



STATISTICS DIRECTORATE

National Accounts and Financial Statistics Division

Developing a quality adjusted output measure for the Scottish Education System

This document will be presented under item 3.1 of the draft agenda and has been prepared by Richard Murray, Scottish Executive

Workshop on measuring Education and Health Volume

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DEVELOPING A QUALITY ADJUSTED OUTPUT MEASURE FOR THE SCOTTISH EDUCATION SYSTEM

1 INTRODUCTION

This paper provides a summary of the work undertaken to develop a new quality-adjusted output measure for the school education system¹ in Scotland. Responsibility for education is devolved to the constituent parts of the United Kingdom: England, Wales, Scotland and Northern Ireland. There are differences between the four systems and therefore an output measure for each constituent part has to be compiled as a building block for a UK measure. The intention is to incorporate this proposed new measure within the Scottish GVA series and within the UK National Accounts.

2 BACKGROUND

The Atkinson Review, published in January 2005, outlined a number of recommendations for improving the way the output from public services are recorded in the UK National Accounts. The main recommendations for education included:

- **Measuring Pupil Numbers:** it was agreed that the number of pupils taught was a reasonable representation of the quantity dimension of schools output. However, it highlighted that the measure should take account of variations over time in absence in order to accurately reflect the number of pupils actually taught.
- **Measuring the Quality of Education Output:** new methods for measuring the quality of education output should be investigated.
- **Coverage:** the new measure for education output should take full account of results from throughout the UK.

These recommendations formed the basis of our programme of work to develop a new output measure for the Scottish education system.

3 DERIVING A QUALITY-ADJUSTED OUTPUT MEASURE

Rationale for Adjusting for Quality

If we do not adjust for changes in the quality of the education system, then output will simply be driven by the number of pupils attending school. This volume-based measure of output fails to take into account the quality of education received.

In theory, the quality of education received could be measured by the quality of teaching in the education system. However, in practice it is very difficult to assess the quality of teaching a pupil receives. Given

¹ This includes publicly funded primary and secondary schools.

such difficulty, often attainment is used as a proxy (i.e. assumes that “high” quality teaching will have a larger impact on pupil attainment than “low” quality teaching).

Although attainment is a useful proxy for such changes in the quality of education received, it is important to recognise that there are some drawbacks to this approach. Principally, it fails to recognise the wider benefits pupils receive from the education system. Like indicators on the quality of teaching, it is very difficult to obtain robust time-series data on these wider benefits which exist.

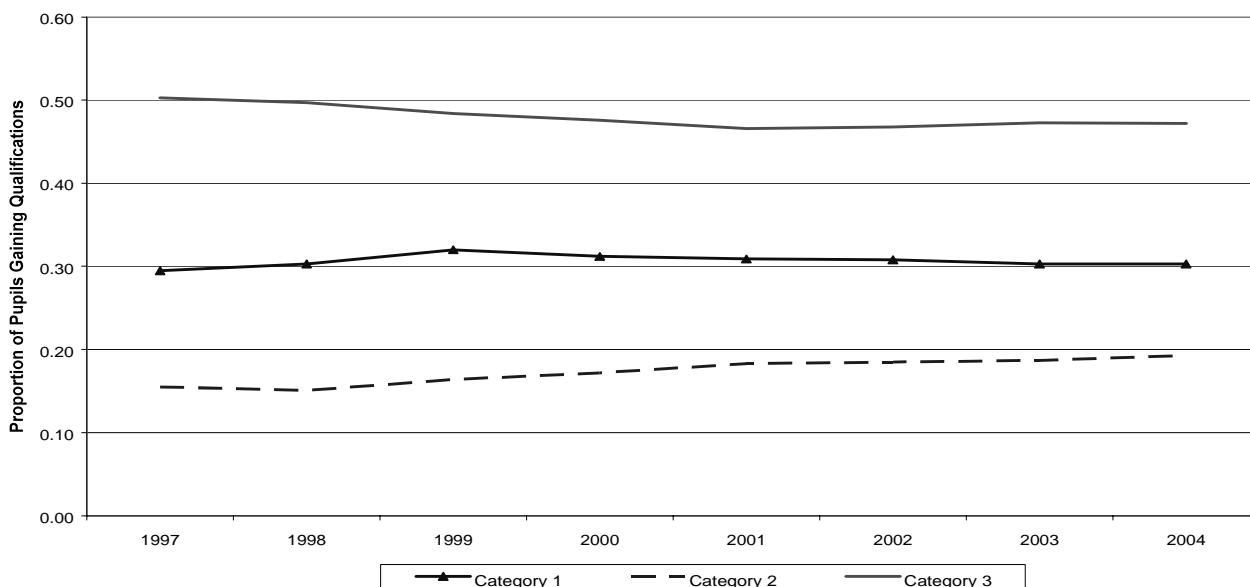
Differentiating Output by Attainment

Given that we accepted the general principle that attainment provides the most suitable proxy for measuring the quality of education, we need to decide what levels of attainment to be captured. We think it is appropriate that the measure reflects changes in attainment at a variety of levels so that we fully capture improvements across the entire attainment spectrum of the education system in Scotland. This fits with the Scottish Executive’s commitment to improving educational performance of all pupils in Scotland.

Pupils in Scotland sit national exams in the final three years of secondary school (S4, S5 and S6). To capture the entire attainment spectrum, we have included all the qualifications gained over these three years (i.e. by the time the pupil leaves school at the end of S6).

We classified the range of levels of attainment received into three categories: Category 1 represents the highest levels of qualifications gained; Category 2 represents the middle level of attainment; and Category 3 represents attainment at the low end of the attainment spectrum. Chart 1 illustrates the proportion of pupils gaining qualifications in these categories.

Chart 1: Proportion of Pupils Gaining Qualifications, by Attainment Category



Over the past eight years there has been a movement from the lowest level of attainment (Category 3) to the medium level of attainment (Category 2). At the same time, the proportion of pupils gaining the highest level of attainment, Category 1, has remained fairly stable at around 30 per cent.

Weighting the Different Levels of Attainment

Measuring quality-adjusted output requires each category of attainment to be given a weight which reflects its contribution to the total. Applications of this approach have traditionally used weights which reflect the cost of producing each category of output. However, in this case there is evidence that the benefits of the education received would not necessarily be reflected by using cost weights.

Instead, we decided to base the weights on the expected future earnings a pupil can expect to receive as a result of gaining a particular level of attainment. This expected future wage is calculated by multiplying the average earnings for each level of attainment by the associated rate of employment. This is highlighted in Table 1.

Table 1: Expected Weekly Wage in Real Terms by Highest Qualification Gained

	1999	2000	2001	2002	2003	2004	2005	Average Weight
Category 1								
Average Earnings	£275	£283	£304	£298	£290	£297	£308	
Employment Rate	0.75	0.77	0.78	0.76	0.77	0.77	0.79	
Expected Earnings	£206	£218	£238	£226	£223	£229	£242	48
Category 2								
Average Earnings	£211	£209	£230	£202	£229	£206	£212	
Employment Rate	0.72	0.70	0.70	0.71	0.72	0.72	0.70	
Expected Earnings	£151	£145	£162	£143	£164	£149	£149	32
Category 3								
Average Earnings	£176	£196	£203	£201	£188	£209	£210	
Employment Rate	0.47	0.48	0.49	0.50	0.50	0.51	0.50	
Expected Earnings	£83	£93	£99	£100	£94	£107	£104	20

As we might have expected, there is a positive relationship between the expected future earnings of an individual and the level of qualification gained at school. Therefore the average weight for the different categories give greater importance to more difficult qualifications gained.

It is important to note that we are not attributing the “credit” of future earnings to the education system, but instead are using expected future earnings as a way of weighting the relative importance of each level of attainment gained in school.

Quality-Adjusted Output Index for Education

In order to produce an output index for education which is adjusted for quality, we take the total number of pupils in the final year of secondary education, differentiate them by the level of attainment they have achieved over the final three years of education, and then weight them according to the relative importance of each category. This weighted total is then converted into an index which tracks the change in output over time. The calculation is illustrated in Table 2.

Table 2: Quality-Adjusted Output Index for Final Year of Secondary Education

Number of Pupils	1997	1998	1999	2000	2001	2002	2003	2004
Category 1	18,189	17,899	18,769	18,486	18,583	18,479	18,494	18,315
Category 2	9,557	8,920	9,619	10,191	11,005	11,100	11,414	11,666
Category 3	31,014	29,358	28,388	28,203	28,024	28,079	28,870	28,531
Total Number of Pupils in Cohort	61,659	59,071	58,652	59,250	60,138	59,998	61,035	60,447
Weighted Total	1799210	1731725	1776452	1777500	1804621	1803780	1830318	1823082
Output Index	99.7	96.0	98.4	98.5	100.0	100.0	101.4	101.0

This output index tracks the change in growth which can be caused by changes in the number of pupils attending school and changes in the proportion of pupils who fall into each attainment category. If these proportions remain constant throughout the period in question, there will be no change in quality and therefore output growth will solely be driven by changes in pupil attendance. If the proportions in each attainment category vary from year to year, then this will represent a change in the quality of education and will therefore influence overall output growth.

This index represents the quality-adjusted output for the final year of pupils in secondary education. However, it fails to capture the output from the other 11 years of school education received in Scotland. One way to address this is to apply the differentiated output from the final year of pupils across each year group in order to more accurately reflect the total output from the school education system.

By doing this, we are saying that the quality of education received in the final years of education (measured by level of attainment), is representative of the quality of education received throughout the school system. This is a realistic assumption as you would not expect significant differences in the quality of education received across the different stages of education (as often it will be the same teacher delivering certain subjects).

By applying the proportion of pupils gaining each level of attainment to all pupils in primary and secondary education, and then weighting by the relative importance of attainment, we can produce an overall output index for the whole school education system. This is highlighted in Table 3:

Table 3: Quality-Adjusted Output Index for Scottish Education System

Number of Pupils	1997	1998	1999	2000	2001	2002	2003	2004
Category 1	205,045	209,672	221,225	213,402	210,277	207,859	204,239	201,522
Category 2	107,735	104,490	113,378	117,645	124,533	124,850	126,048	128,362
Category 3	349,619	343,917	334,603	325,575	317,116	315,838	318,829	313,922
Total Number of Pupils	695,067	691,985	691,329	683,980	680,507	674,867	674,056	665,090
Weighted Total (000s)	20,282	20,286	20,939	20,519	20,421	20,289	20,214	20,059
Output Index	99.3	99.3	102.5	100.5	100.0	99.4	99.0	98.2

The calculation of the quality-adjusted output index captures all pupils attending school and adjusts by the quality of education received (measured by attainment). For those pupils who do not gain any formal qualifications from school, they will not be captured within the three attainment categories and therefore will not have a positive influence on the quality adjustment. This is because we believe it is inappropriate to claim pupils who fail to gain any qualifications have received a high quality education. However, they will still be captured in the quantity dimension of the output index.

4 LIMITATIONS OF THE QUALITY MEASURE

As highlighted earlier in the paper, there are many problems with trying to measure the quality of education received. Although attainment-based methods are often used as a proxy, they still have a number of limitations.

Firstly, they do not fully capture the wider benefits of education such as life-skills which are not reflected in attainment results.

Furthermore, the attainment based approach does not capture changes in quality for that specific year of education, but rather reflects the accumulated impact of the 11 or more years of education a pupil receives. Consequently, there will be a time lag between when a new policy is introduced and when it will feed through to impacting the quality of education.

One area for possible further work is on the weightings for the different categories of attainment. At the moment it is likely we are being slightly conservative in the weightings for Category 1. For example, the expected future earnings are based on the highest level of qualification gained. A high proportion of pupils in this category will go on to university and gain higher expected future earnings, however at the moment this is not captured in the weightings. It is unclear whether we should attribute some of the “credit” for these additional earnings to the school education system.

5 SUMMARY

The Atkinson Review outlined the importance of developing a new quality-adjusted output measure for education. We have taken forward this recommendation and produced a proposed new output measure for the Scottish education system.

The majority of the work undertaken has been investigating possible ways of measuring the quality of education received. We concluded that an attainment-based approach would be the most appropriate proxy for tracking changes in quality.

The quality-adjusted output index was developed which captures changes in a wide spectrum of attainment, which is weighted by the expected future earnings associated with each level of attainment.

Overall, the new output index for the Scottish education system has declined slightly in recent years. This has been driven by the fall in pupil numbers which has more than offset the positive impact of improvements in the quality of education received.