnel, services etc., it is not possible to make allocations of particular expenses on a priori grounds. Accordingly, all items which cannot be allocated to either primary or secondary departments (unambiguously) are coded 28.

10. n denotes the number of pupils

$<$ denotes less than,

$\geqslant$ denotes more than or equal to,

$\leqslant$ denotes less than or equal to.

11. Secondary : 3 Years Junior.

This school offers non-certificate courses only.

12. Secondary : 6 Years Senior.

This school offers courses leading to presentation at S.C.E. 'O' Grade and 'H' Grade, i.e. certificate courses only.

13. Secondary : 6 Years Comprehensive.

This school offers both non-certificate courses and certificate courses (leading to S.C.E. 'O' and 'H' Grades). The origins of this type of school are two fold.

(a) The Scottish 'town school'. These schools have traditionally children of ages five to eighteen under the one roof. Courses leading to University entrance ran alongside courses of general education.

(b)/

(b) The comprehensivisation of schools. The creation of common or central schools offering a range of courses has been stepped up since the war and has been given new impetus by the appearance of S.E.D. Circular Number 600.

14. Secondary : 4 Years

These schools are 'territorial' schools for the first two years in that all children from one area of an authority attend the same school. That is, in the first two years non-certificate course as well as Years I and II of 'O' and 'H' Grade run side-by-side. After two years, those pupils who are judged to be capable of attaining Higher Grade passes at the S.C.E. are transferred to a 6 Years Secondary (either Comprehensive or Senior Secondary). The remaining pupils proceed with either (a) courses leading to S.C.E. 'O' Grade or (b) non-certificate courses.

The chance to transfer from a 4 Years Secondary to a 6 Years Secondary is given, additionally, at the end of the fourth year, to amongst others, those pupils who have sufficient 'O' Grades to merit this.

15. Special Schools : Special Schools and occupational centres.

16. General Unapportioned Items: Items of expense which are not readily assignable to a particular school are coded 99. e.g. Bulk fuel supplies, transport, advertising for staff, meals costs incurred by central cooking centres.

17. Primary Subject - Divisions

No attempt is made to analyse costs to subjects in primaries for two reasons.

(a) The intergrated nature of the primary curriculum makes it impossible to say that e.g. paint brushes are used solely for Art and not for Mathematics, English or Religious Instruction. This situation makes it impossible to allocate costs for all materials and textbooks to particular subjects.

(b) Even if arbitrary allocations were to be made on the basis of the most likely function of a particular item, the practical problem of deciding, from the invoices, which item is used for which function, would be too great.

There is one exception to the above principle. Whenever invoices, or parts of invoices, refer to expenditure on modern languages in the primary school, these are abstracted and treated as if they referred to modern languages in the secondary school - coded 32. [These turned out to be insignificant in the Pilot Project].

18. Modern Studies.

This is a composite group of subjects, including Modern Studies as taught for S.C.E. examination papers, Social Studies as taught in 3 Years Junior Secondaries, and a subject confined mainly to non-examination classes, embracing English, History and Geography.

19. Science.

Whenever possible, it is desirable to allocate costs to one of the branches of science - for the purposes of this project represented by Physics, Chemistry, and Biology.

20. Modern Languages.

By banding four modern languages together it is possible that 'high' unit-costs in, say, Russian will be lost amidst 'low' unit-costs in, say, French.

21. Primary Subjects (91)

In view of note 17, a single code is required to denote expenses allocable to any primary school subject (91).

22. Secondary Subjects (92).

Whenever it is not possible to say, by consideration of an invoice or salary record, to which subject a particular item of expense is to be allocated, a single code is required to distinguish such items from <u>completely</u> unallocables. (These are coded 99).

23. Unallocables (99).

(a) Those expenses incurred by combined primary/secondary schools, which are not clearly allocable to either primary or secondary departments.

(b) Practically all school repairs and maintenance e.g. heat, light plumbing, cleaning.

(c) School and Central Administration costs.

(d) Transport and Accommodation.

(e) Meals.

(f) General Educational Provision.

24. Since the teacher cost, reckoned as teachers' salaries, included employers' contributions to superannuation schemes, graduated pensions and national insurance, accounts for about half of the total revenue expenditure of both Scotland and Area A, a very close examination of 'where the money goes' is necessary. From the figures below it is not possible to discern any distinct trend in the proportion of revenue taken up by salaries for Area A.

Year	Expenditure on Teachers' Salaries etc. in £ hundreds	Total Revenue Expenditure in £ hundreds	Salaries as a proportion of total
60-1	6799	15,257	44.5%
61-2	8045	17,220	46.7%
62-3	8422	18,165	46.3%
63-4	9575	20,241	47.3%
64-5	9635	21,361	44.5%

25. Salary Allocation between Functions: A teacher's salary has three determinants:

(a) the basic salary scale on which he is placed by his initial qualifications,

(b) his position on that scale as determined by his years of teaching experience,

(c) the amount of responsibility payment, if any.

Responsibility payments are held by holders of promoted posts within schools; the size of any such payment is controlled by (i) the roll of the school, (ii) the age distribution of the roll, (iii) the number of pupils engaged in certificate courses. In the adopted functional division of expenses, there is used a scheme of allocation which is a compromise between the following alternative methods.

1. Detailed analysis of each salary and related costs, abstracting all the elements and allocating them to their appropriate functions. This scheme has been adopted by the D.E.S.* Planning Branch in their D.I.E.C.A.T.ϕ project. It involves,

(a) finding out the policies by which the headmaster decides his allocation of classes to teachers:

(b) Allocating to each class that part of the Salary which, it is imagined, is used up in teaching the class.

* D.E.S. Department of Education and Science.
ϕ D.I.E.C.A.T. Developments in Educational Cost Analysis Techniques

The approach is extremely detailed and consequently time-consuming. In addition, it is not clear, at the moment, how such detailed figures will help educational planning.

(2) The Average Salary method. This was submitted by Emil Rado. Briefly, it involves crude allocations of exact salary (and relevant costs) totals. Thus, for a particular school the following calculations are performed

I total number of teacher-hours taught;

II the proportion of this attributable to each subject;

III the total salary bill of school;

IV the % of salary bill attributable to each subject.

This method has the merit of being much shorter but suffers from the disadvantage of not giving such detailed information as method (1). It may, however, be more useful for cost-projection purposes since it glosses over such fortuitous factors as the average unit cost of English being twice that of Mathematics because the English staff happen to be older and better qualified.

While disregarding method (1) because of the excessive time required for the anticipated benefits it was agreed that method (2) should be looked at again after the completion of the Dumfries Pilot Project. [An adaptation of it was applied to the total salaries of schools in Area B (see Chapter 4)].

The Compromise Scheme

This consists of effecting a two-way division of salary (and related costs) for primary schools and a three way division for secondary schools.

26. Salary : Primary Teacher F.T./.P.T. The total salary (and related costs) is divided into two whenever a teacher has an increment for school responsibility. This increment is treated as a School Administration expense and not as a Teaching expense. The remainder (the larger part) is coded to Teaching.

27. Salary : Secondary Teacher. The two way division made in the case of primary schools (see Note 26) applies here also. In addition, since it is one of the aims of the project to determine the cost per pupil for the first three, and last three years, of a secondary school, a further division is made of the 'Teaching' element of the salary between years (I-III) and (IV-VI).

28. Summary of Allocation of Teacher's Salary.

(a) Basic Salary Scale. The number of the scale is built into reference number (it is the first digit on the 5 digit reference number),

(b) Increments for service. This sum is absorbed into Basic Salary.

(c) Responsibility payments - these are treated as School Administration expenses in the case of primary schools and Subject Administration in the case of secondary schools.

The Teaching element of Salary = Total Salary - Responsibility Payments. The Teaching element for secondary teachers is further divided (proportionally on the basis of teaching-minutes) between years (I-III) and (IV-VI).

29. Auxiliary Personnel : includes helpers in Occupation Centres and science store keepers.

30. Salary : Teachers in F.E. and A.E.

(a) All teachers in the county further education college coded 109;

(b) Primary and Secondary teachers who receive salary for work at evening classes are also coded 109.

31. The division between capital items and the rest was made on the basis of an expected durability of two years or more and a cost of more than £25. This applies to all parts of the Pilot Project.

32. This class of expense is meant to encompass items which are for a specific teaching purpose, rather than fittings for the building, cf 411,421.

33. Class 130 includes notebooks, pencils, pens, chalk but excludes protractors, paint, crayons, which came under course supplies 132.

34. Class 131 includes, records, taperecordings tapes.

35. These charges are made by Baths and Parks departments against the Education Department for use of their facilities, where such do not exist in, or are not attached to, schools.

36. In Area A, all secondary schools and primary schools larger than one stream have a non-teaching head teacher, the whole of whose salary including responsibility allowance is coded 201.

37. As indicated in Note 28, certain teachers have allowances varying from £100 to £750 for responsibility. These amounts are coded to 202 and to the corresponding subject where possible. The generally agreed reasons for awarding a secondary teacher a responsibility allowance is for work in presenting certificate candidates and for the additional administrative work in being in charge of the teaching of a subject. Heads of Department, also, have the responsibility of organising the staff and pupils in their own subject. On *a priori* grounds it appears as if, on balance, more of the responsibility allowance should be allocated to the upper school. In the calculations of unit costs of subjects, an arbitrary division of 2 : 1 in favour of upper school pupils is made.

38. Secondary schools and primary schools larger than 1 stream though including 11025 (Eastriggs) have clerical help. As with teachers' salaries, National Insurance and Graduated Pensions contributions are added to the Net Gross Salary to give the cost to the authority of the employee.

39. It is only possible to distinguish class Stationery from the school office Stationery when, either the invoice is marked appropriately or the item is unambiguously recognisable as an office requisite e.g. Roneo paper.

40. The expenses included under Central Administration are almost entirely incurred within the Education Offices, which in Area A is a converted mansion separate entirely from the main County Buildings.

41. Salaries include : Director of Education and his two deputes, Principal Psychologist and Subject advisers in Music, Art, P.E.

42. Includes administrative staff.

43. In some schools, particularly primaries, cleaners are employed in a dual capacity as cleaners and Dining Room Attendant (D.R.A.). Fortunately, separate entries for cleaning and Schools Meals are made on the Salary Card.

44. Capital expenditure : 'Buildings' here is not to be confused with initial expenditure on new buildings which is made out of Capital Account. The code 411 is used for minor projects met out of revenue expenditure such as construction of new cupboards, renewing floor, resurfacing playground, renewing water pipes.

45. The Electrical, Heating and Ventilation System includes, boilers, hotwater piping, electric clocks, gas plant.

46. Hostel Staff includes domestic staff but excludes allowances to teaching staff for supervisory duties.

47. Pupils' Travel Expenses are of two types (a) charges by bus and car hire firms for contracts, (b) reimbursement of pupil's travel expenses. Contractors submit accounts (normally monthly) without detailing distances or schools involved. It is, therefore, not possible to arrive at an allocation of expenditure for transport to a particular school.

48. Because there operated a system of Specific Grant for Meals and Milk (at least in 1964/5 and up to 66/7) some care was taken with both Wages and other costs to separate out any expense which can be legitimately allocated to Meals and Milk.

49. Buildings here can be regarded as those parts of the school used for meals.

50. Separate bills may be submitted for these consumable items particularly where separate meters for the school and the meals room exist. Otherwise, an allocation between the two uses is made and marked on the invoice by the Treasurer's Department.

APPENDIX 2/E

MODIFIED CLASSIFICATION AND CODING OF EXPENSES

CODE	CLASSIFICATION AND DESCRIPTION
	Teaching
100	Primary Teachers' Salary
102	Secondary Teachers' Salary
108	Auxiliary Personnel
119	Capital Equipment
130	Stationery, Apparatus
133	Textbooks
137	Resaleable items
139	Other Supplies
	School Administration
203	Clerical Assistant's Salary
217	Office furniture
219	Office equipment
230	Office Stationery
	Maintenance of School Premises
400	Janitor's wage
401	Cleaner's wage
417	School furniture
419	School fittings
429	Repair of fittings
430	Electricity
431	Gas
432	Oil
433	Solid fuel
437	'Small' furniture
439	Other supplies
	Other
552	Teachers' travel expenses.

S.E.C.P. Area A Pilot Project

APPENDIX 2/F

AREA A EDUCATION AUTHORITY STATISTICS

1.	Area: 1075 sq. miles		
2.	Population: 88,153		
3.	Number of pupils in Primary and Secondary Schools	:	14,631
4.	Number of pupils in Primary Departments	:	9,754
5.	Number of pupils in Secondary Departments	:	4,877
6.	Number of Primary Departments	:	80
7.	Number of Secondary Departments	:	15
8.	Number of whole-time* teachers	:	644
9.	Number of whole-time teachers in Primary Depts.	:	343
10.	Number of whole-time teachers in Secondary Depts.	:	301
11.	Number of visiting teachers in whole-time equivalents**.	:	32
12.	Pupil/teacher ratio in schools; 14631/644	:	22.7
13.	Pupil/teacher ratio in schools; 14631/644 + 32	:	21.6
14.	Pupil/teacher ratio in Primary Depts; 9754/343	:	28.4
15.	Pupil/teacher ratio in Secondary Depts; 4877/301	:	16.2

* A Whole time teacher is one who is employed for a full week in one school. All other teachers are visiting teachers who may be Full-time F.T. (but teach in more than one school) or Part-time P.T. (and teach in one or more schools).

** A teacher-week is 26.2/3 hrs. and a teacher-day 5hr. 20 min. Part-time teachers are paid in units of 40 minutes. A whole time equivalent is therefore the ratio of the total number of part-time hours to 26.2/3.

APPENDIX 2/G

DUMFRIES COUNTY COUNCIL - EDUCATION DEPARTMENT SCHOOLS

10 001 Ae
10 002 Amisfield
62 003 Annan Academy
10 004 Applegarth
10 005 Auldgirth
97 006 Barony
11 007 Beattock
11 008 Breconbeds
10 009 Brownhall
11 010 Brydekirk
10 011 Canonbie
10 012 Carronbridge
10 013 Cogrieburn
11 014 Collin
10 015 Corrie
10 016 Crossford
11 017 Cummertrees
11 018 Dalton
21 019 Dumfries Academy (Prim.)
52 019 Dumfries Academy (Sec.)
28 019 Dumfries Academy (Unassing.)
73 020 Dumfries High
11 021 Duncow
11 022 Dunscore
10 023 Durisdeer
11 024 Eaglesfield
11 025 Eastriggs
10 026 Eskdalemuir
10 027 Ewes
10 028 Gair
10 029 Garrel
10 030 Gilnockie
10 031 Glencaple
10 032 Glenzier
10 033 Goodhope
21 034 Gretna High (Prim.)
30 034 Gretna High (Sec.)
28 034 Gretna High (Unassign.)
11 035 Gretna Primary
10 036 Half Morton
10 037 Harlaw
12 038 Hecklegirth
10 039 Hightae
11 040 Hoddam
10 041 Holywood
10 042 Hottsbridge
10 043 Hutton
10 044 Hutton Hall
10 045 Johnstonbridge
21 055 Loreburn St. Johns (Prim.)
30 055 Loreburn St. Johns (Sec.)
28 055 Loreburn St. Johns (Unassing.)
13 056 Maxwelltown
10 057 Middlebie
21 058 Moffat Academy (Prim.)
70 058 Moffat Academy (Sec.)
28 058 Moffat Academy (Unassign.)
11 059 Moniaive
21 060 Morton Academy (Prim.)
70 060 Morton Academy (Sec.)
28 060 Morton Academy (Unassign.)
10 061 Mount Pleasant
10 062 Mouswald
10 063 Nethermill
13 064 Newington
12 065 Noblehill
11 066 Penpont
11 067 Ruthwell
30 068 St. Andrews Boys
21 069 St. Andrews Girls (Prim.)
30 069 St. Andrews Girls (Sec.)
28 069 St. Andrews Girls (Unassign.)
11 070 St. Columbas
12 071 St. Michaels
11 072 St. Mungo
12 074 St. Teresa's
21 075 Sanquhar Academy (Prim.)
70 075 Sanquhar Academy (Sec.)
28 075 Sanquhar Academy (Unassign.)
10 076 Sheildhill
10 077 Sibbaldie
10 078 Steilston
10 079 Torthorwald
12 080 Troqueer
10 081 Tundergarth
21 082 Wallace Hall Academy (Prim.)
61 082 Wallace Hall Academy (Sec.)
28 082 Wallace Hall Academy (Unassign.)
10 083 Wamphrey
10 084 Wanlockhead
10 085 Westerkirk

Nursery Schools

91 086 Annan Nursery School, Springbells
91 087 Dumfries Nursery School, King St.

Special Schools and Classes

92 089 Catherinefield School, Dumfries
92 090 Lockerbie Academy (Special Class)

APPENDIX 2/G Continued

12 046 Kelloholm
21 047 Kirkconnel (Prim.)
30 047 Kirkconnel (Sec.)
28 047 Kirkconnel (Unassign.)
11 048 Kirkpatrick-Fleming
21 049 Langholm Academy (Prim.)
71 049 Langholm Academy (Sec.)
28 049 Langholm Academy (Unassign.)
12 050 Lincluden
12 051 Locharbriggs
12 052 Lochmaber
13 053 Lochside
21 054 Lockerbie Academy (Prim.)
61 054 Lockerbie Academy (Sec.)
28 054 Lockerbie Academy (Unassign.)

Occupational Centres

(Dumfries Occup. Centre, Elmbank
(92 091
92 092 Sanquhar Occup. Centre, Mennock
99 093 Education Offices & Health Service
99 094 School Houses unattached + let property
95 095 Technical College
99 096 Schools General, Gracefield A.C. Hostels, Library, Youth Centre
99 097 Provision elsewhere - Hospitals, Child Guidance Clinic
99 098 St. Ninians (Being built)

S.E.C.P. FOLLOW-UP AREA B

APPENDIX 2/H

LIST OF SCHOOLS ; ROLLS ; CODES

Primary Schools	Roll	Code
Blacklaw	692	10
Pitcorthie	616	11
Beath Broad St.	559	12
Kinglassie	273	13
Thornton	222	14
Leslie	419	15
Elie	66	16
Guardbridge	67	17
Anstruther West	71	18

Secondary Schools	Roll	Code
Buckhaven High	1124	61
Waid Academy	610	62
Balwearie	661	63
Auchterderran	471	64
Viewforth	565	65

APPENDIX 3/A

1) TOTAL EXPENDITURE OF SCOTTISH EDUCATION AUTHORITIES

Col.1 Year	Col.2 Gross Expenditure £m	Col.3 Adjusted Gross(c) £m	Col.4 Index (1959/60 = 100)
1959/60	80.400 (a)	77.357	100
1960/61	87.146 (a)	83.857	108
1961/62	97.380 (a)	96.825	125
1962/63	103.984 (a)	103.471	133
1963/64	115.072 (a)	114.463	148
1964/65	123.289 (b)	122.879	159
1965/66	134.552 (b)	134.099	173
1966/67	152.375 (b)	151.879	196

Notes:

(a) Audited figures from Reports by the Accountant years 1959/60, 1960/61,1961/62,1962/63,1963/64. Edinburgh: H.M.S.O.

(b) Figures subject to audit from Scottish Educational Statistics, 1967 p.137; Edinburgh: H.M.S.O.

(c) In 1961/62 the Secretary of State took over the responsibility from the authorities of making Awards to Scottish students following full-time courses at universities and colleges of education and advanced full-time or sandwich courses at other further education centres. In order that the totals of education authorities' expenditure might be comparable over the 8 year period, all expenditure on Awards for students has been subtracted from the total in Col.2. The relevant Award figures were

	£m
1959/60	3.043 (a)
1960/61	3.289 (a)
1961/62	0.555 (a)
1962/63	0.513 (a)
1963/64	0.610 (b)
1964/65	0.410 (b)
1965/66	0.453 (b)
1966/67	0.496 (estimate from S.E.D.)

Appendix 3/A Continued:

2) EDUCATION EXPENDITURE AT CONSTANT PRICES

Year	Price Index (e)	Education Expenditure Current Prices Index	Education Expenditure Constant 1959/60 prices Index
1959/60	100	100	100
1960/61	101.2	108	107
1961/62	104.3	125	120
1962/63	108.1	133	123
1963/64	110.1	148	134
1964/65	113.1	159	141
1965/66	118.2	173	146
1966/67	122.9	196	159 (d)

Notes:

(d) The education expenditure at constant prices is obtained by finding the ratio of education expenditure at current prices to the Price Index and multiplying the result by 100.

e.g. $\frac{196}{122.9} \times 100 = 159$

(e) The price index chosen was that for The Final Goods and Services sold on the Home Market, taken from the "blue book", National Income and Expenditure, 1966 and 1967, and recalculated on a 1959 basis.

Vaizey and Sheehan (1968) report that this index is not an unsatisfactory substitute for more complex procedures based on separate price indices for the components of educational expenditure.

APPENDIX 3/B

ANALYSIS OF SCOTTISH EDUCATION EXPENDITURE OVER 1959/60 - 1961/62

Head		1959/60 Amount £m	1959/60 %	1960/61 Amount £m	1960/61 %	1961/62 Amount £m	1961/62 %
1	Administration	1.808	2.2	1.926	2.1	2.131	2.1
	Primary and Secondary Education						
2	(a) Salaries etc.of Educ. Staff	37.681	47.0	40.679	46.3	47.052	48.0
3	(b) Maintenance of Schools	13.850	17.3	14.725	16.7	17.677	18.0
	Formal Further Education						
4	(a) Salaries etc.of Educ. Staff	2.185	2.7	2.645	3.0	3.106	3.1
5	(b) Maintenance of Schools	.879	1.0	1.104	1.2	1.310	1.3
6	Social & Recreational Educ.	.481	0.6	.163	0.1	.187	0.1
	Aid to pupils and students						
7	(a) Transport & Accommodation	5.962 (heads 7–10)	7.1 (heads 7–10)	1.664	1.8	1.815	1.8
8	(b) Board and Lodging			.624	0.7	.678	0.6
9	(c) Education in Hospitals and other places			.127	0.1	.143	0.1
10	(d) Bursaries			3.864	4.4	1.111	1.1
11	School Mid-day Meals (current)	5.843	7.2	6.425	7.3	7.145	7.2
12	School Milk	1.625	2.0	1.630	1.8	1.669	1.7
13	School Health	1.226	1.5	1.293	1.4	1.371	1.4
14	County Library	.654	0.8	.714	0.8	.785	0.8
15	Contributions to other education authorities	.256	0.3	.312	0.3	.327	0.3
16	Contributions for the training of teachers	.349	0.4	.444	0.5	.484	0.4
17	Loan Charges	5.665[e]	7.0	6.317	7.2	7.463	7.6
	Revenue Contributions towards Capital Expenditure						
18	(a) School mid-day meals	.918	1.1	.922	1.0	1.022	1.0
19	(b) Others	-	-	1.341	1.5	1.507	1.5
20	Youth Employment Service	.203	0.2	.205	0.2	.222	0.2
21	Other Expenditure	.468	0.5	.557	0.6	.706	0.7
22	Total Expenditure	80.053	100[d]	87.681	100[d]	97.911	100[d]

Notes:

[a] Figures for 1959/60 taken from Education in Scotland in 1963, p.108

[b] Figures for 1960/61, 1961/62 taken from the Report by the Accountant, 1960/61; 1961/62

[c] Figures for later years directly from Scottish Educational Statistics, 1967, p.137

[d] Percentages do not sum to 100 because of rounding to 1 place of decimals.

[e] This is the sum of heads 17 and 19 for 1959/60.

APPENDIX 3/C Calculation of Unit Costs of Education Scotland 1959/60 - 1966/67

Row			1959/60	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67
(1)	Total Expenditure	£m.	77.357	83.857	96.825	103.471	114.463	122.879	134.099	151.879
(2)	Expenditure on F.E.	£m.	3.064	3.749	4.416	4.876	5.884	7.216	8.775	10.719
(3)	Expenditure on Schools (1) - (2)	£m.	74.293	80.108	92.409	98.595	108.579	115.663	125.324	141.160
(4)	Teachers' Salaries	£m.	37.681	40.679	47.052	48.756	54.502	55.110	57.050	65.714
(5)	Maintenance of Schools	£m.	13.850	14.725	17.677	19.524	20.825	23.044	26.203	28.662
(6)	Number of pupils in millions (a)		0.8584	0.8651	0.8674	0.8642	0.8711	0.8742	0.8692	0.8898
(7)	Expenditure on Schools per pupil $= \frac{(3)}{(6)}$ £ Current Prices		86.5	92.5	106.5	114.0	124.6	132.3	144.1	158.6
(8)	Expenditure on Schools per pupil Constant 1959 £		86.5	91.5	102.1	105.6	113.2	117.0	122.1	129.1
(9)	Teachers' Salaries per pupil $= \frac{(4)}{(6)}$ £ Current prices		43.8	47.0	54.2	56.4	62.5	63.0	65.6	73.8
(10)	Teachers' Salaries per pupil Constant 1959 £		43.8	46.4	53.1	52.2	56.8	55.7	55.5	60.0
(11)	Maintenance of Schools per pupil $= \frac{(5)}{(6)}$ £ Current Prices		16.1	17.0	20.3	22.5	23.9	26.3	30.1	32.2
(12)	Maintenance of Schools per pupil Constant 1959£		16.1	16.8	19.5	20.8	21.7	23.3	25.5	26.2

Note (a) For the years 1960 - 61 to 1964/5, the school population figures were taken from MacLennan,B. The Finance of Grant - Aided Schools in Scotland. p 159 S.J.P.E Vol XIV No.2 June '67. For all other years number of pupils in Education Authority schools was calculated from the formula x = 0.975 x N, where N sum of pupils in education authority and Grant-Aided Schools x is the number in education authority sch and 0.975 is the proportion of all pupils (E.A. + G.A.) who attend Education Authority Schools.

APPENDIX 3/D **Calculation of Unit Costs of School Maintenance - analysed by sub-heads** Scotland 1959/60 - 1966

Row				1959/60	1960/61	1961/62	1962/63	1963/64	(I) 1964/65	(I) 1965/66	(II) 1966/67
(1)	Number of Pupils in Millions			0.8584	0.8651	0.8674	0.8642	0.8711	0.8742	0.8692	0.8898
(2)	Expenditure	(a) books, apparatus	£m.	2.2236	2.4315	2.7292	2.8017	2.8499	3.3541	3.7787	4.2026
(3)		per pupil = $\frac{(2)}{(1)}$	£	2.59	2.81	3.15	3.24	3.27	3.84	4.35	4.72
(4)		(b) furniture, equipment	£m.	0.6991	0.7348	0.7415	0.7561	0.8304	0.9104	0.9318	1.0763
(5)		per pupil = $\frac{(4)}{(1)}$	£	0.81	0.85	0.85	0.87	0.95	1.04	1.07	1.21
(6)		(c) rent, rates, taxes etc.	£m.	1.9353	2.0808	3.6860	3.9958	4.4509	4.9117	5.6228	6.2512
(7)		per pupil = $\frac{(6)}{(1)}$	£	2.25	2.41	4.25	4.62	5.11	5.62	6.47	7.03
(8)		(d) fuel, light, cleaning	£m.	5.6992	6.3006	7.0014	7.8349	8.2898	8.9221	9.9925	10.6242
(9)		per pupil = $\frac{(8)}{(1)}$	£	6.66	7.28	8.07	9.07	9.51	10.21	11.50	11.94
(10)		(e) clerical assistance	£m.	0.3478	0.3602	0.3815	0.4170	0.4500	0.5368	0.6360	0.7355
(11)		per pupil = $\frac{(10)}{(1)}$	£	0.40	0.42	0.44	0.48	0.52	0.61	0.73	0.83

APPENDIX 3/D Continued:

Row					1959/60	1960/61	1961/62	1962/63	1963/64	(I) 1964/65	(I) 1965/66	(II) 1966/67	Cu Pr
(12)	Expenditure	(f)	Other	£m.	0.3052	0.3332	0.3739	0.4486	0.5022	0.5377	0.7027	0.7644	
(13)			per pupil=(12)/(1)	£	0.36	0.39	0.43	0.52	0.58	0.62	0.81	0.86	
(14)			Total	£m.	13.5296	14.7248	17.6770	19.1631	20.4078	22.5439	25.3826	27.7291	(I
(15)			per pupil=(14)/(1)	£	15.76	17.02	20.38	22.17	23.43	25.79	29.20	31.16	

Notes

(I) unaudited; sub-head figures from S.E.D. form F/2

(II) estimated; made available by S.E.D.

(III) These figures do not tie up precisely with those in Appendix 3/C or Fig.3.3 because in order to the detail of head "School Maintenance" financial returns (form F/2) had to be used. They give total Outturns and Estimates for the Education Authorities and are, consequently, unaudited.

APPENDIX 3/E

PER CAPITA ALLOWANCES - SCOTLAND 1961/62 - 1968/69

		61/2	62/3	63/4	64/5	65/6	66/7	67/8	68/9
PRIMARY	Area A (100-200 pupils)	20/-	26/6	29/-	30/-	31/6	40/-	40/-	-
	Area B (100-200 pupils)	30/-	30/-	32/-	32/-	32/-	35/-	38/-	38/-
	Area C	-	-	35/-	40/-	42/6	45/-	45/-	-
	Area D	34/-	34/-	40/-	40/-	50/-	70/-	80/-	-
	Area E	-	29/6	29/6	32/-	33/-	36/6	45/-	50/-
SECONDARY Years I-III	Area A	50/-	62/3	65/-	67/6	70/-	77/6	77/6	-
	Area B	80/-	80/-	85/-	85/-	85/-	87/6	87/6	90/-
	Area C	-	-	80/-	85/-	90/-	100/-	100/-	-
	Area E	-	64/-	64/-	70/-	77/-	80/-	88/- (b)	88/-
SECONDARY Years IV-VI	Area A	82/6	115/6	120/-	125/-	130/-	142/6	142/6	-
	Area B Years IV-V	140/-	140/-	150/-	150/-	150/-	150/-	150/-	153/-
	Area B Years VI	140/-	140/-	200/-	200/-	200/-	210/-	210/-	213/-
	Area C	-	-	140/-	140/-	140/-	150/-	150/-	-
	Area E	95/-	95/-	102/-	105/-	115/6	120/-	132/- (b)	132/-
SECONDARY	Area D estimate from actual total quota (c)	96/-	96/-	106/-	106/-	130/-	180/-	200/-	-

Notes:

(a) - : figures not available

(b) Authority changed to a system based on per capita quotas for years I-III and IV-VI

(c) Authority D does not work a per capita quota system. A total quota for each school is calculated on basis of roll and, for secondary departments, subjects. Actual expenditures by the school are then compared with the quota figure. If this figure is exceeded the school are informed, otherwise they spend until it is surpassed. Such a system causes a few schools to underspend by substantial amour perhaps because the headteachers underestimate their quota.

APPENDIX 3/F

1962/3 FIGURES FOR EDUCATION AUTHORITY EDUCATIONAL EXPENDITURE : in £'s

	Total Unit Outlay	Teachers' Salaries per pupil	Maintenance per pupil	Aid per pupil	Meals and Milk per pupil	Revenue for Capital per pupil
Aberdeen	124	66.8	26.2	1.99	7.03	14.5
Dundee	102	54.6	19.8	1.08	10.2	10.9
Edinburgh	107	56.9	20.6	1.69	9.61	9.00
Glasgow	112	51.7	28.0	3.92	11.7	11.2
Dunbarton	107	46.5	24.8	2.65	10.0	13.1
Lanark	101	46.0	21.5	2.45	10.8	13.4
Renfrew	96.0	48.0	18.6	1.93	10.4	10.3
Ayr	96.0	53.2	18.3	2.65	9.99	5.15
Clackmannanshire	115	59.6	20.6	2.40	8.90	11.4
Fife	111	54.5	21.4	2.58	9.61	14.6
Midlothian	111	53.5	19.8	2.28	10.3	14.1
Stirling	107	51.4	20.7	2.60	7.63	15.0
West Lothian	96.4	49.9	20.8	2.88	7.11	7.82
Aberdeenshire	120	62.1	19.0	5.02	12.8	12.2
Angus	101	56.6	19.5	3.36	7.01	8.42
Banff	113	64.2	18.2	3.85	10.7	6.41
Berwick	149	71.5	21.9	8.49	14.1	19.6
Bute	137	67.2	26.0	8.97	10.7	11.7
Dumfries	113	55.2	21.4	5.51	11.1	10.3
East Lothian	104	52.6	22.8	2.52	9.03	9.73
Kincardine	110	61.0	14.5	4.40	12.9	7.38
Kirkcudbright	142	69.8	18.3	7.56	18.9	14.4
Moray & Nairn	93.2	53.8	12.8	3.51	10.5	5.10
Orkney	150	69.4	21.9	13.6	16.9	13.5
Perth & Kinross	115	60.0	20.2	5.38	11.4	9.69
Roxburgh	124	61.2	24.0	4.46	11.5	12.6
Selkirk	113	59.6	18.2	2.47	6.97	17.9
Wigtown	112	55.3	17.7	5.81	11.6	10.9
Argyll	131	64.8	18.2	11.2	14.5	11.5
Caithness	121	58.2	19.5	4.02	10.8	19.5
Inverness	131	62.5	19.8	11.2	14.7	12.9
Peebles	145	67.6	24.9	12.6	14.9	12.2
Ross & Cromarty	154	68.6	21.3	16.8	18.2	17.7
Sutherland	224	87.8	33.6	30.7	21.5	31.3
Zetland	175	79.2	27.1	21.0	21.6	11.0

APPENDIX 3/G

RELATIONSHIP OF CAPITAL PROVISION TO MAINTENANCE OF SCHOOLS

SCOTLAND 1960 - 1967

Year Completed	Places Provided	Maintenance(T) Cost per pupil Current prices	Maintenance(C) Cost per pupil Current prices	Maintenance(C) Cost per pupil Constant prices
1960	47,940	£15.8	£12.4	£12.4
1961	38,692	17.0	13.4	13.2
1962	46,131	20.4	16.4	15.7
1963	46,033	22.2	18.1	16.7
1964	42,877	23.4	19.2	17.4
1965	60,531	25.8	20.9	18.5
1966	54,617	29.2	23.8	20.2
1967	50,342	31.2	25.2	20.5

Notes 1) Maintenance (T): Appendix 3/D - total of "School Maintenance" heads.

2) Maintenance (C): Appendix 3/D - correct total of Maintenance of buildings, obtained by subtracting expenditure on sub-heads (a) and (b) (books, apparatus and furniture, equipment) from Maintenance (T).

3) Maintenance (C) at constant prices: index used see Appendix 3/A(2).

APPENDIX 3/H

REPORT 1

TABULATION OF EXPENSE HEADS

Code	Expense Head	£ Total	£ Per Pupil
100	Primary Teacher F.T.	352,807	-
101	Primary Teacher P.T.	62,599	-
100 + 101	Primary Teacher	415,406	42.58
102	Secondary Teacher F.T. Y. I-III	291,348	-
103	Secondary Teacher F.T. Y. IV-VI	110,072	-
104	Secondary Teacher P.T. Y. I-III	27,039	-
105	Secondary Teacher P.T. Y. IV-VI	1,007	-
102 + 104		318,386	82.68
103 + 105		111,079	145.20
102 + 105	All Secondary Teachers	429,465	88.05
100 - 105	All Teachers	844,871	57.7
108	Nursery Assistants Etc.	7,282	-
109	Teachers in F.E. or A.E.	56,085	-
100 - 109		908,198	-
110	Classroom Furniture	315	0.02
111	Audiovisual Aids	1,560	0.10
112	Other Course Equipment	4,090	0.27
113	Other Capital Items	278	0.01
110 - 119		6,244	0.42
120	Repairs to Classroom Furniture	3	-
121	Repairs to Audiovisual Aids	416	0.02
122	Repairs to Course Equipment	1,002	0.06
129	Other Repairs	25	-
120 - 129		1,447	0.09
130	Class Stationery	10,848	0.74
131	Audiovisual Aids	997	0.06
132	Course Supplies	13,537	0.93
133	Textbooks	13,175	0.90
139	Sundry Supplies	43	-
130 - 139		38,599	2.63
152	Use of Swimming Pools, Sports Grounds	520	0.03
191	Laundry of Pupils' Clothing	38	-
199	Sundries	27	-
100 - 199		954,792	65.25

Code	Expense Head	£ Total	£ Per Pupil
201	Non-teaching Headmaster	43,252	2.95
202	Teachers-Responsibility Allowances	54,964	3.75
203	Clerical Help	16,905	1.15
210	Office Furniture	124	-
211	Office Equipment	283	-
220	Repair of Office Furniture	21	-
221	Repair of Office Equipment	497	-
230	Office Stationery	1,647	0.11
231	Office Equipment	17	-
232	Office Furniture	19	-
239	Sundry Supplies	3	-
290	Telephone	3,583	0.24
201 - 299		121,324	8.29
300	Administrator, Psychologists etc.	12,003	
301	Clerical	14,323	
305	Cleaning Staff	486	
309	Attendance Officer	737	
312	Capital Equipment	137	
322	Repairs of Equipment	17	
330	Stationery	1,855	
331	Office Supplies	64	
332	Office Equipment	25	
333	Attendance Officer Supplies	17	
339	Other Supplies	53	
390	Telephone	338	
391	Advertising	2,347	
392	Non Taxable Allowances	974	
399	Unapportioned Items	13	
300 - 399		33,387	2.28

400/

Code	Expense Head	£ Total	£ Per Pupil
400	Janitors, Cleaners	68,242	4.66
405	Gardeners	4,730	0.32
411	Buildings	2,563	0.17
412	Electrical, Heating System	1,647	0.11
413	Fixtures, Fittings	3,100	0.21
415	Garden Equipment	977	0.06
421	Repair - Buildings	26,836	1.83
422	Repair Electrical, Heating System	4,736	0.32
423/7	Repair Fixtures, Fittings	783	0.05
424	Repair Cleaning Equipment	2	
425	Repair Grounds	140	
429	Sundry Repairs	377	0.02
430	Consumables - Electricity	24,423	1.66
431	Consumables Gas	734	0.05
432	Consumables Oil	585	0.03
433	Consumables Solid Fuel	34,720	2.37
434	Consumables Cleaning	333	0.02
435	Consumables For Grounds	798	0.05
436	Consumables For Playground	171	0.01
437	Consumables Furniture	587	0.04
438	Consumables Water	3,518	0.24
439	Consumables Sundry	602	0.04
490	Janitor's Uniforms	33	-
499	Other Sundries	82	-
400 - 499		180,719	12.35
500	Hostel Staff	13,357	
501	Medical Adviser	60	
530	Hostel Supplies	10	
550	Pupils' Travel Expenses	23,358	
551	Teachers' Travel Expenses	1,889	
553	Sports	29	
554	Visits	91	
599	Other Travel Expenses	2	
500 - 599		38,797	2.58

Code	Expense Head	£ Total	£ Per Pupil
600	Cooks, D.R.A.	66,119	4.51
607	Meals Transport Wages	5,092	
620	Repair - Buildings	442	
621	Repair Equipment	30	
622	Repair Electrical, Heating Systems	123	
623	Repair Fixtures, Fittings	31	
631	Consumables - Food	117	
633	Consumables Electricity	2,874	
636	Consumables Solid Fuel	111	
600 - 636		74,941	5.12
900	Youth Leader	1,961	
904	Dentists	11,658	
905	Misc. Manual	8,699	
909	Continuation Class	2	
994	Sundries - Health Service	1,013	
995	Sundries Children's Dept. Clothing	21	
999	Sundries Unallocable	51	
900 - 999		26,930	1.84

APPENDIX 3/H

REPORT 2

UNIT COSTS, ROLLS, P.T.R's, of SCHOOLS

A

PRIMARY

SCHOOL	ROLL	TEACHERS	PUPIL-TEACHER RATIO	PER PUPIL TOTAL COSTS	PER PUPIL SALARY COSTS	SALARY AS A % OF TOTAL
Ewes	11	1	11	£139	£ 96.8	69.6%
Cogrieburn	15	1	15	118	83.2	70.5%
Gair	15	1	15	132	101	76.5%
Garrell	16	1	16	135	100	74.0%
Shieldhill	16	1	16	116	92	79.3%
Tundergarth	15	1	16	141	120.3	85.3%
Goodhope	18	1	18	116	92.3	79.5%
Harlaw	18	1	18	108	81.7	75.6%
Middlebie	18	1	18	100	81.7	81.7%
Sibbaldbie	19	1	19	108	77.8	71.7%
Half Morton	20	1	20	120	73.9	61.5%
Steilston	20	1	20	96.2	77.0	80.0%
Westerkirk	21	1	21	113	72.8	64.4%
Gilnockie	22	1	22	102	71.0	69.6%
Crossford	23	1	23	85.1	65.2	76.6%
Mouswald	23	1	23	75.0	51.2	68.2%
Corrie	27	2	13.5	93.1	67.9	72.9%
Durisdeer	27	2	13.5	72.0	56.5	78.4%
Wanlockhead	27	2	13.5	103	71.6	69.5%
Hottsbridge	28	2	14.0	152	114	75.0%
Glencaple	29	2	14.5	121	107	88.5%
Applegarth	30	2	15.0	115	64.8	56.3%
Eskdalemuir	30	2	15.0	128	84.1	65.7%
Mount Pleasant	32	2	16.0	83.7	67.5	80.6%
Carronbridge	33	2	16.5	94.8	74.4	78.4%
Tortherwald	33	2	16.5	81.4	65.5	80.4%
Glenzier	34	2	17.0	129	80.9	62.6%
Hutton	36	2	18.0	—	—	—
Hightae	37	2	18.5	103	78.7	76.4%
Auldgirth	38	2	19.0	103	87.6	85.0%
Wamphrey	44	2	22.0	72.1	54.3	75.3%
Ae	45	2	22.5	80.9	58.0	71.6%
Canonbie	46	2	23.0	105	66.7	63.5%
Holywood	46	2	23.0	69.8	55.4	79.3%
Brownhall	47	2	23.5	84.2	58.4	69.3%
Amisfield	48	2	24.0	59.1	43.6	73.7%

Johnstonbridge/

SCHOOL	ROLL	TEACHERS	PUPIL TEACHER RATIO	PER PUPIL TOTAL COSTS	PER PUPIL SALARY COSTS	SALARY AS A % OF TOTAL
Johnstonbridge	51	2	25.5	£ 71.6	£ 58.1	81.1%
Hutton Hall	53	2	26.5	—	—	—
Nethermill	61	2	30.5	74.9	58.4	77.9%
Ruthwell	55	3	18.3	76.7	61.2	79.7%
Còllin	56	3	18.6	80.0	60.8	76.0%
Brecondeds	57	3	19.0	68.3	52.9	77.4%
St. Mungo's	61	3	20.3	84.3	55.2	65.4%
Brydekirk	64	3	21.3	91.4	78.8	86.2%
Beattock	65	3	21.6	90.2	71.0	78.7%
Cummertrees	66	3	22.0	89.0	68.4	76.8%
Dalton	68	3	23.0	72.9	60.5	82.9%
Duncow	70	3	23.1	51.4	38.0	73.9%
Moniaive	74	3	24.6	87.0	65.3	75.0%
Kirk-Fleming	83	3	27.6	72.1	50.1	69.4%
Eaglesfield	89	3	29.6	69.7	52.2	74.8%
Dunscore	91	3	30.3	64.9	41.6	64.0%
Gretna Primary	91	3	30.3	—	—	—
St. Columbas	102	3	34.0	61.6	38.2	62.0%
Penpont	111	4	27.7	57.0	45.6	80.0%
Hoddam	130	5	26.0	61.6	51.7	83.9%
Eastriggs	214	6	35.6	47.7	29.9	62.6%
Lochmaben	246	8	30.7	60.6	42.3	69.8%
Troqueer	254	8	31.7	54.4	42.2	77.5%
Noblehill	250	9	27.7	66.7	50.5	75.7%
St. Michael's	290	10	29.0	63.0	47.6	75.5%
St. Teresa's	381	12	31.7	—	—	—
Lincluden	377	13	29.0	53.8	40.9	76.0%
Locharbriggs	415	13	31.9	47.4	33.1	69.8%
Kelloholm	448	14	32.0	49.1	35.7	72.7%
Hecklegirth	515	14	36.7	46.0	30.2	65.6%
Maxwelltown	463	16	28.9	58.7	48.7	82.9%
Newington	485	16	30.1	49.97	35.2	70.4%
Lochside	642	20	32.1	46.4	32.8	70.6%

APPENDIX 3/H

REPORT 2 - Continued

B

UNIT COSTS OF COMBINED PRIMARY/SECONDARY SCHOOLS

SCHOOL	PRIMARY		SECONDARY		UNALLOCABLE
	Cost in £ per pupil	Pupil/teacher ratio	Cost in £ per pupil	Pupil/teacher ratio	Cost in £ per pupil
Dumfries Academy	£ 38.40	36.1	£ 137.46	13.4	£ 25.5
Gretna High	51.87	29.6	103.67	17.7	26.00
Kirkconnel	53.17	27.5	52.54	18.3	24.1
Langholm Academy	22.30	34.6	113.17	11.9	17.99
Lockerbie Academy	41.34	31.0	90.48	15.5	20.68
Loreburn St. Johns	52.04	29.6	74.66	17.4	27.50
Moffat Academy	42.06	30.8	104.31	15.2	24.54
Morton Academy	32.98	33.6	132.27	13.5	20.67
St. Andrew's Girls'	43.94	30.6	82.86	16.0	26.31
Sanquhar Academy	39.78	39.8	96.20	17.8	18.28
Wallacehall Academy	18.74	35.3	96.87	17.0	31.48

APPENDIX 3/H
REPORT 3

UNIT COSTS OF TYPES AND SIZES OF SCHOOLS

A PRIMARY

Code	SIZE 10 Pupils= 1172	SIZE 11 Pupils= 1557	SIZE 12 Pupils= 3182	SIZE 13 Pupils= 1589	SIZE 21 Pupils= 2254	TYPE 28 Pupils= 5151
100	£55.38	£36.94	£30.82	£31.66	£32.01	
101	8.54	9.12	4.17	3.57	6.16	
111	0.08	0.09	-	0.03	-	0.33
112	-	-	-	0.02	-	0.16
113	-	-	-	-	-	0.05
121	-	0.04	-	-	-	0.06
122	0.05	0.01	0.02	-	-	0.03
130	0.72	0.63	0.58	0.56	0.04	1.32
131	-	-	0.04	-	-	0.04
132	0.21	0.15	0.15	0.21	0.05	0.12
133	0.83	0.70	0.63	0.53	0.42	0.06
152	-	-	-	-	-	0.03
201	-	-	1.16	1.86	-	5.00
202	7.14	2.98	1.07	0.86	0.74	1.06
203	-	0.26	1.11	0.82	-	1.28
210	-	-	-	-	-	0.02
211	-	0.01	0.02	0.01	-	0.02
230	-	0.03	0.04	0.03	-	0.17
290	1.17	0.32	0.09	0.09	-	0.14
400	4.43	3.27	3.71	2.98	-	5.21
411	0.33	0.07	0.09	-	0.11	0.23
412	0.34	0.24	0.16	-	-	0.04
413	0.16	0.25	0.19	0.03	-	0.19
421	5.59	2.70	1.08	0.79	-	1.40
422	0.64	0.33	0.16	0.11	-	0.38

Unit Costs of Types and Sizes of Schools (Contd.)

Report 3

Code	SIZE 10 Pupils= 1172	SIZE 11 Pupils= 1557	SIZE 12 Pupils= 3182	SIZE 13 Pupils= 1589	SIZE 21 Pupils= 2254	TYPE 28 Pupils= 515
423	£0.02	£0.02	£0.01	£0.02	£ -	£0.02
425	0.02	-	-	-	-	0.01
430	1.48	1.18	0.50	1.50	-	1.94
431	-	-	-	-	-	0.08
432	-	-	-	-	-	0.16
433	2.19	1.56	0.63	0.43	-	0.95
434	0.02	-	-	0.01	-	0.01
435	0.01	-	-	-	-	0.01
436	0.04	0.01	0.02	-	-	-
437	0.07	0.06	0.02	0.01	-	0.07
438	0.35	0.56	0.14	0.08	-	0.20
439	0.10	0.03	0.01	-	-	0.03
600	5.15	3.54	2.76	4.03	-	2.90
607	-	-	0.39	-	-	0.23
620	0.12	0.04	-	0.01	-	0.01
622	0.01	-	-	-	-	-
633	0.42	0.33	0.21	0.33	-	0.05
905	-	0.02	0.02	0.07	-	0.07
909	0.03	0.27	0.26	0.26	-	0.24
TOTAL	£95.86	£66.00	£50.50	£51.13	£39.57	£23.52

APPENDIX 3/H

REPORT 3 - B SECONDARY

CODE	TYPE 30 Pupils= 579	TYPE 52 Pupils= 789	TYPE 61 Pupils= 829	TYPE 62 Pupils= 804	TYPE 70 Pupils= 539	TYPE 71 Pupils= 214	TYPE 73 Pupils=1104	TYPE 28 Pupils=
102	£ 58.31	£ 50.34	£ 59.21	£53.12	£ 76.65	£ 74.78	£ 53.40	£ -
103	-	64.85	18.23	19.83	16.31	14.04	10.53	-
104	17.47	0.91	0.93	5.94	8.79	6.21	3.04	-
105	-	1.15	-	-	0.08	0.20	-	-
110	-	-	-	0.05	-	-	-	-
111	0.58	-	-	-	-	-	0.04	0.33
112	0.24	0.71	0.93	0.37	1.05	1.12	0.83	0.16
113	-	-	-	-	-	-	-	0.05
121	0.02	-	-	0.06	-	-	0.01	0.06
122	0.08	0.12	0.11	0.07	0.10	0.13	0.14	0.03
130	0.06	1.28	0.17	1.06	0.01	0.04	0.89	1.32
131	0.07	0.22	0.05	0.12	0.03	0.02	0.06	0.04
132	1.92	1.97	2.84	2.04	2.98	3.01	1.60	0.12
133	0.46	1.71	1.88	1.31	0.89	1.00	1.01	0.06
152	0.04	-	-	-	-	-	0.11	0.03
201	3.75	-	-	4.12	-	-	2.58	5.00
202	3.26	13.97	4.64	6.65	2.49	2.53	4.40	1.06
203	0.64	-	-	1.28	-	-	0.60	1.28
211	-	-	-	-	-	-	-	0.02
222	-	-	0.57	-	-	-	0.02	-
230	-	-	-	0.14	0.02	-	0.22	0.17
232	-	-	-	0.02	-	-	-	-

REPORT 3 - B SECONDARY (Contd.)

Code	TYPE 30 Pupils= 579	TYPE 52 Pupils= 789	TYPE 61 Pupils=829	TYPE 62 Pupils= 804	TYPE 70 Pupils= 539	TYPE 71 Pupils= 214	TYPE 73 Pupils=1104	TYPE 28 Pupils=
290	£ 0.04	£ -	£ -	£ 0.13	£ -	£ -	£ 0.08	£ 0.14
400	4.48	-	-	4.71	-	-	6.01	5.21
411	-	-	-	-	-	-	0.27	0.23
412	-	-	-	-	-	-	-	0.14
413	0.25	0.05	0.29	0.18	-	-	0.16	0.19
415	-	-	-	0.20	-	-	0.28	-
421	0.65	-	-	0.60	-	-	0.76	1.40
422	0.05	-	-	0.17	0.02	-	0.28	0.38
423	-	0.01	-	-	0.04	-	0.02	0.02
425	-	-	-	-	-	-	-	0.01
429	-	-	-	-	-	-	-	1.94
430	0.86	-	-	4.93	0.38	-	1.03	-
431	-	-	-	0.07	-	-	0.05	0.08
432	-	-	-	-	-	-	-	0.10
433	0.65	-	-	0.10	-	-	0.48	0.95
434	-	-	-	-	-	-	0.04	0.01
435	-	-	-	0.01	-	-	0.05	0.01
437	-	-	-	-	-	-	0.01	0.04
438	0.16	-	-	-	-	-	0.33	0.20
439	-	-	-	-	-	-	-	0.03
600	4.88	-	-	1.09	-	-	3.08	2.90
607	-	-	-	-	-	-	-	0.23
620	0.09	-	-	-	-	-	0.02	0.01
633	0.03	-	-	-	-	-	0.25	0.05
905	-	-	-	0.17	-	-	0.07	0.07
909	0.23	-	-	0.40	-	-	-	0.24
TOTAL	99.43	137.46	90.00	109.12	110.50	113.17	93.06	23.52

APPENDIX 3/H

REPORT 4 - ANALYSIS BY SUBHEADS OF EXPENSE WITHIN SCHOOL

SCHOOL	Sals/Wages	Capital	Repairs	Consumables	Others	Total	% Sals./W / Total
Ewes	116.36	-	6.00	14.63	2.18	139	80.1%
Cogrieburn	94.13	2.46	14.80	4.80	1.60	118	79.7%
Gair	115.86	1.73	5.80	6.33	2.04	132	87.7%
Tundergarth	120.26	2.26	11.20	4.86	2.53	141	85.2%
Garrell	113.25	2.43	10.75	6.06	2.06	135	83.8%
Shieldhill	103.06	-	6.18	5.08	2.12	116	88.8%
Goodhope	108.22	-	0.61	6.66	1.94	116	93.2%
Harlaw	88.44	-	10.88	6.27	2.05	108	81.8%
Middlebie	92.55	-	3.22	2.77	1.77	100	92.5%
Sibbaldbie	89.15	-	10.21	6.89	1.63	108	82.5%
Half Morton	93.20	-	14.25	9.80	2.70	120	77.6%
Steilston	88.55	-	2.60	4.00	0.05	96.2	92.0%
Westerkirk	84.71	-	7.66	19.00	2.09	113	74.9%
Gilnockie	81.18	-	5.09	13.18	2.04	102	79.5%
Crossford	74.83	2.26	2.17	4.30	1.66	85.1	87.9%
Mouswald	61.82	-	8.30	7.52	1.47	75.0	82.4%
Corrie	76.33	-	12.51	3,25	1.03	93.1	81.9%
Durisdeer	64.51	-	2.07	3.70	1.22	72.0	89.5%
Wanlockhead	90.03	0.96	5.96	4.18	1.74	103	87.4%
Hottsbridge	122.64	-	20.17	8.03	1.64	152	80.6%
Glencaple	111.55	-	3.82	5.10	0.37	121	92.1%
Applegarth	72.40	5.33	26.80	8.56	1.50	115	62.9%
Eskdalemuir	105.43	2.76	1.40	17.66	1.50	128	82.3%
Mt. Pleasant	75.59	-	1.87	5.37	0.84	83.7	90.3%
Carronbridge	85.54	-	4.51	3.81	0.90	94.8	90.2%

REPORT 4 (Contd.) Analysis by Subheads of Expense Within School

SCHOOL	Sals/Wages	Capital	Repairs	Consumables	Others	Total	% Sals./Total
Tortherwald	73.12	-	1.72	5.48	1.09	81.4	89.8%
Glenzier	101.42	1.52	8.85	15.97	1.38	129	78.6%
Hutton	30.52	2.77	2.05	4.52	0.86	*	*
Hightae	85.48	-	9.70	6.40	1.16	103	82.9%
Auldgirth	95.55	-	2.26	3.68	1.57	103	92.7%
Wamphrey	60.43	-	6.50	3.93	0.63	72.1	83.8%
Ae	71.75	0	3.24	5.24	0.73	80.9	88.6%
Canonbie	76.30	6.76	8.04	12.89	0.91	105	72.6%
Holywood	64.32	0	0.89	4.17	0.47	69.8	92.1%
Brownhall	67.02	2.44	7.36	6.70	0.72	84.2	79.5%
Amisfield	49.47	0.81	4.35	3.64	0.79	59.1	83.7%
Johnstonebridge	63.92	0	2.80	4.52	0.58	71.6	89.2%
Hutton Hall							*
Nethermill	65.60	0	5.01	3.57	0.70	74.9	87.5%
Collin	67.89	3.21	5.05	3.30	0.53	80.0	84.8%
Breconbeds	60.14	1.24	3.75	2.82	0.36	68.3	88.0%
St. Mungo's	62.67	1.16	13.67	6.34	0.52	84.3	74.3%
Brydekirk	83.43	2.54	1.45	3.96	0	91.4	91.2%
Beattock	83.92	0	2.30	3.70	0.30	90.2	93.0%
Cummertrees	78.06	0.90	4.74	4.75	0.54	89.0	87.7%
Dalton	66.84	0	2.46	2.98	0.62	72.9	91.6%
Duncow	43.47	1.40	1.24	4.97	0.30	51.4	84.5%
Moniaive	71.38	0.37	7.51	6.81	0.51	87.0	82.0%
Kirk-Fleming	57.27	0.36	3.07	10.92	0.46	72.1	79.4%
Eaglesfield	57.38	0.26	6.65	5.29	0.16	69.7	82.3%
Dunscore	55.76	0	0.91	7.58	0.54	64.9	85.9%
Gretna Primary							*
St. Columbas	53.86	1.04	1.73	4.86	0.18	61.6	87.4%
Penpont	51.92	0	0.95	3.91	0.27	57.0	91.0%
Hoddam							

Report 4 (Contd.) Analysis by Subheads of Expense within Schools

SCHOOL	Sals./Wages	Capital	Repairs	Consumables	Others	Total	% Sals./W / Total
Hoddam	54.92	0	0.84	7.65	0.12	61.6	89.1%
Eastriggs	39.64	0.52	3.31	4.21	0.09	47.7	83.1%
Lochmaben	50.16	3.45	2.30	4.50	0.15	60.6	82.7%
Troqueer	51.40	0	0.59	2.29	0.09	54.4	94.4%
Noblehill	60.70	0.58	2.42	2.81	0.12	66.7	91.0%
St. Michaels	54.24	0.71	1.58	4.50	0.06	63.0	86.0%
St. Teresa's	26.51						*
Lincluden	49.15	0.23	2.12	2.25	0.10	53.8	91.3%
Locharbriggs	43.04	0	0.38	3.91	0.09	47.4	90.7%
Kelloholm	43.13	0.40	2.94	2.49	0.13	49.1	87.8%
Hecklegirth	43.37	0	0.06	2.75	0.02	46.0	94.2%
Maxwelltown	54.87	0.23	0.32	3.17	0.05	58.7	93.4%
Newington	43.74	0	2.25	3.77	0.15	50.0	87.4%
Lochside	41.60	0.10	0.49	4.13	0.08	46.4	89.6%

* No reliable figures are available.

APPENDIX 3/H

REPORT 4 - Analysis by Subheads of Expense within School.

1. Primary Department of Secondary Schools
2. Joint Costs
3. Secondary Department of Secondary Schools

SCHOOL	PER PUPIL COSTS						
	Sals/ Wages	Capital	Repairs	Consum- ables	Others	Total	% Sals. / Total
1 Dumfries Academy	£ 38.19	£-	£0	£0.20	£-	£ 38.40	99.4%
2 " "	16.00	0.55	1.38	7.31	0.27	25.50	62.7%
3 " "	131.29	0.78	0.15	5.22	0.02	137.46	95.5%
1 Gretna High	51.29	-	-	0.58	-	51.87	98.8%
2 " "	16.69	1.75	3.07	4.45	0.07	26.00	64.2%
3 " "	99.63	-	0.16	3.84	0.02	103.67	96.1%
1 Kirkconnel Secondary	52.90	-	-	0.26	-	53.17	99.5%
2 " "	17.13	0.84	2.92	3.05	0.14	24.10	71.1%
3 " "	49.45	0.49	0.32	2.18	-	52.54	94.1%
1 Langholm Academy	21.93	-	-	0.37	-	22.30	98.3%
2 " "	11.82	0.48	1.48	3.94	0.28	17.99	65.7%
3 " "	107.83	1.12	0.13	4.13	-	113.17	95.3%

REPORT 4 - Analysis by Subheads of Expense within School.

SCHOOL	PER PUPIL COSTS						
	Sals/ Wages	Capital	Repairs	Consum- ables	Others	Total	% Sals/ Total
1 Lockerbie Academy	£ 40.75	£-	£-	£0.57	£0.01	£ 41.34	98.6%
2 " "	16.45	0.41	0.65	3.05	0.09	20.68	79.5%
3 " "	84.68	0.83	0.13	5.61	0.03	90.48	93.6%
1 Loreburn St. Johns	51.70	-	-	0.34	-	52.04	99.3%
2 " "	18.59	1.04	2.74	4.46	0.63	27.50	67.6%
3 " "	72.02	0.68	0.18	1.76	-	74.66	96.5%
1 Moffat Academy	41.00	-	-	1.63	-	42.06	97.5%
2 " "	17.49	0.57	2.43	3.91	0.10	24.54	71.3%
3 " "	100.04	0.82	0.18	3.27	-	104.31	95.9%
1 Morton Academy	32.65	-	-	0.32	-	32.98	99.0%
2 " "	15.71	0.14	2.19	2.42	0.18	20.67	76.0%
3 " "	126.48	1.43	0.17	4.15	-	132.27	95.6%

REPORT 4 - Analysis by Subheads of Expense within School (Contd.)

SCHOOL	PER PUPIL COSTS						
	Sals./ Wages	Capital	Repairs	Consum- ables	Others	Total	% Sals./Total
1. St. Andrew's Girls	£ 43.52	£-	£-	£0.42	£-	£43.94	99.0%
2 " "	17.64	0.96	2.21	5.16	0.20	26.31	67.0%
3 " "							*
1 Sanquhar Academy	38.52	0.92	-	0.33	-	39.78	96.8%
2 " "	12.83	0.98	1.85	2.49	0.12	18.28	70.2%
3 " "	89.76	0.90	0.15	5.39	-	96.20	93.3%
1 Wallacehall Academy	17.96	0.04	-	0.73	-	18.74	95.8%
2 " "	18.68	2.57	3.79	6.25	0.22	31.48	59.3%
3 " "	86.43	2.13	1.94	3.47	0.20	96.87	89.2%
1 St. Andrew's Boys							*
2 Annan Academy	97.35	0.81	0.94	9.86	0.13	109.12	89.2%
3 Dumfries High	83.75	1.63	1.29	6.12	0.22	93.06	90.0%

* No reliable figures available.

REPORT 4 - Analysis by Subheads of Expense with School (Contd.)

NURSERY SCHOOLS, SPECIAL SCHOOLS AND OCCUPATIONAL CENTRES.

SCHOOL	PER PUPIL COSTS						
	Sals./ Wages	Capital	Repairs	Consum- ables	Others	Total	% Sals / Total
Annan Nursery	£ 87.92	£-	£4.78	£15.17	£0.60	£108.47	81.1%
Dumfries Nursery	91.05	1.45	3.82	7.70	1.05	105.07	86.6%
Catherinefield	95.50	-	4.47	2.90	0.60	103.47	92.3%
Dumfries Occup. Centre	48.35	-	3.78	21.92	1.35	75.40	64.1%
Sanquhar Occup. Centre	213.22	-	3.76	13.11	2.00	232. 09	91.9%
Barony	617.66	-	0.05	5.57	-	677.28	91.2%

APPENDIX 3/H

REPORT 5

SUB-HEADS OF EXPENSE WITHIN SCHOOL TYPE

	SUBHEADS				
SCHOOL TYPE	SALARIES	"CAPITAL"	REPAIRS	CONSUMABLES	SUNDRIES
10	80.70	0.91	6.52	6.49	1.17
11	56.44	0.68	3.18	5.33	0.32
12	45.53	0.48	1.32	3.04	0.09
13	46.15	0.11	0.98	3.74	0.09
21	40.05	0.11	-	0.53	-
28	16.02	0.81	1.91	4.45	0.14
30	93.06	1.08	0.91	4.27	-
52	131.29	0.78	0.15	5.22	-
61	84.45	1.23	0.69	4.95	-
62	97.35	0.81	0.94	9.86	0.13
70	104.93	1.05	0.16	4.33	-
71	102.34	1.12	0.13	4.13	-
73	83.75	1.63	1.29	6.12	0.08

APPENDIX 3/H

REPORT 6 - Analysis of Secondary School Expenses within Subjects.
TABLE A - Unit Staffing Costs.

SUBJECT	S_p I-III	S_p IV-VI	S_{pp} I-III	S_{pp} IV-VI	S_{tg} I-III	S_{tg} IV-VI	S_P	S_{PP}	S_{TG}
English	£12.43	£17.75	£1.81	£2.40	£225.54	£237.38	£13.34	£1.92	£228
History	5.09	26.55	2.24	3.59	116.47	211.50	6.63	2.51	133
Geography	3.94	18.57	1.67	3.45	86.55	163.65	5.22	1.99	101
Modern Studies	6.64	9.87	1.30	2.17	161.33	158.00	6.96	1.38	160
Mathematics	11.17	17.23	1.81	2.36	162.94	184.06	12.15	1.91	167
Physics	8.57	18.63	3.64	4.80	136.45	150.81	11.89	4.16	143
Chemistry	10.20	18.04	4.44	4.27	170.26	172.03	12.83	4.36	171
Biology	6.77	24.90	2.94	4.55	104.35	249.87	10.79	3.59	148
General Science	10.08	15.80	2.41	2.77	145.10	249.33	10.33	2.43	149
Classics	23.17	40.57	4.66	6.14	185.42	145.77	31.25	5.45	159
Mod. Languages	13.14	28.56	2.22	4.39	257.88	308.09	17.64	2.90	279
Art	7.33	14.51	2.51	3.90	103.99	99.78	8.00	2.68	103
Music	2.84	5.90	1.44	3.45	55.50	67.57	3.26	1.68	58
Phys. Education	4.48	4.54	1.48	1.62	69.16	65.56	4.49	1.50	68
Commercial	8.20	13.35	1.25	2.32	99.09	268.00	9.81	1.56	135
Domestic Science	12.92	28.86	2.22	5.08	106.09	173.20	14.47	2.49	114
Technical	16.19	24.43	2.55	4.06	129.89	125.72	17.39	2.76	129

APPENDIX 3/H

REPORT 6 - Analysis of Secondary School Expenses Within Subjects.

TABLE B - Unit Teaching Costs.

SUBJECT	TEACHING COSTS		
	C_P	C_{PP}	C_{TG}
English	£14.23	£2.05	£243.38
History	7.30	2.77	147.30
Geography	5.71	2.18	110.88
Modern Studies	7.75	1.54	179.11
Mathematics	13.09	2.06	180.37
Physics	16.09	5.63	194.18
Chemistry	15.09	5.12	201.03
Biology	12.09	4.03	166.44
General Science	11.46	2.70	165.69
Classics	36.70	6.40	187.12
Modern Languages	18.96	3.12	300.32
Art	8.89	2.99	114.65
Music	3.83	2.00	68.84
Physical Education	5.33	1.78	81.30
Commercial	11.64	1.85	160.50
Domestic Science	16.10	2.77	126.46
Technical	19.96	3.17	148.09

C_P: Teaching Cost per pupil

C_{PP}: Teaching Cost per pupil-period

C_{TG} : Teaching Cost per teaching-group

APPENDIX 3/H

REPORT 6 - Analysis of Secondary School Expenses Within Subjects

TABLE C - Salary Element as a Proportion of Whole Cost per Pupil

SUBJECT	Staffing Cost per pupil S_p	Responsibility Allowance Cost per pupil RA_p	$S_p + RA_p$	Teaching Cost per pupil C_p	$\frac{S_p + RA_p}{C_p}$ x
English	£13.34	£0.53	£13.87	£14.23	97.47%
History	6.63	0.44	7.07	7.30	96.80
Geography	5.22	0.28	5.50	5.71	96.30
Modern Studies	6.96	0.73	7.69	7.75	99.22
Mathematics	12.15	0.53	12.68	13.09	96.86
Physics	11.89	0.24	12.13	16.09	75.38
Chemistry	12.83	0.99	13.82	15.09	91.58
Biology	10.79	0.29	11.08	12.09	91.64
General Science	10.33	0.56	10.89	11.46	95.02
Classics	31.25	4.49	35.74	36.70	97.38
Modern Languages	17.64	0.85	18.49	18.96	97.52
Art	8.00	0.41	8.41	3.89	94.60
Music	3.26	0.30	3.56	3.83	92.95
Physical Education	4.49	0.45	4.94	5.33	92.68
Commercial	9.81	0.95	10.75	11.64	92.35
Domestic Science	14.47	0.78	15.25	16.10	94.72
Technical	17.39	0.89	18.28	19.96	91.58

APPENDIX 3/H

REPORT 6 - Analysis of Secondary School Expenses Within Subjects

TABLE D - Per Pupil Costs of Non-Teaching Expenses

SUBJECT	EXPENSE CODES 112	121	122	130	131	132	133	222	413	423	430
English	-	-	-	0.02	0	-	0.32	-	-	-	-
History	-	-	-	0.02	0	0	0.16	-	-	-	-
Geography	-	-	-	0.01	0	0	0.17	-	-	-	-
Modern Studies	-	-	-	-	-	-	0.05	-	-	-	-
Maths.	0.01	-	-	0.05	-	0.01	0.20	0.10	-	-	-
Physics	1.41	-	0	0.04	0.02	2.22	0.23	-	-	-	-
Chemistry	-	-	-	0.06	0	1.07	0.11	-	-	-	-
Biology	0.25	-	-	0.04	0.01	0.54	0.14	-	-	-	-
General Science	0.15	-	0	0	0	0.29	0.01	-	0.07	-	-
Classics	-	-	-	0.07	0	-	0.81	-	-	0.06	-
Mod. Languages	-	-	-	0.04	0.05	0	0.37	-	-	-	-
Art	0.06	-	0	0.03	-	0.32	0	-	0.02	-	-
Music	0.05	0	0.03	0	0.02	0.03	0.10	-	-	-	-
Phys. Education	0.03	-	0.01	0	0	0.25	0	0	0.06+	-	-
Commercial	0.34	-	0.08	0.17	0	0.05	0.20	-	-	-	-
Domestic Science	0.09	-	0.05	0.02	0	0.58	0.07	-	-	-	-
Technical	0.20	-	0.08	0.04	-	1.16	0.02	-	0.01	-	0.11
General	0.13*	0.02	0	0.36	0.07	0.05	0.13	**	**	**	**

\+ : Expense Code 152

* : Sum of 110,111,112

** : Whereas those General expense codes 112,121,122,130,131,132,133 contain costs which could r allocated to any of the above subjects on a priori basis at the stage of coding the invoice expenses of the type 222,413,423,430,437 would not as a rule be allocable to any school sub and are accordingly treated as overhead expenses.

APPENDIX 3/H REPORT 7

DUMFRIES ACADEMY - DETAILED COST ANALYSIS

TABLE A - UNIT STAFFING COSTS OF SUBJECTS

SUBJECT	S_p I-III	S_p IV-VI	S_{pp} I-III	S_{pp} IV-VI	S_{tg} I-III	S_{tg} IV-VI	S_P	S_{PP}	S_{TG}
English	£11.35	£18.40	£ 1.73	£2.43	£325.85	£237.89	£14.82	£2.10	£265
History	6.79	40.56	2.35	5.31	154.00	257.86	13.80	3.56	204
Geography	5.14	28.61	1.74	3.71	110.33	143.05	10.70	2.63	129
Mathematics	16.25	17.64	2.45	2.27	292.55	192.90	16.52	2.36	232
Physics	7.00	15.30	3.19	4.08	99.09	109.28	9.78	3.60	104
Chemistry	6.64	19.24	3.24	4.17	98.14	144.3	10.75	3.72	120
Biology	9.22	18.89	4.42	3.05	106.44	187.88	12.89	3.54	140
Classics	27.43	33.82	5.56	4.82	215.57	141.68	30.95	5.09	164
Modern Languages	15.64	29.38	2.63	4.88	313.63	314.06	21.80	3.65	313
Art	9.89	16.20	3.80	3.10	114.04	96.46	11.85	3.47	105
Music	2.25	6.41	1.81	3.43	40.86	58.62	4.15	2.72	51.[illegible]
Physical Education	5.29	5.91	1.81	1.86	64.09	76.45	5.57	1.83	69
Commercial	14.55	10.40	2.25	2.55	168.43	113.90	11.48	2.45	127
Domestic Science	10.06	17.88	3.54	4.11	120.13	149.06	13.28	3.83	134
Technical	11.17	10.48	4.38	2.56	105.90	71.52	10.92	3.50	90
General	-	-	-	-	-	-	* 4.088	0.10	-

* Obtained from the sum of unallocable teaching salaries(less the R.A.) over 789 pupils

APPENDIX 3/H REPORT 7

DUMFRIES ACADEMY - DETAILED COST ANALYSIS

TABLE B - UNIT TEACHING COSTS OF SUBJECTS

SUBJECT	C_P	C_{PP}	C_{TG}
English	£16.41	£2.32	£294.17
History	15.95	4.11	235.96
Geography	12.62	3.09	152.20
Mathematics	18.95	2.65	260.88
Physics	11.20	4.13	119.28
Chemistry	12.52	4.34	140.56
Biology	13.80	3.79	150.17
General Science*	0.18	0.059	1.99
Classics	36.87	6.07	195.80
Modern Languages	23.38	3.91	336.60
Art	13.57	3.98	121.25
Music	5.07	3.32	63.48
Physical Education	–	–	–
Commercial	14.36	3.06	159.60
Domestic Science	15.82	4.57	160.33
Technical	13.94	4.47	115.57

* Obtained by spreading expenses under "29" subject code over sum of p/ pp/ tg in 23, 24,25.

APPENDIX 3/H REPORT 7

DUMFRIES HIGH SCHOOL - DETAILED COST ANALYSIS

TABLE A - UNIT STAFFING COSTS OF SUBJECTS

SUBJECT	S_p I-III	S_p IV-VI	S_{pp} I-III	S_{pp} IV-VI	S_{tg} I-III	S_{tg} IV-VI	S_P	S_{PP}	S_T
English	£10.10	£17.75	£1.45	£2.18	£266.83	£246.8	£11.05	£1.55	£2
History	7.64	13.15	3.09	3.28	258.66	263.0	8.13	3.11	2
Geography	5.28	8.75	2.10	2.18	181.50	245.0	5.70	0.81	1
Modern Studies	5.38	8.76	1.15	1.89	144.83	159.60	6.20	1.23	1
Mathematics	6.60	9.59	1.15	1.45	151.69	222.33	7.00	1.20	1
General Science	13.62	14.50	2.95	2.85	163.3	180.28	13.18	2.94	1
Modern Languages	7.23	25.40	1.08	3.17	246.00	381.00	8.47	1.25	2
Art	8.12	6.22	2.82	1.55	117.79	49.8	7.96	2.68	1
Music	1.79	5.75	0.95	3.47	47.48	92.00	2.04	1.08	[illegible]
Physical Education	3.78	4.19	1.23	1.39	59.58	64.77	3.83	1.25	[illegible]
Commercial	5.61	19.58	0.78	1.69	63.51	133.83	7.16	0.93	7
Domestic Science	12.55	24.94	2.08	2.94	106.72	179.60	13.39	2.16	11
Technical	16.02	24.68	2.24	2.69	94.51	132.92	17.16	2.32	1
General	0.10	-	-	-	-	-	0.10	-	-

APPENDIX 3/H REPORT 7

RESULTS - DUMFRIES HIGH SCHOOL - DETAILED COST ANALYSIS
TABLE B - UNIT TEACHING COSTS OF SUBJECTS.

SUBJECT	C_P	C_{PP}	C_{TG}
English	£11.93	£1.68	£283.34
History	8.76	3.35	279.28
Geography	5.85	2.17	195.71
Modern Studies	6.67	1.32	158.00
Mathematics	7.84	1.34	180.44
General Science	14.76	3.29	184.86
Modern Languages	8.74	1.29	273.57
Art	8.65	2.91	108.34
Music	2.63	1.40	67.00
Physical Education	4.47	1.46	70.23
Commercial	8.49	1.10	89.51
Domestic Science	15.02	2.42	126.14
Technical	19.86	2.68	115.67
General	1.04	0.02	-

APPENDIX 3/I REPORT 1 ANALYSIS OF EXPENSE HEADS AREA B: SAMPLE OF 14 SCHOOLS 1964/5

Code	Description	Value £	As a Proportion of total %	
100	Primary Teacher's Salary	108,808	18.26	78.6% Teachers' Sala
102	Secondary Teacher's Salary	357,370	60.00	
108	Auxiliary Personnel	11,863 (1)	1.99	
119	Capital Equipment	5,899	1.00	
130	Stationery,equipment	26,558	4.46	7.32% Consumable Cla Equipment, Textbooks
133	Textbooks	15,075	2.53	
137	Re Saleable items	425	0.07	
139	Other Supplies	1,530	0.26	
203	Clerical Salary	2,787	0.47	
217	Office furniture	24	0.00	
219	Office Equipment	52	0.00	
230	Office Stationery	348	0.06	
400	Janitor's wage	11,641	1.96	5.02% Janitors', Cle wages
401	Cleaner's wages	18,245	3.06	
417	School furniture	1,891	0.32	
419	School fittings	72	0.01	
429	Repair of fittings	95	0.02	
430	Electricity	19,776	3.32	5.32% Heating, Lighti
431	Gas	850	0.14	
432	Oil	7,956	1.33	
433	Solid fuel	3,158	0.53	
437	Small furniture	275	0.04	
439	All other supplies	1,195	0.20	
552	Teachers' Travel Expenses	197	0.03	
Total		596,090	100	

Notes (1) Includes £139 allocable to an auxiliary in F.E.

CALCULATION OF UNIT COSTS IN PRIMARY SCHOOLS

Code	Description	Value £	Cost per pupil £
100	Primary teacher's salary	108,808	36.46
108	Auxiliary personnel (1)	772	0.26
119	Capital Equipment	91	0.03
130	Stationery, equipment	2,129	0.71
133	Textbooks	2,624	0.88
139	Other supplies	286	0.10
217	Office furniture	24	0.00
230	Office Stationery	41	0.01
400	Janitors' Wage	5,441	1.82
401	Cleaners' Wage	4,510	1.51
417	School furniture	1,349	0.45
429	Repair of fittings	66	0.02
430	Electricity	1,378	0.46
431	Gas	79	0.02
432	Oil	1,888	0.63
433	Solid fuel	3,095	1.04
439	Other supplies	265	0.09
552	Teachers' Travel Expenses	82	0.02
Total		132,928	44.54 (2)

Notes (1) The £772 refers only to the sample schools; a further £5219 was incurred by primary depts. outwith the sample schools.

(2) All figures in this column were obtained by dividing the "value" by 2984 - the total number of pupils on rolls of 9 schools.

CALCULATION OF UNIT COSTS IN SECONDARY SCHOOLS

Code	Description	Value £	Cost per pupil £
102	Secondary teacher's salary	357,370	104.16
108	Auxiliary personnel [1]	886	0.40
119	Capital Equipment	5,809	1.69
130	Stationery, equipment	24,428	7.12
133	Textbooks	12,451	3.63
137	Re-saleable items	425	0.12
139	Other supplies	1,244	0.36
203	Clerical salary	2,787	0.81
219	Office equipment	52	0.01
230	Office stationery	307	0.09
400	Janitor's wage	6,200	1.81
401	Cleaner's wage	13,735	4.00
417	School furniture	542	0.16
419	School fittings	72	0.02
429	Repair of fittings	30	0.00
430	Electricity	18,399	5.36
431	Gas	772	0.22
432	Oil	6,068	1.77
433	Solid fuel	63	0.01
437	Small furniture	275	0.08
439	Other supplies	930	0.27
552	Teachers' Travel expenses	111	0.03
Total		452,956	132.01 [2]

Notes (1) The 886 refers only to the sample schools; a further £4846 was incurred by secondary depts. outwith the sample schools.

(2) All figs. in this column were obtained by dividing the "value" by 3431 - the total number of pupils on rolls of the 5 schools.

UNIT COSTS IN INDIVIDUAL PRIMARY SCHOOLS

School Code		10	11	12	13	14	15	16	17	18	
Roll		692	616	559	273	222	419	66	66	71	
Unit Costs											Description of Expense
Codes	100	£35.35	£31.81	£34.64	£41.54	£36.29	£34.27	£71.81	£47.51	£52.57	Primary Teacher's Sala
	108	0.63	0.38	-	-	-	-	-	1.40	-	Auxiliary Personnel
	130	0.63	0.44	0.55	0.75	0.98	1.03	0.83	1.39	1.42	Stationery,equipment
	133	0.72	0.84	1.27	0.61	0.58	1.01	0.93	1.13	0.33	Textbooks
	139 +119	0.07	0.12	0.10	0.19	0.08	0.07	0.07	0.27	0.09	other supplies
											Capital equipment
	230	0.01	-	-	-	-	+217 0.05	0.06	0.04	0.01	Office equipment
	400	1.09	1.19	1.50	1.87	3.19	1.60	5.72	6.87	5.35	Janitor's wage
	401	1.84	1.61	1.33	1.82	2.24	1.17	-	-	-	Cleaner's wage
	417 +429	-	-	2.36	-	0.21	0.01	0.03	0.04	-	School furniture,fitti
	430	0.38	0.43	0.38	0.37	0.45	0.77	0.33	0.68	0.53	Electricity
	431	-	-	0.08	0.04	0.04	-	0.16	-	0.02	Gas
	432	1.26	1.25	-	-	-	-	-	-	3.45	Oil
	433	-	-	1.68	1.92	2.33	1.40	3.01	4.87	-	Solid fuel
	439	0.11	0.06	0.13	0.13	0.02	0.05	-	0.10	0.01	Other supplies
	552	0.04	0.03	0.04	-	-	-	-	0.03	-	Teachers' travel exper
Total		£42.2	£38.3	£44.1	£49.4	£46.5	£41.5	£82.9	£64.3	£63.8	

APPENDIX 3/I REPORT 3 - SECONDARY

UNIT Costs in Individual Secondary Schools

Area B 1964/5

School Code		61	62	63	64	65	
Roll		1124	610	661	471	565	
Unit Costs	Codes						Description of Expense
	102	£104.92	£113.57	£109.69	£71.05	£113.58	Secondary Teachers' Sa
	108	0.23	-	0.63	-	-	Auxiliary personnel
	119	0.91	0.89	4.96	1.35	0.55	Capital equipment
	130	3.81	3.01	22.03	3.18	3.95	Stationery, equipment
	133	2.06	1.50	11.89	1.28	1.33	Textbooks
	137 +139	0.22	0.28	1.03	0.43	0.58	"Other" supplies
	203	0.74	0.93	0.72	0.73	0.96	Clerical Salary
	230	0.07	0.06	0.26	0.08	0 .03	Office stationery
	400	1.82	1.22	1.80	1.58	2.58	Janitor's wage
	401	3.35	3.75	4.03	5.07	4.62	Cleaner's wage
	417 +429	0.09	0.03	0.34	0.26	0.25	School furniture, fiti
	430	1.66	2.98	10.50	13.56	2.42	Electricity
	431	0.24	0.08	0.32	0.35	0.11	Gas
	432	2.49	2.67	-	-	2.89	Oil
	433	-	-	-	0.03	0.08	Solid fuel
	437 +439	0.17	0.17	0.90	0.38	0.20	Other supplies
	552	0.02	-	-	0.11	0.03	Teachers' travel exper
Total		£122.9	£131.2	£169.2	£99.5	£134.3	

APPENDIX 3/J

USE OF TEACHER RESOURCES IN SECONDARY DEPARTMENTS

Notes.

Area A

1. Data for the secondary : primary unit cost ratio was taken from Fig.3.24 and Fig. 3.18.

2. The upper secondary : lower secondary unit cost ratio is based on Teachers' Salaries only:

   Unit Cost of Teachers' Salaries Year I-III = £ 82.68

   " " " " " " IV-VI = £145.20

∴ Upper secondary : lower secondary unit cost ratio = 1.76 : 1

Area B

3. The secondary : primary unit cost ratio was taken from Fig. 3.23

4. The upper secondary :lower secondary unit cost ratio was obtained in 6 steps. [In the process generating the data concerning the use of teacher resources, see the Cost in Teacher Resources.]

   Step (i) We require to know how much time teachers spend teaching pupils in the lower and upper years of secondary school. Such information was obtained by a close scrutiny of the time-tables, the sums of teachers' time spent with classes of pupils in years I-III and IV-VI were found:

RESULT	YEARS I-III	YEARS IV-VI
Teaching minutes	214,365	79,574

   Step (ii) The total numbers of pupils taught in the lower and upper years were found:

RESULT	YEARS I-III	YEARS IV-VI
Pupils	2,633	798

Step (iii) The ratio of (i) and (ii) gives the numbers of teaching-minutes per pupil:

RESULT	YEARS I-III	YEARS IV-VI
Teaching-Minutes per pupil	81.4	99.7

Step (iv) The teaching-minutes per pupil statistic is an index of the teaching resources used on each pupil. [No data is available on how a teacher apportions his non-teaching time between his various classes]. The ratio of these resources used in years IV-VI to those in years I-III is, in turn, an index of the relative cost of the upper and lower years.

RESULT

Ratio of teacher resources used in upper;lower secondary $= \frac{99.7}{81.4} = 1.22$

Step (v) The conversion of teacher resources into money terms follows thus: If a minute of a teacher's time had a standard cost attached to it then the result of Step (iv) would mean that pupils in years IV-VI were costing 1.22 times as much as their younger school mates. But the staff teaching at the upper end of the secondary school are on the average a) better qualified b) older c) in possession of responsibility payments. What we then require is some notion of the relative expensiveness of the upper and lower years of the secondary school (at least as far as teachers are concerned). The accurately costed study in Area A provides the basis for just this piece of data. A full description of the derivation is given in Appendix 4/E.

In brief, the derivation rests on the "expensiveness constant" K, which is related to the total salary bill (T), the salaries allocable to years I-III ($T_{I - III}$) and the proportion of the total teachers' time taken up by contact with years I-III (A) in the following way.

$T_{I-III} = k_{I-III} \times A \times T$ - (1)

From Area A data, estimates of T_{I-III}, A and T are available $\therefore$, k_{I-III} can be determined.

$$k_{I-III} = \frac{T_{I-III}}{A \times T} = \frac{318{,}386^*}{0.75 \times 429{,}465} = 0.988$$

similarly $k_{IV-VI} = 1.035$

Using relationship (1), the actual salary cost allocable to years I-III and years IV-VI can be computed.

A = 0.7293 years I-III; A' = 0.2707 years IV-VI - obtained from Step (i) above.

T = £357,370 (from Appendix3/I, Report 2B)

T_{I-III} = 0.988 x 0.7293 x 357,370 = £257,500

T_{IV-VI} = 1.035 x 0.2707 x 357,370 = £ 99,870

Unit costs follow:

U_{I-III} = Unit cost of pupil in years I-III = $\frac{257{,}500}{2{,}633}$ = £ 97.80

U_{IV-VI} = Unit cost of pupil in years IV-VI = $\frac{99{,}870}{798}$ = £125.15

Step (v) The upper secondary : lower secondary unit cost ratio is found by the ratio

$$\frac{U_{IV-VI}}{U_{I-III}} = \frac{125.15}{97.80} = 1.28 .$$

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* These figures are taken from Appendix 4/F (i) and 4/F (ii)

APPENDIX 3/J (Contd.)

5. Unit Costs of Primary and Secondary education:Scottish City 1964/5

	PRIMARY	SECONDARY
Teachers' salaries	£54.9	£116.8
Maintenance	£23.1	£ 42.3
Total	£78	£159.1
		Overall ratio = 2.04 ;1

Data from S.E.D.

6. From Education Statistics 1966 -7 (1968) The Institute of Municipal Treasurers and Accountants. London:

7. Costs per pupil

(For adjustments in respect of pupils living in one area and educated in another)

	1964/5	1965/6	1966/7	1967/8
Primary pupil	£ 71	£ 80	£ 83	£ 89
Secondary pupil aged under 16	£121	£140	£150	£164
Secondary pupil aged 16 and over	£242	£280	£260	£289

Source From Education and Science, 1968 A report of the D.E.S., p.119, London: H.M.S.O.

APPENDIX 4/A (i)

Unit Staffing Costs Of Subject Departments - Their Derivation and Meaning

Unit costs are obtained by dividing the total Staffing Cost of a department, d, by the relevant units, e.g. pupils, sq. feet, minutes of instruction, teaching sets etc., to give a cost per pupil, per square foot, per minute of instruction, per teaching set.

Unit Cost is also an economic term for a measure of economic efficiency if output is related to the total value of input. Eide (1968)

The cost per pupil parameter has the draw-back of not taking into account that a pupil may receive one or perhaps eight periods of instruction in a subject. The cost per class parameter depends not on the number of pupils but on the number of separate teaching units; the latter being more numerous in practical subjects. It is the cost per pupil-period parameter which carries most information and therefore the most useful unit in calculations involving staffing costs is the number of pupil-periods of instruction. The notion of a pupil-period may be conveyed in an example. One pupil receiving 1 period of instruction per week, represents 1 pupil-period,and thirty pupils receiving 6 periods of English per week represents 180 pupils-periods in English.

The Staffing Cost, d, refers to one year's instruction, thus the number of pupil-periods in one week should be multiplied by the number of weeks in a school year (say 40) so that the cost of the presence of one pupil for one period may be calculated. In practice, this is such a small number (of the order of £5 $\times 10^{-2}$ per pupil-period) that cost per pupil-period figures are usually referred to a year. Thus £2 per pupil-period means the cost of providing 1 pupil-period of instruction throughout a school year is £2. Dividing £2 by 40 will give the cost of a single pupil-period of instruction.

Ultimately, so that comparisons between costs of different modes and levels of instruction may be compared it would be wise to standardise the 'period' at an hour. Consequently valid (or near valid) comparisons could be made between the cost of a pupil-hour of e.g. 'H' grade chemistry by conventional instruction in a school, and that of the cost of a pupil-hour of 'H' grade chemistry by programmed instruction

Appendix 4/A (i) contd.

and laboratory practice in an F.E. college (or elsewhere).

APPENDIX 4/A (ii)

Alternative Ways of Allocating Costs

Let the Cost of Teachers' Salaries in a subject department, d, be £15,488 over a year:

let the number of pupil-periods in a week be 9207:

then the cost per pupil-period = $\frac{15,488}{9,207}$ = £1·682 per pupil-period for one year.

This is the simplest approach to the allocation of costs across pupil-periods, in that it assumes that all expenditure on Teachers' Salaries can be related to actual teaching.

A more complex approach to the derivation of unit costs might involve the following type of assumptions.

Assume that the number of periods for which teachers are available in a week is 405.

Then (i) the cost per period per week = $\frac{£15,488}{405}$ = £38.2 for one year.

But (ii) not all of these periods are teaching periods, only 310 are teaching periods (the remaining 95 being spent in preparation, correction, administration).

The cost per period per week = $\frac{£15,488}{310}$ = £50.0 for one year.

If the cost of a period is accepted as £38.2, it means that a separate accounting head - equivalent to a department - would have to be created to include the cost of all non-teaching time. In the present example, only 310 periods are teaching periods, repreeenting, at the rate of £38.2 per period, an expenditure of £11,842 on teaching time. The remaining £3,646 should be allocated to such accounting heads as lesson preparation, correction, departmental organisation, library etc. On the other hand, the assumption behind £50.0 per period is that all of the staffing costs are allocated to teaching and no extra account heads are required. This may be justified if we assert that the function of a teacher is to teach (and be in the presence of)pupils.

The allocation problem boils down to whether Staffing Costs should be spread over the entire time for which a teacher is employed or over only those times at which he has class contact. If the former procedure is adopted, then, in our example, library supervision by a teacher for one period per week costs £38.2 over a year. Whereas if the latter procedure is adopted there is zero cost for library supervision since the teacher does this in his 'free' time. Also , if for some reason the amount of teaching time or class contact is increased, then, using the first procedure the cost per period is unchanged, whereas using the second procedure the cost per period decreases since the denominator increases. The resolution of this allocation dilemma may move from the theoretical plane to the practical one when claims for the increase in non-teaching staff in schools are pressed. If one takes the line that each minute of a teacher's time has a cost and not just those minutes in which he has class contact, then it is almost certain that a minute of his time will be more costly than a minute of an auxiliary's time. Thus, employment of auxiliaries could be advisable in that it improves the mix of human resources through allowing teachers to spend more time teaching while still permitting non-teaching tasks to be performed and performed at a lower cost.

Returning to the calculation of Staffing Cost per pupil-period; if the cost per period is divided by the average number of pupils forming a teaching unit (the pupil-teacher contact ratio) the cost per pupil-period is obtained:

Pupil-Teacher Contact Ratio = $\frac{9{,}207}{310}$ = 29.7 =

= $\frac{\text{weekly pupil-teacher contacts}}{\text{periods actually taught}}$

On the basis of assumption (i) we have-

A. the cost per pupil-period = £38.2/ 29.7 = £1.286 per pupil-period;

while on the basis of assumption (ii) we have -

B. the cost per pupil-period = £50.0/29.7 = £1.682 per pupilperiod.

This latter unit cost is the same as that obtained by the simple approach of dividing the total staffing cost by the number of pupil-periods.

The relationship between unit costs A and B can be seen more clearly when the component elements are highlighted:

$$A = £1.286 = \frac{£15,488/405}{9,207/310} = \frac{£15,488}{9,207} \times \frac{310}{405}$$

$$= £1.682 \times \frac{310}{405}$$

$$= B \times \frac{310}{405}$$

Thus the unit cost derived on the assumption that the total staffing cost should be allocated across all possible periods whether they are "teaching" periods or not turns out to be the more simply derived unit cost modified by what might be termed an intensity factor. This intensity factor is the ratio of the number of periods actually taught to the total possible number of teaching periods.

Neither approach is "right". Without some separate account head - non-teaching time - the unit costs of type A are unsatisfactory in that part of the staffing cost remains unallocated. The simpler approach has the weakness of overestimating the unit cost of subjects by allocating all salaries to the teaching function.

APPENDIX 4/B

Analysis of Secondary School Expenses within Subjects Unit Teaching Costs

SUBJECT	UNIT TEACHING COSTS		
	C_P	C_{PP}	C_{TG}
English	£14.23	£2.05	£243.38
History	7.30	2.77	147.30
Geography	5.71	2.18	110.88
Modern Studies	7.75	1.54	179,11
Mathematics	13.09	2.06	180.37
Physics	16.09	5.63	194.18
Chemistry	15.09	5.12	201.03
Biology	12.09	4.03	166.44
General Science	11.46	2.70	165.69
Classics	36.70	6.40	187.12
Modern Languages	18.96	3.12	300.32
Art	8.89	2.99	114.65
Music	3.83	2.00	68.84
Physical Education	5.33	1.78	81.30
Commercial	11.64	1.85	160.50
Domestic Science	16.10	2.77	126.46
Technical	19.96	3.17	148.09

C_P : Teaching Cost per pupil

C_{PP} : Teaching Cost per pupil-period

C_{TG} : Teaching Cost per teaching-group

APPENDIX 4/C

S.E.C.P. Dumfries Pilot Project - Report

ANALYSIS OF THE TIMETABLES OF 15 SECONDARY SCHOOLS

SUBJECT	N_p I-III	N_p IV-VI	N_{pp} I-III	N_{pp} IV-VI	N_{tg} I-III	N_{tg} IV-VI	M_{tg} I-III	M_{tg} IV-VI
English	4044	829	27692	6109	223	62	18.1	13.3
History	2901	223	6592	1646	124	28	22.8	7.9
Geography	2939	282	6913	1517	134	32	21.9	8.8
Modern Studies	874	96	4449	436	36	6	24.2	16.0
Mathematics	3674	705	22638	5131	252	66	14.5	10.6
Physics	525	259	1237	1004	33	32	15.9	8.0
Chemistry	567	286	1303	1208	34	30	16.6	9.5
Biology	1093	311	2512	1700	71	31	15.3	10.0
General Science	3037	142	12664	810	211	9	14.3	15.7
Classics	112	97	556	641	14	27	8.0	3.5
Modern Languages	1334	550	7879	3575	68	51	19.6	10.7
Art	3786	392	11018	1456	267	57	14.1	6.7
Music	3867	618	7609	1055	198	54	19.5	11.4
Physical Education	3744	693	11335	1938	243	48	14.9	14.4
Commercial	664	301	4337	1732	55	15	12.0	20.0
Homecraft	1888	204	10970	1158	230	34	8.2	6.0
Technical	1877	319	11899	1917	234	62	8.0	5.3
TOTALS	36,926	6307	151,603	33,018	2430	644		

NOTES:

1. The information was collected from the form S8, which shows the number of pupils and teachers in each subject at one point in time - 21st September, 1964.
2. A division between lower school (years I-III) and upper school (years IV-VI) was made.
3. Symbols,

N_p I-III N_p IV-VI : Number of pupils taught in Years I-III and Years IV-VI.

N_{pp} I-III N_{pp} IV-VI : Number of pupils-periods taught in Years I-III and Years IV-VI.

N_{tg} I-III N_{tg} IV-VI : Number of teaching groups taught in Years I-III and Years IV-VI.

M_{tg} I-III M_{tg} IV-VI : Mean size of teaching groups in Years I-III N_p I-III / N_{tg} I-III

" " " " " " Years IV-VI N_p IV-VI / N_{tg} IV-VI

4. Mod Lan. : Modern Languages (a) French, (b) German, (c) Russian.

APPENDIX 4/D

QUANTIFICATION OF THE RELATIONSHIP BETWEEN CLASS SIZE AND UNIT COST OF SUBJECTS

Size of Class	Cost per pupil-period	Size of Class	Cost per pupil-period
X	Y	X	Y
18.1	£1.81	13.3	£2.40
22.8	2.24	7.9	3.59
21.9	1.67	8.8	3.45
24.2	1.30	16.0	2.17
14.5	1.81	10.6	2.36
15.9	3.64	8.0	4.80
16.6	4.44	9.5	4.27
15.3	2.94	10.0	4.55
14.3	2.41	15.7	2.77
8.0	4.66	3.5	6.14
19.6	2.22	10.7	4.39
14.1	2.51	6.7	3.90
19.5	1.44	11.4	3.45
14.9	1.48	14.4	1.62
12.0	1.25	20.0	2.32
8.2	2.22	6.0	5.08
8.0	2.55	5.3	4.06

Source: Class Size - Appendix 4/C; Cost per pupil-period - Appendix 4/A.

$N = 34$

$\Sigma X = 445.70$

$\Sigma Y = 101.91$

$\Sigma X^2 = 6773.25$

$\Sigma Y^2 = 358.52$

$\Sigma XY = 1183.03$

$r = -0.6879$

$b = -0.1642$

$a = 5.1498$

APPENDIX 4/E

Derivation of Unit Staffing Costs for the Sample of Five Schools in Area B

The precursor to estimates of costs of individual subjects is the total salary bill for a single secondary school. Unfortunately, except in the case of our grant-aided establishments, it is not standard procedure to collect, let alone publish, expenditure figures for individual schools. Leaving aside this difficulty for one moment, let us consider how an estimate of staffing costs for a subject may be made, at least in theory.

Suppose that there are "i" subjects being taught in a school, and that each subject takes the same proportion of the timetable;

1	2	3	4	5	6	 i

then if T is the total staffing cost, the cost of any particular subject "i" is given by $T_i = T/i$ (1)

Equation (1) assumes that teachers in each subject are receiving equal salaries, or more accurately, the average salary in each subject is the same.

However, it is almost inconceivable that the same number of teacher-hours should be devoted to say Latin and English in any school. Therefore, equation (1) must be modified to take account of the different proportions of teacher-hours spent on different subjects.

1	2	3	4	5	6	 i

Suppose, then, that the "i" subjects each take proportions a_1, a_2, a_3... a_i of the timetable Then $T_i = a_i T$ (2)

From which it follows, that if maths take 1/5 of the teacher-hours ($a_i = 1/5$) and if T = £100,000 then the Staffing Cost of maths is £20,000.

No mention has been made so far of some subjects being more popular than others, thus causing class sizes to vary and affecting unit costs markedly. This difficulty is dealt with below.

Inherently, because of pay scales, some subjects are more expensive than others. In addition to pay scales, the factors of age and responsibility allowances complicate further the relation of the cost of any one subject to the total staffing cost as expressed by equation (2).

In fact, the relation between the cost of a subject, total staffing cost and proportion of teacher-hours taken up by a subject is not a direct equality as indicated by equation (2) but rather of a proportionality form:

$T_i \propto a_i . T$ (3)

This relationship expresses that the cost of a subject is proportional to the product of the proportion of teacher-hours taken up by the subject and the total staffing costs. Removing the proportional sign and introducing an equality sign and the constant k we have

$T_i = k.a_i . T$ (4)

$\therefore k = T_i / a_i T$ (5)

When k = 1, then equation (2) applies and it may be interpreted that the subject is of "average" expensiveness.

When $k > 1$, the subject is of more than "average" expensiveness, and when $k < 1$, the subject is of less than "average" expensiveness.

Values of k for any subject or, for that matter, any subdivision or year group of any subject, can be calculated provided the actual staffing cost of the subject is known T_i, together with the total salary T and the proportion of time in teaching-hours spent on that subject a_i.

If values of k were available from reliable data then, assuming that these values would not change radically between schools, education authorities, or years, and provided that the total staffing cost for a school and the relevant values of a_i are available, an easy if somewhat crude method of arriving at staffing costs of individual subjects exists.

Putting it another way, if we assume that the differentials in salaries between say English and Technical are maintained both between schools and education authorities, and if nothing happens to the differential over time, then values of k calculated at one point in time in one authority should be relevant to data at another time in another place.

One result of the Scottish Educational Costs Project was the identification of detailed staffing costs of each subject for 15 secondary schools. Since timetables were also available for all these schools, average values of a_i were calculated. The total salary cost for all 15 schools was also available. Values of k were calculated for each subject, for lower school (years I-III) and upper school (years IV-VI) See Appendix 4/F (1) and (2).

Sample calculation:

Total Salary cost of English (years I-III) - found by accurate cost allocation = £50,298

Total salary cost of all subjects =£429,465

Proportion of timetables devoted to English (years I-III) = 0.106

$\therefore k = 50298 / 0.106 \times 429465 = 1.104$

Similar calculations gave for	Music	(years I-III)	k = 0.752
	Modern Languages	(years IV-VI)	k = 1.407
	Technical	(years IV-VI)	k = 0.907

While it must be admitted that these first calculations are crude in that they depend on data from only 15 schools which might not be a representative of Scotland, they are the first figures available and provide a relatively simple mathematical tool for some interesting calculations. Using equation (4) it is now possible to estimate directly the cost of any subject, provided that the total salary cost of the school and estimates or values of the proportion of teacher-hours devoted to a subject are known.

Thus, for a comprehensive school with 800 pupils:

T = £63,436 and a_i = 0.100, for English : k = 1.104

Then $T_1 = k.a_1\ T$

$= 1.104 \times 0.100 \times 63,436$

$=$ £7,003

<u>Application of the above principles to secondary schools in Area B</u>

Once the total staffing* bill for each of the five secondary schools had been determined, b y using the proportions of teacher time devoted to the teaching of each subject (available from timetables) and the indices of/

* Staffing here denotes Teachers' Salaries only.

expensiveness [from Appendix 4/F (ii)] the Staffing Costs of each subject in each school were found. The corresponding unit costs shown in Appendix 4/F (iii) and 4/F (iv) were found by dividing the Staffing Cost of each department by the number of pupil-periods taught. The use of the term period must be clarified because both Tables of results refer to periods of four lengths. Area A schools fortunately all worked on an eight period day, each of 40 minutes. Hence, all the teaching and staffing costs in Appendices 4/A and 4/B are covering a period of 40 minutes. The five schools in Area B showed a variety of timetabling procedures. Schools N,Q and R operated the 40 minute period. School M operated six periods of 35 minutes, one of 45 minutes and two of 40 minutes. School P operates eighteen periods - ten periods of 20 minutes and eight periods of 15 minutes. To ease the load of calculation it was decided to assign 35 minutes to each of the nine periods in School M and to compute all time in minutes in School P. Consequently, the first column under each school gives the cost per pupil-period where period is 35,40 or 1 minutes depending upon the school. The second column puts all schools on the basis of the pupil-hour. It is this latter cost unit which should be studied for comparison with the costs in Area A, (naturally these costs are higher because they refer to one hours instruction, but the general trend is similar).

APPENDIX 4/F (1)

COMPUTATION OF PROPORTIONS OF TEACHER PERIODS DEVOTED TO EACH SCHOOL SUBJECT

SUBJECT	TEACHER—PERIODS Y I-III	Y IV-VI	Totals	A $\frac{a_i}{\sum a_i}$ I-III	B $\frac{a_i}{\sum a_i}$ IV-VI
English	1058	268	1326	0.106	0.027
History	292	114	406	0.029	0.011
Geography	287	124	411	0.028	0.012
Modern Studies	132	17	149	0.013	0.001
Maths	985	273	1258	0.099	0.027
Physics, Chemistry, Biology, General Science	1020	397	1417	0.102	0.040
Classics	71	115	186	0.007	0.011
Modern Languages	365	265	630	0.036	0.026
Art	659	170	829	0.066	0.017
Music	338	106	444	0.034	0.010
Physical Education	450	76	526	0.045	0.007
Commercial	196	149	345	0.019	0.015
Homecraft	801	165	966	0.080	0.016
Technical	825	206	1031	0.083	0.020
TOTAL	=7479	=2445	=9924		

Unallocable ....1 − 0.987 = 0.013

SOURCE: Timetables of fifteen secondary schools - S.E.D. Form S.8 1964/5

TABLE 4/F (ii)

DERIVATION OF INDEX OF RELATIVE EXPENSIVENESS CONSTANTS k FOR SCHOOL SUBJECTS - YEARS I - III

T = £429,465

SUBJECT	Total Cost T_i I - III	A	$k = T_i / A.T$	
English	£50298	.106	$= \frac{50298}{0.106 \times 429465}$	= 1.104
History	14792	.029	$= \frac{14792}{0.029 \times 429465}$	= 1.187
Geography	11589	.028	$= \frac{11589}{0.028 \times 429265}$	= 0.963
Modern Studies	5808	.013	$= \frac{5808}{0.013 \times 429465}$	= 1.039
Maths.	41061	.099	$= \frac{41061}{0.099 \times 429465}$	= 0.965
General Science	48318	.102	$= \frac{48318}{0.102 \times 429465}$	= 1.103
Classics	2596	.007	$= \frac{2596}{0.007 \times 429465}$	= 0.863
Modern Languages	17536	.036	$= \frac{17536}{0.036 \times 429465}$	= 1.134
Art	27766	.066	$= \frac{27766}{0.066 \times 429465}$	= 0.979
Music	10991	.034	$= \frac{10991}{0.034 \times 429465}$	= 0.752
Physical Education	16807	.045	$= \frac{16807}{0.045 \times 429465}$	= 0.869
Commercial	5450	.019	$= \frac{5450}{0.019 \times 429465}$	= 0.667
Homecraft	24401	.080	$= \frac{24401}{0.080 \times 429465}$	= 0.710
Technical	30395	.083	$= \frac{30395}{0.083}$	= 0.852
Unallocable	12872	.013	$= \frac{12872}{0.013}$	= 2.305

SOURCE : Total Cost (T_i) for each subject - from accurate cost allocation of salaries by means of timetables.

TABLE 4/F (ii) (Page 2)

DERIVATION OF INDEX OF RELATIVE EXPENSIVENESS CONSTANTS k1 FOR SCHOOL SUBJECTS - YEARS IV - VI

T = £429,465

SUBJECT	Total Cost T'_i IV - VI	B	$k^1 = \frac{T'_i}{B.T}$
English	£14718	.027	$= \frac{14718}{0.027 \times 429465} = 1.269$
History	5922	.011	$= \frac{5922}{0.011 \times 429465} = 1.253$
Geography	5237	.012	$= \frac{5237}{0.012 \times 429465} = 1.016$
Modern Studies	948	.001	$= \frac{948}{0.001 \times 429465} = 2.207$
Maths.	12148	.027	$= \frac{12148}{0.027 \times 429465} = 1.047$
General Science	19976	.040	$= \frac{19976}{0.040 \times 429465} = 1.162$
Classics	3936	.011	$= \frac{3936}{0.011 \times 429465} = 0.833$
Modern Languages	15713	.026	$= \frac{15713}{0.026 \times 429465} = 1.407$
Art	5688	.017	$= \frac{5688}{0.017 \times 429465} = 0.779$
Music	3648	.010	$= \frac{3648}{0.010 \times 429465} = 0.849$
Physical Education	3147	.007	$= \frac{3147}{0.007 \times 429465} = 1.046$
Commercial	4020	.015	$= \frac{4020}{0.015 \times 429465} = 0.624$
Homecraft	5889	.016	$= \frac{5889}{0.016 \times 429465} = 0.857$
Technical	7795	.020	$= \frac{7795}{0.020 \times 429465} = 0.907$
Unallocable	—	—	

SOURCE: Total Cost (T_i) for each subject - from accurate cost alloeation of salaries by means of timetables.

TABLE 4/F (iii) - YEARS I - III

COST PER PUPIL-PERIOD OF EACH SUBJECT TAUGHT IN 5 SAMPLE SCHOOLS

SUBJECT	1 SCHOOL M Cost Per pupil-35 min	2 Cost per pupil-hr.	3 SCHOOL N Cost Per pupil-40 min	4 Cost per pupil-hr.
English	1.74	2.97	2.37	3.55
History	1.96	3.35	2.51	3.76
Geography	1.69	2.88	2.80	4.20
Maths	1.65	2.82	2.31	3.46
Science	3.53	6.03	2.76	4.14
Classics	1.43	2.44	1.98	2.97
Modern Language	1.89	3.23	2.75	4.12
Art	2.90	4.95	3.65	5.47
Music	2.48	4.24	1.98	2.97
Physical Education	2.20	3.76	2.50	3.75
Commercial	2.47	4.22	3.52	5.28
Homecraft	2.08	3.55	3.34	5.01
Technical	2.79	4.77	3.49	5.23
Nautical Studies	-	-	7.35	11.02

Notes

Col.2 = Col.1 x 1.71 ; $1.71 = \frac{60}{35}$ = conversion factor

Col.4 = Col.3 x 1.5 ; $1.5 = \frac{60}{40}$ = conversion factor

Col.6 = Col.5 x 60

Col.8 = Col.7 x 1.5

Col.10 = Col.9 x 1.5

TABLE 4/F (iii) - YEARS I - III Contd.

SUBJECT	5	6	7	8	9	10
	SCHOOL P		SCHOOL Q		SCHOOL R	
	Cost per pupil-1 min	Cost per pupil-hr.	Cost per pupil-40 min	Cost per pupil-hr.	Cost per pupil-40 min	Cost per pupil-hr
English	0.055	3.30	1.80	2.70	2.35	3.52
History	0.060	3.60	1.66	2.49	2.87	4.30
Geography	0.058	3.48	1.30	1.95	2.05	3.07
Maths	0.062	3.72	2.50	3.75	2.72	4.08
Science	0.089	5.34	3.12	4.68	5.12	7.68
Classics	-	-	-	-	-	-
Modern Language	0.067	4.02	-	-	-	-
Art	0.091	5.46	2.78	4.17	5.27	7.90
Music	0.058	3.48	0.97	1.45	2.00	3.00
Physical Education	0.042	2.52	1.64	2.46	2.31	3.46
Commercial	0.084	5.04	-	-	2.47	3.70
Homecraft	0.057	3.42	2.09	3.13	2.95	4.42
Technical	0.058	3.48	2.26	3.39	3.20	4.80
Nautical Studies	0.102	6.12	-	-	-	-

Notes

Col.2 = Col.1 x 1.71 ; 1.71 = $\frac{60}{35}$ =Conversion factor

Col.4 = Col.3 x 1.5 ; 1.5 = $\frac{60}{40}$ = Conversion factor

Col.6 = Col.5 x 60
Col.8 = Col.7 x 1.5
Col.10 = 9 x 1.5

TABLE 4/F (iv) - YEARS IV - VI

COST PER PUPIL-PERIOD OF EACH SUBJECT TAUGHT IN 5 SAMPLE SCHOOLS

SUBJECT	1 SCHOOL M Cost per pupil- 35 min	2 Cost per pupil-hr.	3 SCHOOL N Cost per pupil- 40 min	4 Cost per pupil-hr.
English	2.39	4.08	3.01	4.51
History	3.63	6.20	6.87	10.30
Geography	2.61	4.46	4.81	7.81
Maths	2.29	3.91	3.90	5.85
Science	3.58	6.12	4.48	6.72
Classics	3.07	5.24	4.57	6.85
Modern Language	3.87	6.61	4.87	7.30
Art	2.50	4.27	4.18	6.27
Music	3.58	6.12	6.13	9.19
Physical Education	1.56	2.66	2.42	3.63
Commercial	2.86	4.89	4.25	6.37
Homecraft	5.76	9.84	9.48	14.22
Technical	3.48	5.95	5.85	8.77
Nautical Studies	-	-	42.00	63.00

Notes

Col.2 = Col.1 x 1.71 ; 1.71 = Conversion factor = $\frac{60}{35}$

Col.4 = Col.3 x 1.5 ; 1.5 = Conversion factor = $\frac{60}{40}$

Col.6 = Col.5 x 60
Col.8 = Col.7 x 1.5
Col.10 = Col.9 x 1.5

TABLE 4/F (iv) - YEARS IV - VI Contd.

SUBJECT	5 Cost per pupil- 1 min SCHOOL P	6 Cost per pupil-hr.	7 Cost per pupil- 40 min SCHOOL Q	8 Cost per pupil-hr.	9 Cost per pupil- 40 min SCHOOL R	10 Cost pe pupil-h
English	0.096	5.76	2.26	3.39	4.37	6.55
History	-	-	1.55	2.32	3.51	5.26
Geography	0.115	6.90	2.09	3.13	2.42	3.63
Maths	0.119	7.14	2.91	4.36	4.62	6.93
Science	0.120	7.20	3.27	4.90	4.13	6.19
Classics	-	-	-	-	-	-
Modern Language	-	-	-	-	-	-
Art	0.175	10.50	2.02	3.03	3.33	4.99
Music	0.020	1.20	1.27	1.90	0.78	1.17
Physical Education	0.048	2.88	4.08	6.12	2.58	3.87
Commercial	-	-	-	-	2.32	3.48
Homecraft	0.061	3.66	2.76	4.14	6.02	9.03
Technical	0.109	6.54	2.50	3.75	3.66	5.49
Nautical Studies	-	-	-	-	-	-

Notes

Col.2 = Col.1 x 1.71 ; 1.71 = Conversion factor = $\frac{60}{35}$

Col.4 = Col.3 x 1.5 ; 1.5 = Conversion factor = $\frac{60}{40}$

Col.6 = Col.5 x 60
Col.8 = Col.7 x 1.5
Col.10 = Col.9 x 1.5

APPENDIX 5/A

S.E.D. Regulations on size of classes etc., extracted from Schools (Scotland) Code 1950 and 1956

Size of classes : the number of pupils on the roll of any class or group o of classes under the charge of 1 teacher shall not exceed:

(a) 45 in primary departments.

(b) 40 in classes I,II,III of the Secondary department.

(c) 30 in classes IV,V,VI, " " " "

But number restricted to -

(a) 25 in a 1 teacher school

(b) 30 in a 2 teacher school

(c) 35 in a 3 teacher school

(d) 35 in a 4 teacher school

(e) 25 in classes of backward pupils

(f) 25 in classes of physically handicapped pupils

(g) 20 in classes of mentally handicapped pupils

(h) 15 in classes of blind pupils

(i) 10 in classes of deaf and partially deaf pupils

(j) 20 for all practical subjects: Science, art crafts, mechanics, benchwork, cookery, laundrywork, dressmaking, housewifery, agriculture, gardening, dairying, navigation, seamanship.

<u>APPENDIX 5/B</u>

Suppose the roll of a school is x pupils and the unit staffing outlay is £y; then, for a roll of a school which is p.x pupils, the unit staffing outlay is £y*. The best fit relationship between x and y is of the form

$\log y = b \log x + k$ see Equation 5.3 or 5.4

We have also $\log y^* = b \log p.x + k$

hence $\log \frac{y}{y^*} = - b \log p$ or $\frac{y}{y^*} = p^{-b}$ **(z)**

This relationship is best understood through an example thus; if p = 2 i.e. if we consider 2 schools one of which is twice the size of the other, then:

$\log \frac{y}{y^*} = - b \log 2$

The regression coefficient, b, has been found to have a value −0.2624 (for Equation 5.3)

$\log \frac{y}{y^*} = - (- 0.2624) \log 2$

$= 0.0789$

taking antilogs, we have $\frac{y}{y^*} = 1.199$

This means that the ratio of the unit staffing outlay in one school to that in another twice its size is 1.199. Putting that another way, unit outlays of the larger school are $\frac{1}{1.199} \times 100 = 83.40\%$ of the smaller.

Using equation (Z) with p = 4,5,6,8,10, Col. 3 of the Table below was derived using b = −0.2624 **(Equation 5.3)**, and Col. 4 was derived using b = − 0.2659 (Equation 5.4).

<u>DERIVATION OF UNIT OUTLAYS FOR SCHOOLS OF DIFFERENT ROLLS</u>

Col 1 SchoolM Size	Col 2 SchoolN Size	Col 3 Ratio of Unit Staffing Outlay school N / SchoolM	Col 4 Ratio of Unit "Total" Outlay School N / School M
x	2x	83.4%	83.1%
x	4x	69.5%	69.2%
x	5x	65.6%	65.2%
x	6x	62.5%	62.1%
x	8x	57.9%	57.5%
x	10x	54.6%	54.2%

APPENDIX 5/C

Relationship Of Outlay Per Pupil On Teachers' Salaries To size: "Small" Schools 1964/5
(Equation 5.10)

Reciprocal of Roll = X

Unit Outlay on Teachers' Salaries = Y (£)

X	Y	X	Y	X	Y
0.0909	96.8	0.0370	56.5	0.0208	43.6
0.0666	83.2	0.0370	71.6	0.0196	58.1
0.0666	101	0.0357	114	0.0182	61.2
0.0625	100	0.0345	107	0.0178	60.8
0.0625	92	0.0333	64.8	0.0175	52.9
0.0666	120	0.0333	84.1	0.0164	58.4
0.0555	92.3	0.0312	67.5	0.0164	55.2
0.0555	81.7	0.0303	74.4	0.0156	78.8
0.0555	81.7	0.0303	65.5	0.0154	71.0
0.0526	77.8	0.0294	80.9	0.0151	68.4
0.0500	73.9	0.0270	78.7	0.0147	60.5
0.0500	77.0	0.0263	87.6	0.0143	38.0
0.0476	72.8	0.0227	54.3	0.0135	65.3
0.0454	71.0	0.0222	58.0	0.0151	71.8
0.0435	65.2	0.0217	66.7	0.0151	47.5
0.0435	51.2	0.0217	55.4	0.0140	52.6
0.0370	67.9	0.0213	58.4	0.0120	50.1

Then:
$\Sigma X = 1.7180$
$\Sigma Y = 3645.1000$
$\Sigma X^2 = 0.0727$
$\Sigma Y^2 = 276524.4700$
$\Sigma XY = 134.0007$
$r = 0.7260$
$b = 752.4090$
$a = 46.1266$
$S_Y(e) = 12.4227$

Significance of b: for 49 d. of f. $P(|t| > 7.8) < 0.01$ both b and r are highly significant

DATA FOR FIG 5.6

ROLL Pupils	UNIT COST* £
10	121
15	96
20	83
30	71
40	65
50	61
60	59
70	57
75	56

* derived using formula, unit cost $= \frac{752.4090}{\text{roll}} + 46.1266$

APPENDIX 5/D

Relationship Of Outlay Per Pupil On Teachers' Salaries To size: "Large" Schools 1964/5
(Equation 5.11)

X $1/\text{roll} \times 10^4$	Y UNIT COST of Teachers' Salaries	X $1/\text{roll} \times 10^4$	Y UNIT COST of Teachers' Salaries
	£		£
120	50.1	24.1	33.1
112	52.2	22.3	35.7
110	41.6	21.6	48.7
98.0	38.2	20.6	35.2
90.1	45.6	19.4	30.2
76.9	51.7	15.6	32.8
46.7	29.9	14.4	35.3
40.6	42.3	16.2	31.8
39.4	42.2	17.9	34.6
40.0	50.5	36.6	41.5
33.8	47.0	45.0	36.3
26.5	40.9	23.9	34.3

$\Sigma X = 1111.6$
$\Sigma Y = 961.7$
$\Sigma X^2 = 78820.64$
$\Sigma Y^2 = 39712.73$
$\Sigma XY = 47814.54$
$r = 0.5769$ Significance of r: $/t/ = 3.31$ for 23 d. of f.
$b = 0.1196$ Significance of b: $P\ (/t/ > 3.31) < 0.01$
$a = 34.5313$
$S_{\hat{Y}}(e) = 5.96$

DATA FOR FIG 5.7

SIZE	UNIT COST *
	£
100	46.5
150	42.5
200	40.5
250	39.3
300	38.5
400	37.5
500	36.9
600	36.5
650	36.4
680	36.3

* derived from using formula, unit cost

$$= \frac{0.1196}{\text{roll}} \times 10^4 + 34.53$$

APPENDIX 5/E

Relationship Of Per Pupil Outlays On Teachers' Salaries To P.T.R.

(Equation 5.16)

SCHOOL	P.T.R.	UNIT COST	SCHOOL	P.T.R.	UNIT COST
	X	Y		X	Y
Linlithgow Acad.	15.3	£91.6	Dumfries High	20.0	71.3
Bathgate S.S.	16.4	86.9	Gretna High	17.7	100
St. Mary's B.gate	26.8	63.1	Kirkconnel	18.3	49.4
Lindsay High	18.4	75.4	Langholm	11.9	107
Boness Academy	18.6	82.2	Lockerbie	15.5	61.9
Broxburn Academy	15.0	100	Loreburn St.Johns	17.4	71.9
Buckhaven High	14.4	105	Moffat Academy	15.2	100
Waid Academy	13.5	114	Morton Academy	13.5	126
Balwearie	11.3	110	Sanquhar Academy	17.8	89.7
Auchterderran	16.2	71.0	Wallacehall Acad.	17.0	89.0
Viewforth	12.8	114	Annan Academy	16.8	85.4
Dumfries Academy	13.4	131			

Data for Financial Year 1964/5

$\Sigma X = 373.2$

$\Sigma Y = 2095.8$

$\Sigma X^2 = 6288.12$

$\Sigma Y^2 = 200795.3$

$\Sigma XY = 32942.01$

$r = -0.7044$ Significance of r: For 21 d. of f. $P(/t/ > 4.5) < 0.01$

$b = -4.5781$ Significance of b: For 21 d. of f. $P(/t/ > 4.6) < 0.01$

$a = 165.4063$

$S_Y(e) = 15.35$

$N = 23$

APPENDIX 6/A

ANALYSIS OF HEADS OF EXPENDITURE AS PROPORTIONS OF TOTAL CURRENT EXPENDITURE; AND RELATED DATA
SCOTLAND 1959/60 - 1966/7

Row		1959/60	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	Growth Ra
(1) Total Expenditure on Schools	£m.	74.293	80.108	92.409	98.595	108.579	115.663	125.324	141.160	
(2) Teachers' Salaries	£m.	37.681	40.679	47.052	48.756	54.502	55.110	57.050	65.714	
(3) Maintenance of Schools	£m.	13.850	14.725	17.677	19.524	20.825	23.044	26.203	28.662	
(4) Teachers' Salaries as a proportion of Total Expenditure = row(2) / row(1)		50.7%	50.7%	50.9%	49.4%	50.1%	47.6%	45.5%	46.5%	-1.3%
(5) Maintenance as a proportion of Total Expenditure = row (3) / row (1)		18.6%	18.3%	19.1%	19.8%	19.1%	19.9%	20.9%	20.3%	
(6) Total Number of Teachers		37,722	38,367	39,043	39,244	40,000	40,416	42,317	42,271	
(7) Salary Cost per Teacher = row 2 / row 6		£999	£1060	£1206	£1243	£1362	£1364	£1349	£1557	6.5%

Source: Education in Scotland for 1960, '61, '62, '63, 64, '65
Scottish Educational Statistics 1966, '67
The Report by the Accountant 1960-1, '61-62, '62 - '63, '63 - '64

Estimation of Average Primary and Secondary Teachers' Salaries in 1966/7

Dec. '67 Total number of teachers in primary and secondary depts. = 42,264
Jan.'67 Number of teachers in primary schools = 21,773
" " " " secondary " = 19,176
Total number of teachers in Jan.'67 40,949
(Figures from Scottish Educational Statistics 1967)

Therefore, the increase of December over January figures = 1,315. This extra number might reasonably be allocated to primary and secondary schools on the basis of 21,773:19,176. We then have as an estimate of the staffing position at Dec. '67:

Number of primary teachers = 22,470
" " secondary " = 19,794

Suppose that the average salary of a primary teacher is £x, then the average salary of a secondary teacher is £c.x where c is the ratio of secondary:primary Teachers' Salaries. Roughly 2/3 of teachers in secondary schools are graduates while graduates are only 1/6 of teachers in primaries. (Education in Scotland 1966,p.66). Using these "weights" on the mid-points of Salary Scale 3 (Ordinary graduates) and Scale 6 (Diploma holders in secondary), for an estimate of the cost of a Secondary school teacher we have;

$\therefore$ £ $(\frac{2}{3} \times 1210 + \frac{1}{3} \times 1180) = £1{,}197$ *

While for primary school average salary we use weights - 1/6 of graduates in primary school (Scale 4) and 5/6 of Diploma holders in primary (Scale 7) $\therefore$ $(\frac{1}{6} \times 1180 + 5/6 \times 890) = £940$

So that a crude estimate if "c" is 1.3

Since the total expenditure in Teachers' Salaries in 1966/7 was roughly £66m. we have a crude estimate of average salary in primary school as

$22{,}470x + 19794 \times 1.3x = 66{,}000{,}000$

$\therefore$ x = £1,362 and cx = £1,770

* The salary figures quoted here - £1210,£1180 and £890- are actual gross annual salaries, without the addition of authorities' contributions to superannuation, G.P., or N.I.

APPENDIX 6/C

PART I

LONGITUDINAL ANALYSIS OF SALARY COSTS IN AREA B

PRIMARY SCHOOLS

School Code	ROLLS			TEACHERS' SALARIES PER PUPIL		
	1961/2	1964/5	1967/8	1961/2	1964/5	1967/8
11	663	692	599	£22.14	£35.35	£47.41
12	622	616	613	30.18	31.81	46.57
13	609	559	520	29.47	34.64	45.17
14	300	273	233	25.40	41.54	49.84
15	228	222	187	29.82	36.29	40.82
16	373	419	409	34.68	34.27	40.88
17	78	66	78	48.62	71.81	77.82
18	82	66	83	61.95	47.51	55.50
19	72	71	95	48.93	52.57	55.35
TOTAL ROLLS	3072	2984	2817			
AVERAGE COST	-	-	-	£31.65	£36.46	£46.98
1961/2 = 100	-	-	-	100	115	148

School Code	JANITORS'/CLEANERS' SALARIES per pupil			ALL SALARIES per pupil		
	1961/2 £	1964/5 £	1967/8 £	1961/2 £	1964/5 £	1967/8 £
11	2.68	2.93	5.80	31.83	38.28	53.20
12	2.45	2.80	5.04	32.65	34.61	51.61
13	1.46	2.88	4.60	30.95	37.52	49.77
14	4.55	3.69	8.87	29.96	45.23	58.71
15	1.93	5.43	10.72	31.76	41.72	51.54
16	4.24	2.77	4.76	38.93	37.04	45.64
17	4.41	5.72	9.24	53.02	77.53	87.06
18	5.02	6.87	9.69	66.97	54.38	65.19
19	4.50	5.35	5.16	53.43	57.92	60.54
AVERAGE	2.86	3.33	6.03	-	-	-
1961/2 = 100	100	116	210	-	-	-
AVERAGE	-	-	-	34.52	39.79	53.01
1961/2 = 100	-	-	-	100	115	153

PART II

LONGITUDINAL ANALYSIS OF SALARY COSTS IN AREA B

SECONDARY SCHOOLS

School Code	ROLLS			TEACHERS'SALARIES per pupil		
	1961/2	1964/5	1967/8	1961/2	1964/5	1967/8
				£	£	£
61	1345	1124	919	72.57	104.92	158.29
62	660	610	500	86.25	113.57	163.04
63	618	661	727	65.17	109.69	126.84
64	466	471	520	50.16	71.05	90.70
65	799	565	531	62.53	113.58	140.44
TOTAL ROLL	3888	3431	3197			
AVERAGE COST	-	-	-	68.97	104.16	137.92
INDEX 1961/2 = 100	-	-	-	100	151	199

School Code	JANITORS'/CLEANERS' SALARIES per pupil			ALL SALARIES per pupil		
	1961/2 £	1964/5 £	1967/8 £	1961/2 £	1964/5 £	1967/8 £
61	3.81	5.17	8.13	76.39	112.89	166.43
62	3.98	4.97	9.88	90.23	118.54	172.92
63	N.A.	5.83	7.10	65.17[2]	115.52	133.95
64	3.49	5.65	7.68	53.66	76.70	98.38
65	3.81	7.20	10.99	66.35	120.78	151.44
AVERAGE COST	3.80[1]	5.81	8.57	72.77	109.97	146.49
INDEX 1961/2 = 100	100	152	225	100	151	201

NOTES

1. For 4 schools only

2. Teachers' Salaries only: If school 63 is omitted from the calculation of Average Cost of All Salaries then the average cost is £73.49 not £72.77.
The final line then becomes,100:149:199 instead of 100:151:201.

APPENDIX 6/C

PART III

THE RELATIONSHIP OF INPUTS TO SECONDARY TO THOSE IN PRIMARY

SALARIES/WAGES	1961/2	1964/5	1967/8
Ratio of Secondary Teachers'	$\frac{68.97}{31.65} = 2.17$	$\frac{104.16}{36.46} = 2.85$	$\frac{137.92}{46.98} = 2.93$
Primary Teachers'	Index 100	131	135
Ratio of Sec.Janitors'/Cleaners'	$\frac{3.80}{2.86} = 1.32$	$\frac{5.81}{3.33} = 1.74$	$\frac{8.57}{6.03} = 1.42$
Prim.Janitors'/Cleaners'	Index 100	131	107
Ratio of Sec. All Salaries'	$\frac{72.77}{34.52} = 2.10$	$\frac{109.97}{39.79} = 2.76$	$\frac{146.49}{53.01} = 2.76$
Prim. All Salaries'	Index 100	131	131
Ratio of Secondary pupils	$\frac{3888}{3027} = 1.28$	$\frac{3431}{2984} = 1.14$	$\frac{3197}{2817} = 1.13$
Primary Pupils	Index 100	89	88

Data : From Appendix 6/c Parts I and II

APPENDIX 6/D

Longitudinal Study of Costs At School Level Deflationary Exercise

	YEARS		
	1961	1964	1967
Price Index (1963 = 100)$^{\emptyset}$	94.4	103.3	115.9
Index based on 1961 = 100	100	109.4	122.7

Ø Index of Final Goods and Services Sold on Home Market
National Income and Expenditure 1969 London H.M.S.O. Table 16

Salary/Wages Costs Per Pupil Over Years 1961/2,1964/5,1967/8

	Current Prices / Constant 1961 Prices		
HEAD	61/2	64/5	67/8
Teachers' Salaries			
Primary:Current	£31.65	£36.46	£46.98
Constant 1961	31.65	33.3	38.2
Index 1961/2 = 100	100	105	120
Secondary:Current	£69.97	£104.16	£137.92
Constant 1961	69.97	95.1	112.3
Index 1961/2 = 100	100	136	161
Janitors'/Cleaners' Wages			
Primary:Current	£2.86	£3.33	£6.03
Constant 1961	2.86	3.04	4.91
Index 1961/2 = 100	100	105	172
Secondary:Current	£3.80	£5.81	£8.57
Constant 1961	3.80	5.31	6.98
Index 1961/2 = 100	100	140	183

APPENDIX 6/E

THE RELATIONSHIP OF UNIT COSTS TO ROLLS - SCOTTISH CITY DATA 1961/2 - 1966/7

	1961/2			1962/3			1963/4		
	A £	B £	C	A £	B £	C	A £	B £	C
Teachers' Salaries (1)	50.4	86.5	1.72	50.2	97.5	1.94	55.2	111.8	2.02
Maintenance (2)	19.5	30.4	1.56	20.2	35.8	1.77	22.2	37.5	1.69
Sum of (1) and (2)	69.9	116.9	1.69	70.4	133.3	1.89	77.4	149.3	1.93
	P	Q	R	P	Q	R	P	Q	R
Roll (Thousand)	17.980	10.693	0.595	18.440	9.959	0.540	18.528	9.783	0.528

Source: S.E.D. 13.5.68

A: Primary unit cost
B: Secondary unit cost
C: Ratio of Secondary:Primary unit cost = $B/_A$

P: Number of Pupils on primary roll
Q: Number of pupils on secondary roll
R: Ratio of number of pupils on secon[dary] roll:number on primary roll = $Q/_P$

APPENDIX 6/E Contd.

THE RELATIONSHIP OF UNIT COSTS TO ROLLS - SCOTTISH CITY DATA 1961/2 - 1966/7

	1964/5			1965/6			1966/7		
	A £	B £	C	A £	B £	C	A £	B £	C
Teachers' Salaries (1)	54.9	116.8	2.13	53.9	137.1	2.54	61.0	149.9	2.46
Maintenance (2)	23.1	42.3	1.85	24.0	54.9	2.29	25.5	53.6	2.10
Sum of (1) and (2)	78.0	159.1	2.04	77.9	192.0	2.46	86.5	203.5	2.35
	P	Q	R	P	Q	R	P	Q	R
Roll (Thousand)	18.675	9.583	0.513	19.302	8.579	0.444	19.508	8.996	0.461

Source: S.E.D. 13.5.68

A: Primary unit cost
B: Secondary unit cost
C: Ratio of Secondary:Primary unit cost = B/A

P: Number of pupils on primary roll
Q: Number of pupils on secondary roll
R. Ratio of number of pupils on secondary : number on primary roll = Q/P

APPENDIX 6/F

CALCULATION OF TEACHER REQUIREMENTS FOR 1970/71 and 1975/76 based on alternative assumptions.

Scotland (Public and Grant-Aided Schools)

1) 1965/6 Standards

TABLE 1

Row		PRIMARY	SECONDARY
1	Number of teachers employed	20,533	19,551
2	Estimate[ϕ] of additional teachers "needed"	1,512	2,210
3	TOTAL	22,045	21,761
4	Number of uncertificated teachers employed	1,169	1,537
5	Number of certificated (registered) teachers required to meet 1965/6 standards	20,876	20,224
6	Enrolment:number of pupils in public and grant-aided schools	582,786	283,592
	P.T.R. = ratio of row 6 : row 5	27.9	14.0

ϕ Estimates are made by each education authority, the figures shown then are the sum of 35 local estimates. They represent the number of teachers required to (a) fill vacancies (b) eliminate oversize classes (c) replace uncertificated (unregisgered) teachers (d) replace teachers aged over 70.

Source of estimates: Annex on Quantitative Data on Teachers Tables 1,2,4,5,8. Study on Teachers:United Kingdom O.E.C.D. Paris 1969

2) Estimate of required number of teachers 1970/71 and 1975/76

TABLE 2

Row		1970/71		1975/6	
		Primary	Secondary	Primary	Secondary
1	Number of pupils in public and grant-aided schools	616.6 thou	324.4 thou	600.6 thou	399.6 thou
2	1965/6 staffing standards see 1) above = P.T.R.	27.9	14.0	27.9	14.0
3	Required number of teachers = ratio of row 1:row 2	22,100[(a)]	23,200[(a)]	21,500[(a)]	28,500[(a)]
4	"Higher" standards of staffing = P.T.R.	25.0	12.0	25.0	12.0
5	Required number of teachers = ratio of row 1 : row 4	24,700[(a)]	27,000[(a)]	24,000[(a)]	33,300[(a)]

Source: row 1 see under Table 1 above. Other data Table 1 and text.
(a) rounded to nearest hundred.