



LA Formula Reasonableness Illustration Support Notes

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Context

As local authorities take decisions about formula funding for schools over the coming years, and schools increasing struggle with cost pressures increasing faster than funding, the design of an educationally viable formula becomes more and more important. Indeed, the development of an evidence base about the real cost of delivering the educational offer that parents and politicians expect is, in part, in the hands of local authorities. A well-informed dialogue, in a local Schools Forum, that realistically draws together key educational parameters and the resources available is a key part of this.

A workbook has been produced to support the presentation given at the National Fair Funding Conference organised by Babcock Education and held in Birmingham on 19th October 2017. This can provide tool for LA officers and school representatives as they discuss options over the coming months and years. This note supports that workbook, its use and the underlying theory.

It should be noted that the workbook is supplied on the understanding that it is illustrative and may well contain errors. All sheets with the exception of the sheet READ ME FIRST are locked with the password PASSWORD. These can be unlocked and corrected or modified by the user as required subject to the conditions of use set out in the READ ME FIRST sheet.

A note about additionality: a school with a certain level of additional need, however defined, will receive additional funding. The expectation is that this allows the school to make additional or differentiated provision with higher costs, whether in staffing or other costs or both. When basic funding is insufficient to meet the needs of a reasonable basic curriculum, this undermines the intended additionality. Exposing the “hidden subsidy of core educational provision” could inform the next iteration of the National Funding Formula, in the same way that addressing “hidden deprivation” has featured in the first version.

The sheet READ ME FIRST contains some general notes. The rest of this document provides brief notes on each sheet in turn.

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Introduction

The sheet relies heavily on a piece of mathematics that links school expenditure and curriculum operation. Over the years since this item was first derived by Sam Ellis in his role of ASCL Funding Specialist it has been variously referred to on ASCL courses and also on the DfE website as 'The equation of life' and 'The Magic Numbers'. Detailed notes on the relationship, originally written for the DfE website in 2014 are included as Appendix 1 to these notes.

The relationship is $\frac{ATC}{I \times p_T} = PTR = c \times ACS$

Where ATC = Average Teacher Cost

I = per pupil revenue

p_T = proportion of revenue expenditure available for teacher cost in a balanced budget

PTR = Pupil to teacher ration

c = teacher contact ratio

ACS = average class size.

The purpose of the workbook is to allow the user to put in the LA formula funding allocations and then assess the reasonableness of that allocation when the additional needs of each individual school are taken into account.

The implicit assumption is that a school with no additional needs should receive sufficient from the formula funding it receives for it to put on a baseline curriculum working at reasonable average teacher costs and proportions of budget spend on teachers and for the teaching staff to be working at a reasonable level in the light of workload considerations and for all pupils to be in acceptably sized groups in a building that is adequately equipped and serviced.

The user can define reasonable values for variables that define the parameters in the equation above and, in so doing, describe the local interpretation of educational viability. More detail is given in the notes below where relevant.

The user also has to define a reasonable level of reduction in PTR value for schools that have additional needs when compared with the baseline school with no additional needs. Benchmark reference values are given below and also in the workbook itself.

The workbook calculates the cost of the baseline curriculum in each school and then subtracts that from the funding received to give the effective additional money the school has with which to address its additional needs. There is no implication that a school does this in any particular manner but the use of the additionality funding is referenced to a possible shift in PTR value because that can be benchmarked. The sheet converts this to a cash value and the actual cash value of the additionality available to each school is compared to the 'reasonable value' defined by the user. This is represented on a chart so it is easy to see how the LA funding allocation distributes individual schools around the 'reasonable value' trend line.

There are several cells in the sheet with a help comment attached. These have a small red triangle in the top right corner and the comment can be read by hovering the cursor over the cell.

BASELINE INPUTS sheet

The Baseline curriculum is defined for Primary schools and secondary schools using a range of inputs. The primary school inputs are on lines 2, 3, 15,16 and 19. These are described first in isolation

	A	B	C	D
1	Key Stage 1 & 2 parameters			
2	Maximum Reception class size	30		
3	Maximum class size Years 1 to 6 (mixed age classes)	30		
4	Key Stage 3 parameters			
5	Maximum core class size	30		
6	Maximum enhanced (e.g. Technology) class size	20		
7	Proportion of timetable cycle in enhanced classes	0.08	Equivalent periods in 25 p cycle shown in column D	2
8	Key Stage 4 parameters			
9	Maximum core class size	28		
10	Number of pupils for one option choice for year groups greater than threshold level pupils	22	See attached comment	
11	Minimum number of option choices for year groups below the threshold level	3		
12	Threshold level of pupils in option scheme	66		
13	Proportion of timetable cycle in option classes	0.36	Equivalent periods in 25 p cycle shown in column D	9
14	Teacher Contact Ratios			
15	Baseline Teacher Contact Ratio Reception	0.9		
16	Baseline Teacher Contact Ratio Key stage 1&2	0.85		
17	Baseline Teacher Contact Ratio Key Stage 3&4	0.78		
18	Primary School curriculum combination drivers			
19	Primary School Curriculum Combination	All combined (Reception calculated as in KS1&2)		

As with all curriculum inputs in the model unless the user is very familiar with the curriculum and timetable construction in primary and secondary schools it may well be advisable to consult in some detail with those who actually work in those areas of school management on a day to day basis to establish a view of reasonable values. The workbook is intended to support such dialogue. The values in the sheet as supplied are simply illustrative.

The maximum class sizes for reception and years 1 to 6 are exactly that. These inputs drive the tables RECEPTION and KSONETWO on the TABLES sheet. If, for example the input for Reception is 30 then for a roll of say 45 pupils this is divided by 30 and then rounded up to give the number of reception classes. This is then converted to a number of FTE teachers by using the contact ratio as described below. The result is in the second column of the appropriate table on the TABLES sheet.

Lower down the sheet on line 19 is a combination switch so the user can select different ways of combining year groups in the Primary schools. In the sheet as supplied only three permutations are included as examples. For say the 'All combined' option the total roll including reception is looked up in the KSONETWO table to get a total number of FTE teachers.

The contact ratio for teaching staff in primary schools is entered on lines 15 and 16.

In the sheet as supplied the contact ratio in Reception is initially set at 0.9 to represent reception teachers who have the equivalent of 10% of the week as planning and preparation time. This may not necessarily be the case in a school given that the actual terms and conditions of service state that a teacher is entitled to 10% of 'teaching time' as opposed to 10% of the school week. The model assumes that a basic level reception class has one qualified teacher with it for every lesson as a reasonable baseline.

The lower level of contact ratio in years 1 to 6 is to reflect the need for some management time in the school.

If there are 5 classes on a timetable then the total number of FTE teachers required can be calculated by dividing 5 by the contact ratio. This calculation occurs in the tables on the TABLE sheet. Contact ratio is described in more detail in the Appendix.

The secondary contact ratio works in the way described in the last paragraph but is initially set at a lower value of 0.78 in the sheet as supplied to represent the higher levels of management time required in a secondary school with specialist teaching in the curriculum. It should be noted that even this value will be higher than that currently in use in many schools and particularly in schools in London.

The curriculum model for key stage three is for pupils to be in larger class size groups, which may be simple classes or sets as the school decides, for most of the week and then in smaller classes for the remaining time in the week in subjects like Technology where there may be a requirement for smaller teaching groups. The two class sizes used in the sheet and the proportion of the week in the smaller groups are defined by the inputs on lines 5 6 and 7. The FTE teaching staff required for different sizes of year group in KS3 is in the table KSTHREE on the TABLES sheet.

	A	B	C	D
1	Key Stage 1 & 2 parameters			
2	Maximum Reception class size	30	See the support document NOTES for help with the inputs on this sheet	
3	Maximum class size Years 1 to 6 (mixed age classes)	30		
4	Key Stage 3 parameters			
5	Maximum core class size	30		
6	Maximum enhanced (e.g. Technology) class size	20		
7	Proportion of timetable cycle in enhanced classes	0.08	Equivalent periods in 25 p cycle shown in column D	2
8	Key Stage 4 parameters			
9	Maximum core class size	28		
10	Number of pupils for one option choice for year groups greater than threshold level pupils	22	See attached comment	
11	Minimum number of option choices for year groups below the threshold level	3		
12	Threshold level of pupils in option scheme	66		
13	Proportion of timetable cycle in option classes	0.36	Equivalent periods in 25 p cycle shown in column D	9
14	Teacher Contact Ratios			
15	Baseline Teacher Contact Ratio Reception	0.9		
16	Baseline Teacher Contact Ratio Key stage 1&2	0.85		
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Key stage four has more complicated inputs to account for the idea of option schemes. The inputs on lines 9 and 13 are similar to the inputs for key stage three. The proportion of the week spent in an option scheme is initially set at 36% which is fairly typical but again something which should be discussed at the local level as to what is appropriate in a baseline school with no additional needs.

In order to accommodate pupil preferences in an option scheme class sizes usually need to be smaller than in general teaching groups. In the sheet as supplied this value is set at 22. However, in a small school this could mean that subject choice is unfairly reduced. The user inputs the minimum number of choices to be made available to pupils on line 11. In the sheet as supplied the number 3 has been used. This is only an example and not a recommendation. When taken together with the class size this value provides a threshold for calculating the number of FTE teachers required. In this way the model seeks to provide for equality of opportunity for pupils in smaller secondary schools.

Remember: white cells with blue text are for user input

This means it is possible for an LA to discuss target reasonable values for ATC and p_T with its local schools and consider the possible impact as well as consider the type of benchmark values as supplied with the sheet.

The p_T value is particularly relevant for primary schools. The educational offer in a school is about more than just teachers. Spend on educational resources, teaching assistants and the maintenance of an effective learning environment are all important. These considerations, together with organisational and back office running costs make up the percentage of the funding not spent on teachers. Local discussion about affordability and expectations, particularly in respect of the basic ratio of teaching assistants to teachers, will be important in determining the percentage of funding available for teachers. Workforce census data is published by the DfE, providing the means of benchmarking current teacher/TA provision, whereas financial benchmarking data will allow for comparison of the balance of spend on teachers compared to everything else.

Secondary Schools and Primary schools

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	School	LA Formula Funding Allocation	Additionality Percentage	y7	y8	y9	y10	y11	Roll Total	Per Pupil Funding (LA allocation)	FTE teachers required for basic curriculum	PTR required for basic curriculum	Per pupil cost of PTR in previous column, i.e. for basic curriculum	Amount of funding remaining for additionality (ACTUAL ADDITIONALITY) after funding the basic curriculum model
2	See note attached	See note attached	See note attached	See note attached					See note attached	See note attached	See note attached	See note attached	See note attached	See note attached
3	Secondary 1	£4,540,440	9.5	167	177	158	205	235	942	£4,820	47.6	19.8	£4,306	£514
4	Secondary 2	£4,270,716	11.2	147	196	181	175	174	873	£4,892	44.2	19.8	£4,314	£578
5	Secondary 3	£3,207,477	12	125	123	134	136	133	651	£4,927	34.6	18.8	£4,529	£398
6	Secondary 4	£5,839,587	12.6	234	244	224	242	235	1179	£4,953	58.3	20.2	£4,213	£740
7	Secondary 5	£6,192,620	13	241	289	239	234	243	1246	£4,970	61.4	20.3	£4,199	£771
8	Secondary 6	£2,830,650	13.9	109	117	114	119	106	565	£5,010	28.5	19.8	£4,298	£712

The secondary and primary schools sheets are very similar. The only differences are the additional columns in the primary sheet to allow for different combinations of year groups, the data for ATC and p_T and the lookup tables used by each sheet.

There are comments on various columns along line 2 (indicated by a red triangle in the top right hand corner of the cell).

Column B contains the LA formula funding value under consideration. Column M (Secondary) and R (Primary) give the per pupil cost of running the BASIC CURRICULUM at the costs defined by the user inputs on the BASELINE INPUTS sheet. This is subtracted from the per pupil LA formula funding value and the answer is shown in the last column in the table as ACTUAL ADDITIONALITY. This represents the additional funding a school has per pupil with which it can enhance its basic curriculum. These values are plotted on the chart as points against the user input additionality percentage in column C.

As a reference we have included two sheets Secondary Additionality and Primary Additionality for the user to construct a reference trend line on the charts on the schools sheets. There are notes on the sheets to explain these. The user may also choose to completely ignore these trend lines and just consider the spread of points and ask the question 'Is this reasonable?' The points show the additional funding available as the additionality measure increases.

Note that it is quite possible to have schools with negative numbers in the last column of the table and hence negative values on the vertical axis of the chart. These schools have insufficient funding to put on the basic curriculum as defined by the user at the specified costs.

Cohorts of schools

The sheet applies the same values to all the schools within a phase. If it is felt that say small primaries need different user parameters than large primary schools, then several versions of the sheet can be run to represent different cohorts. Local adaptation will be required to cater for a three tier system or all through schools

Where the number of schools in a cohort exceeds the lines available the sheet can be unlocked with the password PASSWORD and additional lines added. If this is done then the chart will also need to be modified. This is done by right clicking on any data point from the Actual Additionality series and using the 'select data' option to edit the range of data points

**Remember: white cells with
blue text are for user input**

Appendix

The Equation of Life

By Sam Ellis (2014)

The Equation of Life

The title is a slightly tongue in cheek reference to the way I have been presenting and analysing the financial and curriculum situation in all types of school for the past few years. Aspects of this approach have been used, presented and discussed in a range of ASCL-PD training courses and are also featured on the ASCL-PD training DVDs on Timetabling, Governor Training and Strategic Finance¹.

The equation links five quantities to the Pupil Teacher Ratio a school can afford in a balanced budget set for an academic year. The terms are defined below and the derivation of the equation is also given.

The equation is

$$PTR = \frac{ATC}{I \times p_T} = c \times ACS$$

Where

PTR is Pupil to teacher ratio

ATC is Average Teacher Cost

I is revenue available per pupil

p_T is proportion of revenue available for expenditure on teacher cost

c is teacher contact ratio

ACS is average class size

There are other ways of calculating the number of teachers a school can afford to employ given estimates of funding, teaching salaries plus on cost and all other school expenditure but I have found the format above to make the calculation in terms of PTR is quite useful in a number of ways. Firstly, the quantities in the equation lend themselves easily to benchmarking activity. Secondly the link to the curriculum plan and hence the timetable through c and ACS is a simple one.

A third way of thinking of these terms is to estimate them for a given year and then view them as targets. Unexpected events such as long term illness or planned situations such as introducing increased management time change these targets and imply adjustment in other values in order to maintain a balance. The equation also provides a mechanism for looking at the finances from a non-financial point of view which also has the advantage of being in terms of only a few quantities.

¹ At the time of writing (June 2014) the Strategic Finance DVD was in preparation

Given a value for the PTR that the school can afford and a typical value for the teacher contact ratio the value of ACS can be calculated. Understanding the meaning of this number in the context of a school is a little like a doctor understanding the possible implications of a blood pressure value. Details of this are described in the ASCL-PD Timetable training DVD material available from the ASCL website.

A value of ACS implies a budget of teacher periods for the curriculum plan which can be planned in the context of a staff deployment analysis. This is described in detail in both the Timetable training DVD and the Strategic Finance DVD and summarised later in this paper.

Technical terms and basic relationships

Note that the relationships below apply to an academic year. If a school is working in financial years the values of ACS, I and p_T should be estimated for the academic year that the teacher contact ratio, Pupil to Teacher Ratio and Average Class Size relate to

PTR

This is the pupil to teacher ratio found by dividing the pupil roll by the total number of teachers expressed in terms of Full Time Equivalent (FTE)

ATC

This the Average Teacher Cost and is the total salary plus on costs of all the teachers counted in PTR calculation divided by the FTE teaching staff total. It is probably useful to include supply and agency costs in addition to salary and on costs.

I

(The symbol is a capital letter I). This is the revenue funding in pounds per pupil. This is the sum of all funding, income and anything else which can be legitimately counted in the global pot of money to spend on revenue items divided by the number of pupils. I suggest that any carry forward is excluded so the in-year position can be assessed. If a school is working in financial years the value of I used should be estimated for the academic year in question.

p_T

This is the proportion of revenue available for spending on teachers. It is the decimal fraction produced when the total revenue budget is divided into the sum of all expenditure lines not included in the ATC as defined above.

c

This is the teacher contact ratio. It is the average teaching load of the FTE teacher total used in the PTR and ATC calculations expressed as a fraction of the timetable cycle. It can be calculated by taking the total number of available teaching periods and dividing that by the product of the periods in the timetable cycle and the FTE teacher total used in earlier sections. It is typically a decimal in the 0.6 to 0.8 area. Values as high as 0.8 are now seem extremely rare. 0.8 was the norm around 30 years ago but school organisation now has quite different demands on it. I have only seen values for c as low as 0.6 in situations where schools are generously funded. More frequently, the values I have observed are in the mid-range between 0.7 and 0.8. For the last five years I have advocated 0.78 as an aspirational target on the basis that that represents approximately 10% of

all teacher time in planning and preparation, 10% in management activity and allows 2% error since $10+10+2 = 22$ and $100-22 = 78$.

ACS

This is the average class size. This is a global statistic for an institution and does not actually represent any particular class. It is the number of pupils that would be allocated to a teacher if all the teachers who are teaching on any period of the week, on average shared all the pupils on roll evenly between them. There are two relationships for calculating it:

The first follows from the definition:

If tp represents the number of teacher contact periods on the whole timetable and w represents the number of periods there are in the timetable cycle, then the average number of teachers in contact with students on any one period is given by

$$\frac{tp}{w}$$

If the number of pupils on roll, N , is divided by this fraction we get the average class size so (N.B I have inserted multiplication signs to distinguish between separate symbols and symbols that have more than one letter.

$$ACS = \frac{N \times w}{tp}$$

The second is

$$ACS = \frac{PTR}{c}$$

This follows by substitution since

$$c = \frac{tp}{T \times w}$$

where T is the full time equivalent number of teachers.

and

$$PTR = \frac{N}{T}$$

The second relationship for **ACS** is **one of the two basic relationships** needed to relate finance and curriculum (As above I have inserted multiplication signs from time to time to make the distinction between terms easier to see)

$$PTR = c \times ACS$$

The second basic relationship is

$$PTR = \frac{ATC}{I \times p_T}$$

This can be derived as follows:-

Let the expenditure on teaching staff be \mathcal{E}_T

The average teacher cost ATC is therefore given by

$$ATC = \frac{\mathcal{E}_T}{T}$$

So

$$ATC \div PTR = \frac{\mathcal{E}_T}{T} \times \frac{T}{N}$$

So

$$ATC \div PTR = \frac{\mathcal{E}_T}{N}$$

But

$$\frac{\mathcal{E}_T}{N} = I \times p_T$$

Where I is the income per pupil and p_T is the proportion of revenue expenditure on teaching staff

Hence

$$PTR = \frac{ATC}{I \times p_T}$$

Combining the two basic relationships, with PTR as the fulcrum, gives:

$$\frac{ATC}{I \times p_T} = PTR = c \times ACS$$

Using the Equation of Life to balance budget and curriculum in a school

- 1) Estimate the available revenue funding for the academic year in question
- 2) Calculate the current average teacher cost including on cost from actual salaries, on costs and FTE values. Use this to make a best estimate allowing for pay increases, pay progression, staff changes and any restructuring of the average teacher cost for the academic year in question. It may be useful to estimate a range, highest to lowest for this. This gives ATC for the equations above
- 3) Analyse all the non-teaching costs for the academic year in question and split them into essential and desirable elements to assess the overall range of flexibility between the upper and lower levels of expenditure on non-teaching costs. Use these results with the value for the available revenue to calculate values for p_T as defined for the equations above
- 4) Make a best estimate or best, most likely and worst estimates for the per pupil funding for the academic year in question from point 1) above and estimated roll numbers. This gives I for the equations above
- 5) Use

$$PTR = \frac{ATC}{I \times p_T}$$

To calculate the PTR that can be afforded

- 6) Use the teacher contact ratio to calculate the Average class size in the curriculum from $PTR = c \times ACS$

Plan the curriculum to match the value of ACS or estimate the teacher period budget from the first ACS equation or from the roll, PTR contact ratio and periods in the timetable week.

If a lower value of ACS is the only curriculum possibility work backwards to find the PTR required for that and hence the change in p_T or ATC needed to do that or if that is not possible the degree of overspend required shown as a change in I .

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