Subject VA Grid spreadsheet for Jun '18 using 2018 Transition Matrices – detailed notes

SUMMARY 1

WHAT'S NEW IN THIS VERSION (V11 - JAN '19) 2

WHAT'S NEW IN THIS VERSION (V10 - JAN '18) 3

WHAT'S NEW IN THIS VERSION (V9 - JAN '17) 3

OVERVIEW 5

INTRODUCTION 6

Transition matrices (TMs) 6
School exam data-checking datafiles ("Forvus") 6

USING THE SUBJECT TRANSITION MATRICES (TM) GRID SPREADSHEET 6

Preparation 6
Using the Subject TM Grid workbook (combination of spreadsheets) 7
The sheets within the Subject VA Grid workbook 7

HOW TO INTERPRET THE INFORMATION 12

How is the school subject data compared with national subject data 12
Why do are the cumulative graphs used? 14
Interpreting the graphs 14
Using the supplied blank template 15
Worked example 15

HOW TO ANALYSE THE INFORMATION 15

Averages (see Front Panel on spreadsheet and Overview on p.2-3) 15
National entry patterns 17
Significance and other estimates 18
The "cumulative difference" grid itself 18

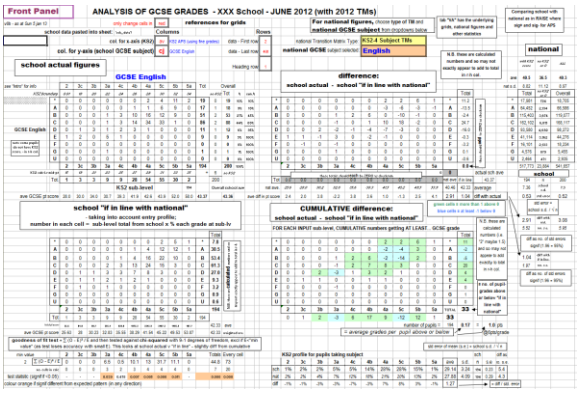
NATIONAL TRANSITION MATRICES - LOCATION??? 19

KS2 PRIOR ATTAINMENT 20

PROGRESS 8 KS2 PRIOR ATTAINMENT 20
2015 BOYCOTT ISSUES 20
Impact of boycott 21

DISCLAIMER 22

Instructions on how to use the spreadsheet are on page 5 "Using the Subject Transition Matrices (TM) Grid spreadsheet". There is a separate spreadsheet available from the ASCL website to analyse the Progress 8 information.



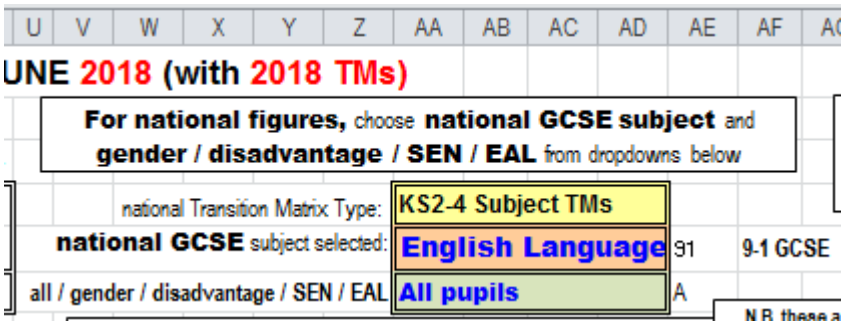
Summary

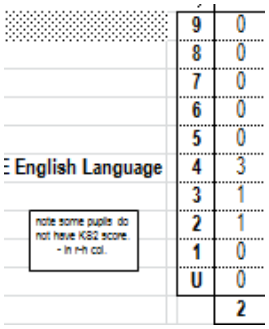
A powerful Subject value-added (VA) Grid can be calculated by combining RAISE (DfE/Ofsted) Transition Matrices for subjects with the existing pupil-

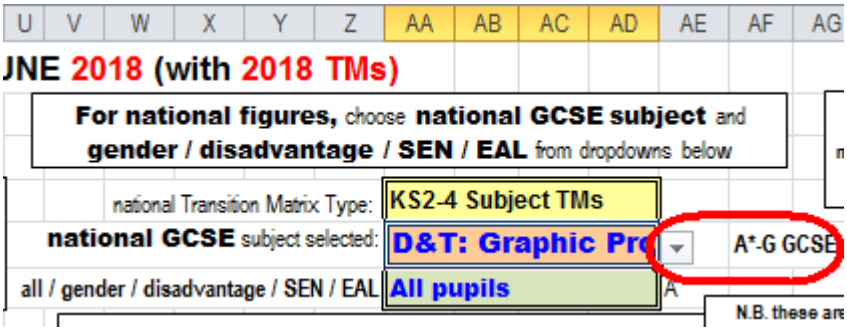
level data already produced for each school by DfE for the Forvus exam result data-checking exercise each October. A Subject VA Grid spreadsheet to do this has been developed by the ASCL Data group, and is available from the ASCL website. At a glance (using the familiar RAISE convention of green = "good" / blue = "under", you can see for each of the main GCSE subjects how your school has performed against national by each KS2 sub-level. This Grid format facilitates a detailed discussion,.

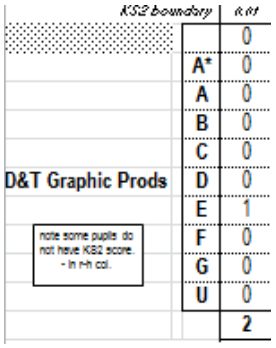
What's New in this version (v11 - Jan '19)

- **9-1 grading in almost all but A*-G in a few:** The spreadsheet automatically adjust itself according to whether a "9-1" GCSE or a "A*-G" GCSE is selected - see red rings below
- The GCSE pt score figures are also calculated using the appropriate points scale depending on whether 9-1 or A*-G

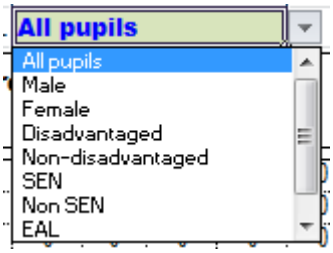




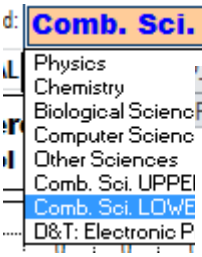




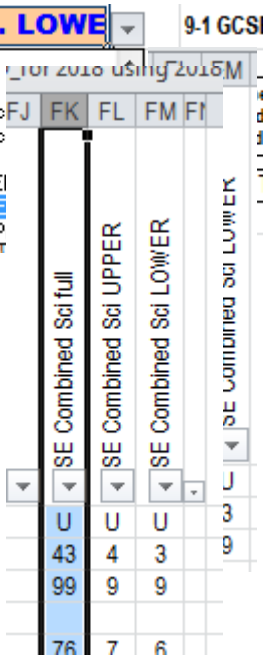
- **Breakdown by All pupils / Male / Female / Disadvantage / Non-disadvantage for all subjects** - DfE has this year published national TMs with a breakdown in each of the above categories which is really helpful in seeing what is happening at a subject level. The spreadsheet compares those in each category at your school with the comparable national figures



- **Combined Science** - although the TMs are supplied on 17 point scale this spreadsheet sticks to 9-1 grid and has UPPER grade and LOWER grade (which may be the same). So if the awarded grade is 7-6, then the Upper grade is 7 and Lower is 6; if the awarded grade is 7-7, then the Upper grade is 7 and Lowe r is 7. Note that the Ofqual "anchor points" are set at 7-7, 4-4 and 1-1, so use the Lower grade grid for comparison, as 4 in the Lower grid equates to 4-4 and 5-4 but not 4-3.



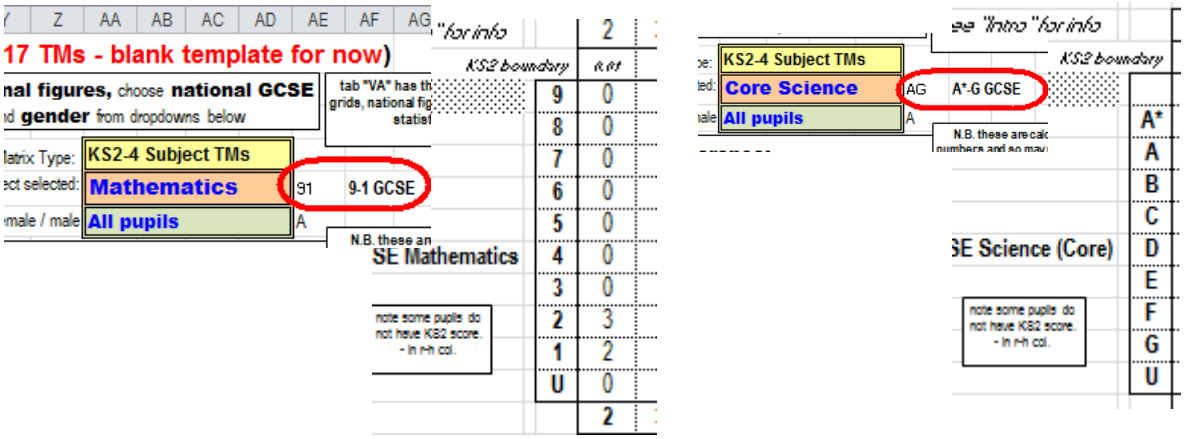
- Splitting Combined Science in the datafile: however, it does require splitting the Combined Science column into two separate columns with single grades. make a copy of the column and paste it in at the right-hand end.



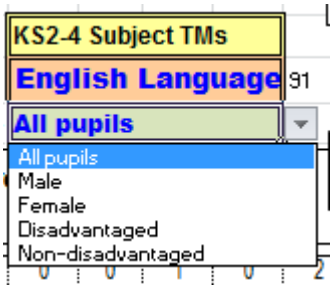
- Highlight the column. Data > Text to Columns > Fixed width and put the splitter between the two values. Then adjust the headings. You may wish to use the filter option to put a U in both columns

What's New in this version (v10 - Jan '18)

- **9-1 grading in GCSE Eng and Maths but A*-G in others** has led to adaptation of the grids (and also looking ahead to 2018 when almost all, but not entirely, others will become A*-G)
- The spreadsheet automatically adjust itself according to whether a "9-1" GCSE or a "A*-G" GCSE is selected - see red rings below



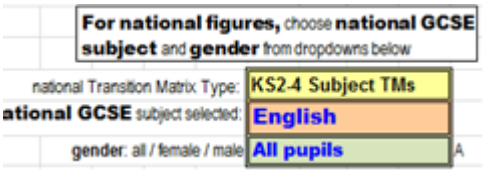
- The GCSE pt score figures are also calculated using the appropriate points scale depending on whether 9-1 or A*-G
- **Breakdown by All pupils / Male / Female / Disadvantage / Non-disadvantage for all subjects**
- DfE have now taken direct responsibility for the TMs as RAISE has been stopped and website no longer exists. They are now published under Guidance on DfE Performance Tables website The first set of TMs will include a gender breakdown as well as figures for all pupils - this spreadsheet enables a school's results by gender to be analysed against national figures disaggregated by gender. For June 2017 both gender and disadvantage were both published together in January 2018



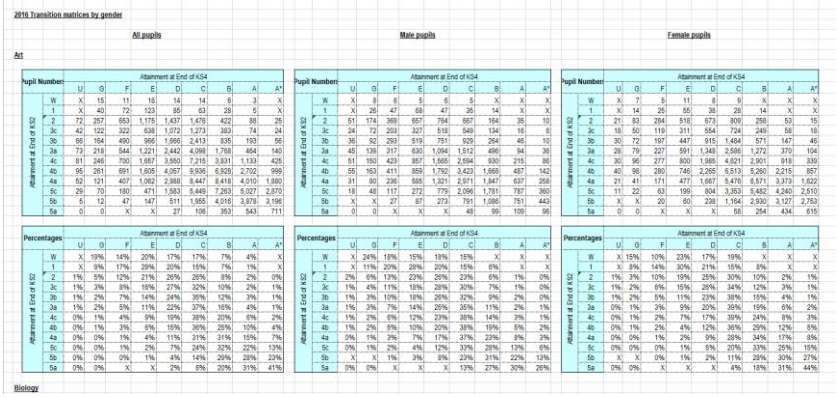
- Disadvantage grids will be published later after the Performance Tables appear in January.

What's New in this version (v9 - Jan '17)

- A **gender analysis** option has been added now that DfE have published the Transition Matrices for June 2016 for all / female / male pupils. These are included as a tab "2016 TMs" within the spreadsheet.



- The spreadsheet uses the same DfE Checking file as issued for Progress 8, ensuring consistency of analysis
- However, care is needed to distinguish between Progress 8 KS2 prior attainment and the "old" (sub-Level based) input to TMs. Therefore both the KS2



English fine sc ore and KS2 Maths fine score are explicitly referenced and used.

- At the technical level, the DfE National subject TMs are now published as a single table (see above) which has meant that the formulae within the spreadsheet have been re-written, but it has reduced the overall number of tabs.
- A blank template has been provided to copy over the results for each subject into a separate tab, enabling a single spreadsheet to have all the subjects for a school. Grouping the tabs makes it easy to print them all as a pdf for distribution - **tip** - click on the first tab, and hold SHIFT whilst you click on the last - they will all go white. If you then print, and select "PDF" you can produce a single document. Right-click and ungroup to separate.

Overview

Choose subject from school datafile to display grid of school actual results by KS2 sub-level

Choose subject from national TMs (and gender)

Calculation of national and school averages and standard deviations to help with RAISE significance

Difference between school actual and "if in line" with national

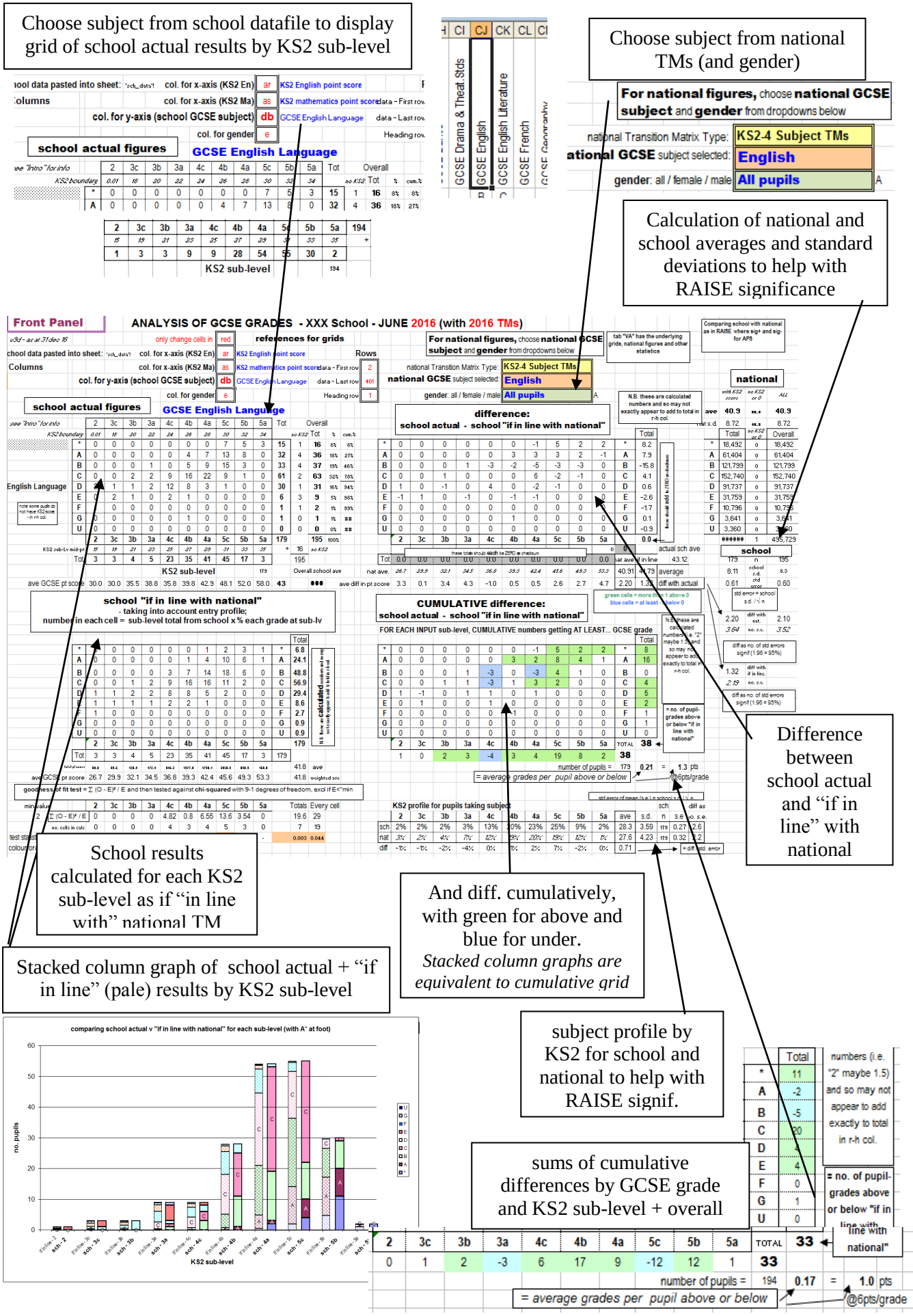
School results calculated for each KS2 sub-level as if "in line with" national TM

And diff. cumulatively, with green for above and blue for under.
Stacked column graphs are equivalent to cumulative grid

Stacked column graph of school actual + "if in line" (pale) results by KS2 sub-level

subject profile by KS2 for school and national to help with RAISE signif.

sums of cumulative differences by GCSE grade and KS2 sub-level + overall



Introduction

Transition matrices (TMs)

A **transition matrix** is simply a grid showing how many pupils in a particular subject began with a certain KS2 sub-level and finished with a certain GCSE grade. Those published in RAISEonline either within individual schools' reports (e.g. for Expected Levels of Progress) or in the Library at a national level, are in the format on the right with the level on the left-hand axis.

	U	G	F	E	D	C	B	A	A*
Attainment at End of KS4									
Attainment at End of KS2									
B	49	129	185	126	86	45	34	19	7
N	49	129	185	126	86	45	34	19	7
2	49	129	185	126	86	45	34	19	7
3c	26	93	183	175	120	55	22	8	4
3b	27	163	331	419	340	178	44	28	8
3a	43	273	623	963	949	555	121	50	14
4c	67	329	975	1,863	2,686	1,895	419	121	40
4b	76	354	1,090	2,858	5,269	5,162	1,717	429	132
4a	45	257	905	2,754	7,215	10,052	4,859	1,752	470
5c	38	124	374	1,473	5,401	11,119	9,358	5,279	1,684
5b	9	36	101	388	1,860	5,748	8,172	8,260	4,874
5a	0	0	3	11	54	267	668	1,402	1,817

It is more familiar in terms of value-added to transpose them so that the "input" (the KS2 sub-level) is on the x-axis and the "output" (the GCSE grade) is on the y-axis (as on the right)

note transposing to get INPUT on x-axis, OUTPUT on y-axis

													Total
*	7	7	7	4	8	14	40	132	470	1,684	4,874	1,817	*	9,064
A	19	19	19	8	28	50	121	429	1,752	5,279	8,260	1,402	A	17,386
B	34	34	34	22	44	121	419	1,717	4,859	9,358	8,172	668	B	25,482
C	45	45	45	55	178	555	1,895	5,162	10,052	11,119	5,748	267	C	35,166
D	86	86	86	120	340	949	2,686	5,269	7,215	5,401	1,860	54	D	24,152
E	126	126	126	175	419	963	1,863	2,858	2,754	1,473	388	11	E	11,282
F	185	185	185	183	331	623	975	1,090	905	374	101	3	F	5,140
G	129	129	129	93	163	273	329	354	257	124	36	0	G	2,016
U	43	43	49	26	27	43	67	76	45	38	9	0	U	478
	TA	B	N	**2**	**3c**	**3b**	**3a**	**4c**	**4b**	**4a**	**5c**	**5b**	**5a**		130,166
Tot	680	680	680	686	1,538	3,591	8,395	17,087	28,309	34,850	29,448	4,222			**130,166**
												130,166			

From a school perspective, these are enormously powerful because school improvement within a school is often managed through a subject / Dept basis, and then down to the individual teacher / class in a subject. To have a method of calculating and displaying Value-Added in this grid format is an extremely useful starting point for the conversations about what can be learnt from the data.

DfE and Ofsted produce Transition Matrices (TMs) for top 30 subjects and for English and Maths. These are available from the RAISEonline Library.

In the of the Subject Transition Matrices Grid Spreadsheet, these National TMs have already been downloaded and saved into the spreadsheet, so that you do not have to do this. It does mean though that you must use the correct version of the spreadsheet to be comparing the data with whichever year you want to do the comparison.

School exam data-checking datafiles ("Forvus")

A pupil-level datafile is produced for each school by DfE for the Forvus checking exercise in September / October (and then updated for the publishing of the Performance Tables in January). The official DfE data checking website is https://tableschecking.education.gov.uk There is a secure login protection.

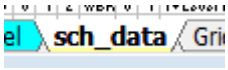
Using the Subject Transition Matrices (TM) Grid spreadsheet

Preparation

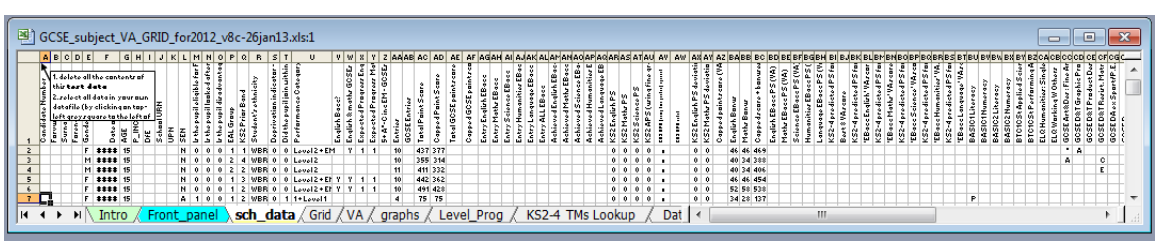
1. **Download school data from DfE Checking website**

Schools should download their data (as a .csv file). This .csv file should then be saved as an Excel file for convenience.

Within the spreadsheet there is a tab **"sch_data"** for your data, and where initially 200 pupils (anonymised) are supplied for practice, but this should be replaced by your own school data for actual use.

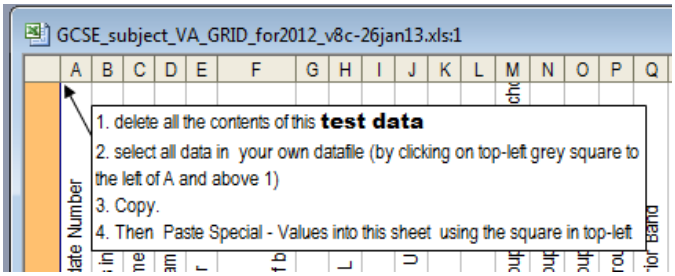


The names of the first columns (from column A



onwards) are the same for all schools, but the exam results data column headings after that initial section vary from school to school.

2. One-off operation to copy your own school data into the main TM spreadsheet



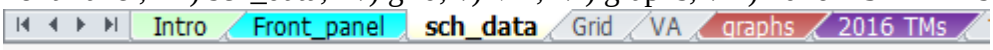
1. delete all the contents of **this test data** in "sch_data" (by clicking on top-left grey square to the left of A and above 1 to select the whole sheet – it all goes blue)
2. select all data in **your own school datafile** (by clicking on top-left grey square)
3. Copy.
4. Then Paste Special - Values into this sheet "sch_data" using top-left grey square
5. Save the main spreadsheet, perhaps with a new name. You may also find it helpful to print the sheet with Row Headings displayed so you have a convenient record of which subject is in which column.

Using the Subject TM Grid workbook (combination of spreadsheets)

The school data and the National TM data are contained within the overall workbook / spreadsheet which brings all the data together

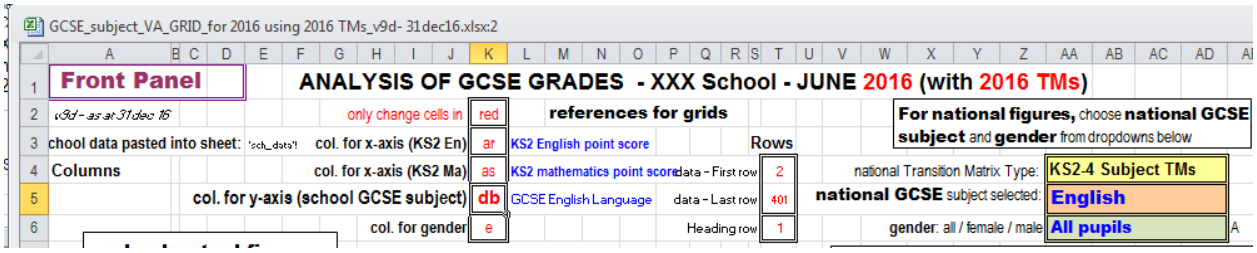
– there are **7** individual tabs

i) Intro, ii) Front Panel, iii) sch_data, iv) grid, v) VA, vi) graphs, viii) 2016 KS2-4 TMs



Check in the Front Panel that:

- cell L3 says "KS2 English point score" (cell K3 will say "ar", to indicate that in sheet "sch_data", the KS2 English point scores are in column AR
- cell L4 says "KS2 Maths point score" (cell K4 will say "as", to indicate that in sheet "sch_data", the KS2 Maths point scores are in column AS
- cell K6 say "e", to indicate that in sheet "sch_data", the genders are in column E
- cell H7 says GCSE _____ (controlled by cell K5) and matches the subject chosen in the National TMs, displayed in cell AA5
- cell AA5says "All / Female / Male" depending on which gender analysis you wish



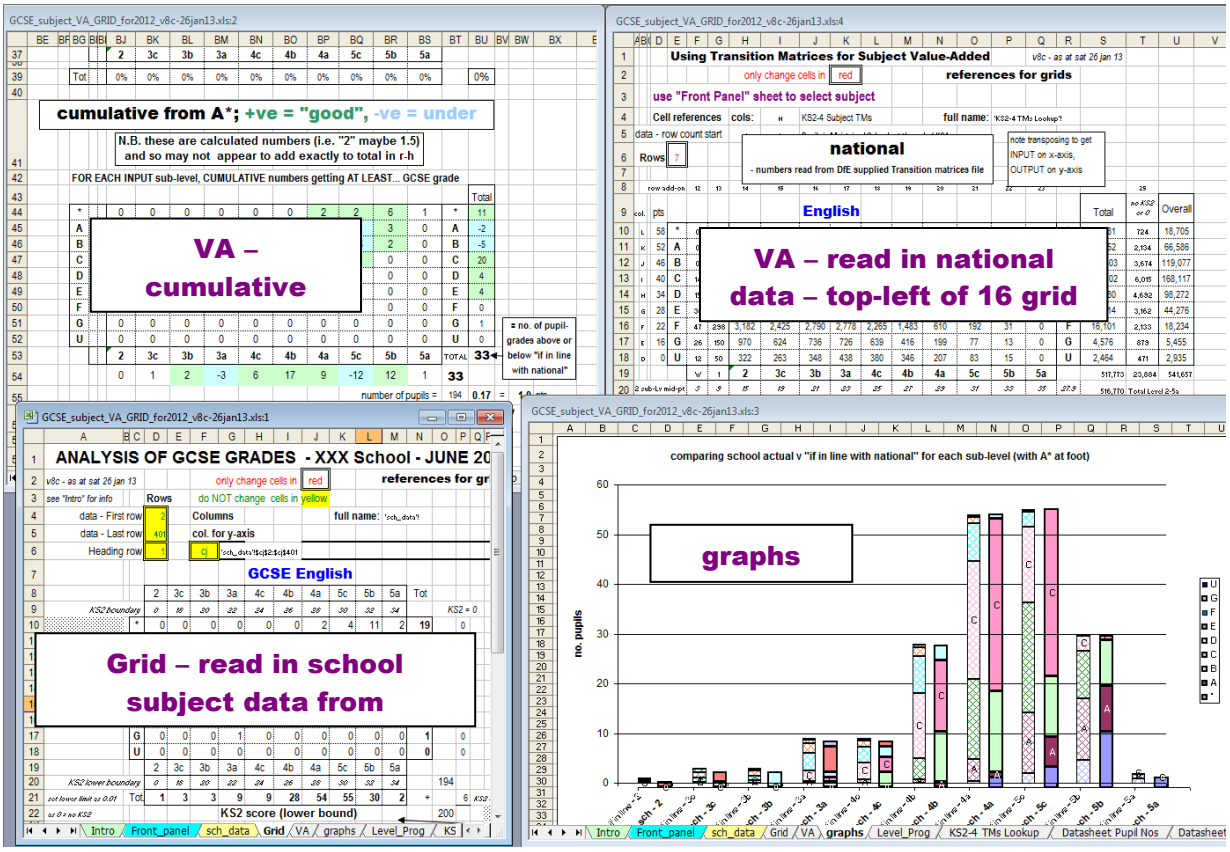
The sheets within the Subject VA Grid workbook

There are over **8** individual sheets

i) Intro, ii) Front Panel, iii) sch_data, iv) grid, v) VA, vi) graphs, vii) Level_Prog

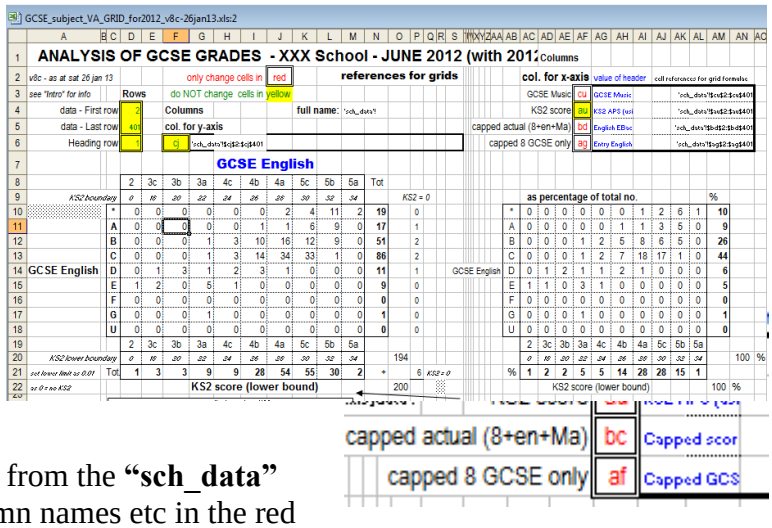
viii) KS2-4 TMs Lookup and other linked sheets from the National TMs **

the 4 underpinning ones are displayed in the screen shot below:



1. The sheet **"intro"** contains a text box summarising these instructions

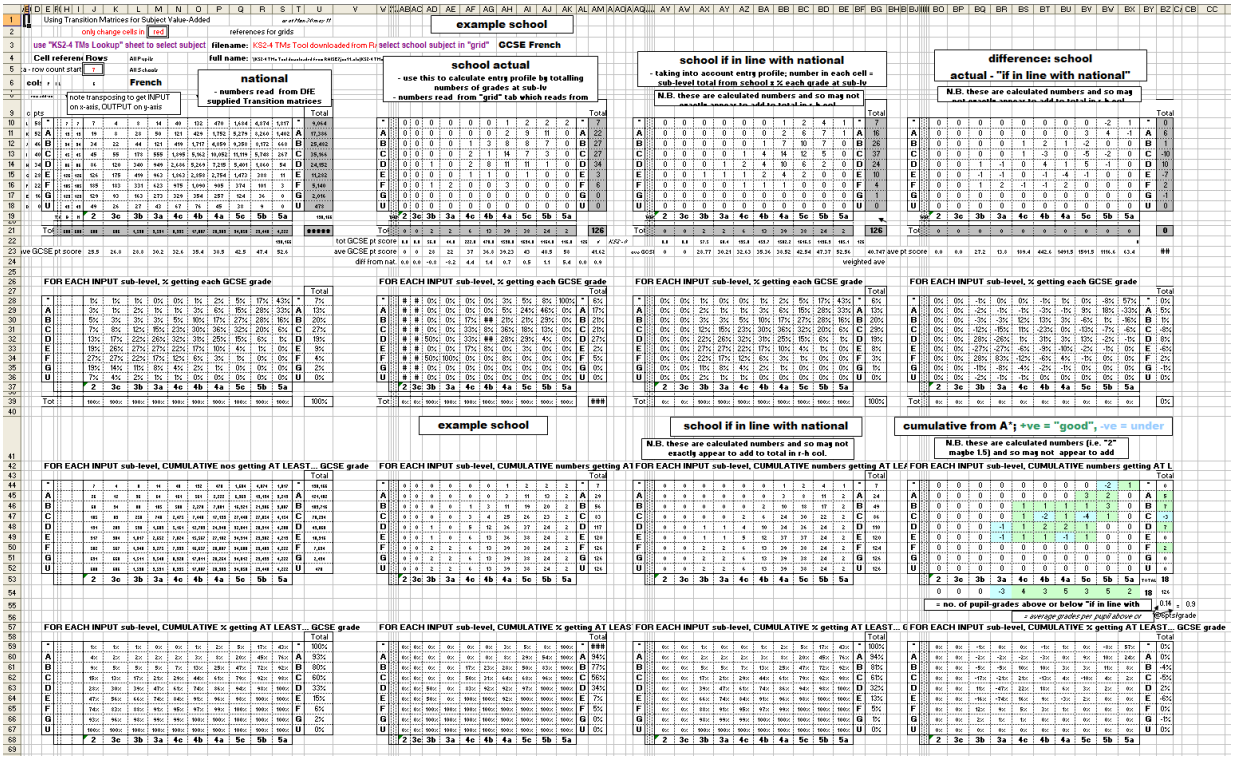
2. The sheet **"grid"** has a grid with formulae which are highly flexible and allow all kinds of comparisons, but the top one is against average KS2 score. The numbers in the grid refer to the numbers of pupils at the example school gaining a particular GCSE grade in a specified subject (e.g. GCSE English).



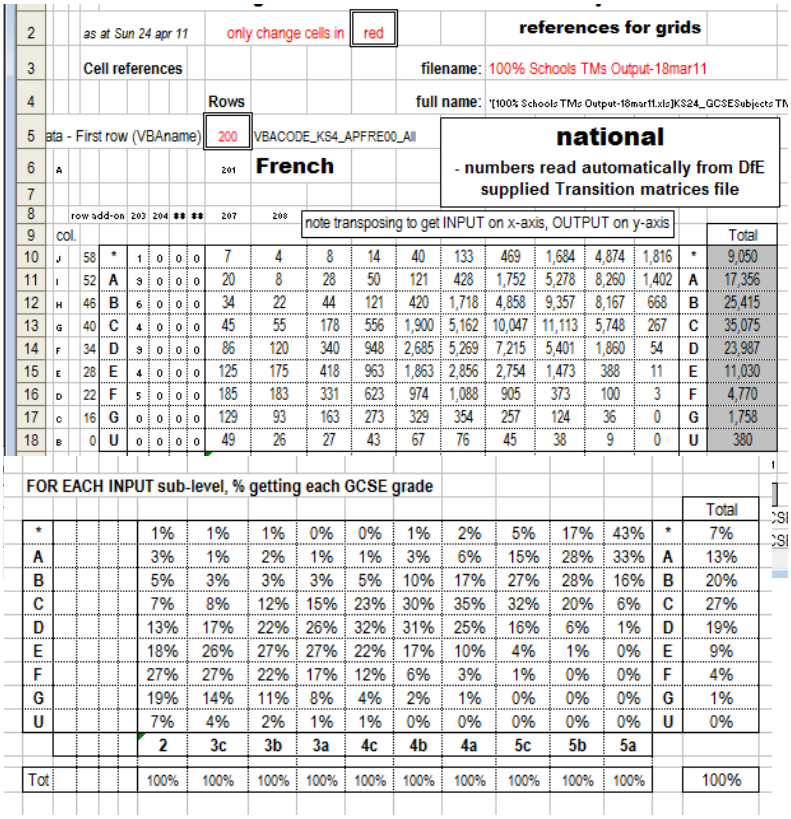
   The data is obtained automatically from the **"sch_data"** sheet. You need to enter the column names etc in the red cells or Front Panel (green on yellow). For example, GCSE English is in column CJ (and ave KS2 score in col AU, etc), so this is specified, as are the first and last rows of pupil data (2 to 401).

   The grid lower down the table enable you to compare a particular subject with: another subject
   You will need to make sure the correct columns are entered in cells AF4-6. The cell contents corresponding to the columns entered are displayed in blue as a check.

3. The sheet **"VA"** contains 16 grids which bring together the national info for the specified subject and that for the subject within the school itself. The top-left corner is displayed as that shows which subject has been selected for the national figures and for the school's figures

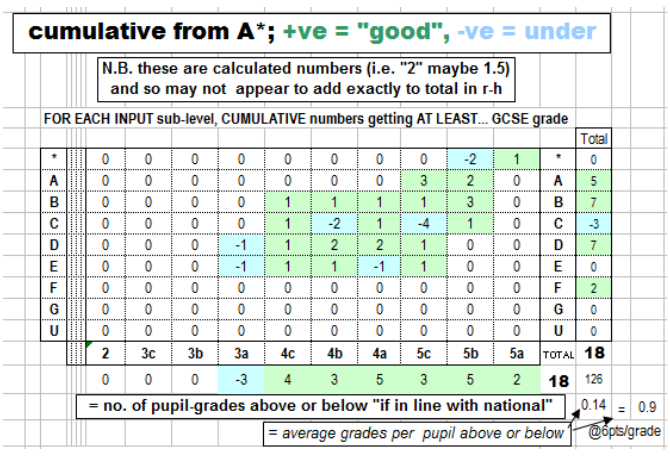


The National numbers are read directly from the **"TMs"** spreadsheet by specifying and the subject of interest in the Front Panel. The formulae also transpose the data so that it is in its more familiar orientation of "input" i.e KS2 along the x-axis, and "output" i.e. GCSE along the y-axis. So in this example looking at GCSE French, row 200 is specified.



From the matrix, you can see that1,816 pupils gained a grade A* from a KS2 sub-level of 5a etc

Also note that the matrix has the **actual numbers** of pupils which is also very helpful for a variety of analyses. An average score can also be calculated for each sub-level using the usual points scores (A*=58 etc). In the case of sub-level 5c = 42.5. For each sub-level, we can then calculate the percentage getting each grade e.g. in sub-level 5c, 6% gained A* and 15% gained A nationally.



The **most important grid** is that of the difference between the school actual figures for the subject, and those from the national numbers, adjusted for the ability profile for that particular subject in that school. (These are cumulative figures – see below for explanation).

Although it is possible to combine the cells to get row- and column-totals, and then an overall total figure, the real emphasis and value of this method is the GRID, which immediately gives you a detailed picture, and leads to a useful, informed discussion, which is not possible from a single figure

0	0	0	0	0	0	G	0
0	0	0	0	0	0	U	0
4c	4b	4a	5c	5b	5a	TOTAL	18
4	3	5	3	5	2	18	126
bove or below "if in line with national"						0.14	= 0.9
= average grades per pupil above or below						@6pts/grade	

However, the figure is calculated for reference. The bottom-right corner of the grid is shown enlarged.

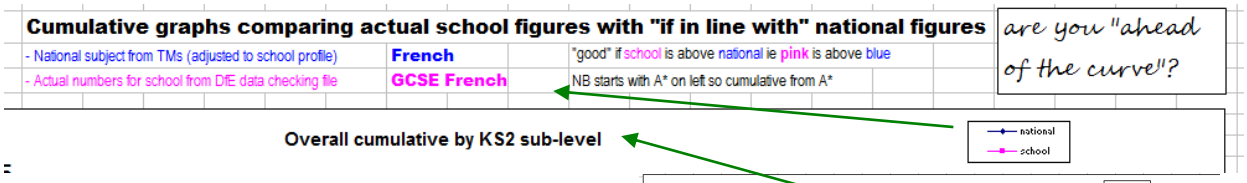
In this example, 18 is the number of pupil-grades above or below (e.g. could be 18 pupils 1 grade up or 6 pupils 3 grades up or any other combination). There are 126 pupils, so that is an average of 18/126 = 0.14 grades per pupil above average. Usually in RAISEonline, 1 grade = 6 points, so multiplying by 6 gives 0.9 points per pupil above avergae. A negative figure would mean below average.

N.B. this is all relative, so that across the country as many will be above as below

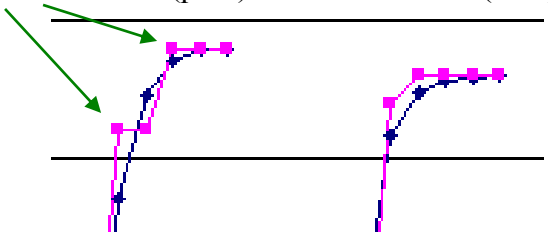
N.B. these are calculated numbers (i.e. "2" maybe 1.5) and so may not appear to add exactly to total in r-h e.g. in the top row, you might be puzzled that -2 and 1 combine to give a total of 0, but actually the figures are as per on the right here

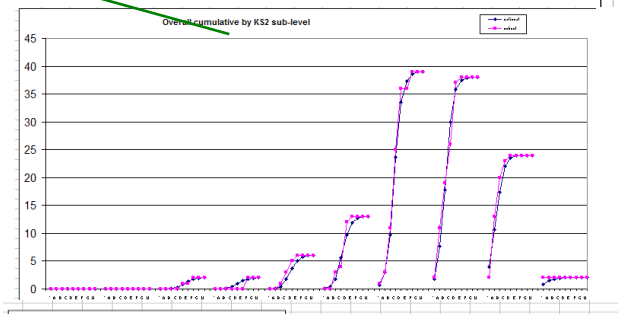
			Total
-1.97	1.14	*	-0.46

4. The sheet **"graphs"** contains different graphs to assist in the interpretation of the data – see section "Interpreting the graphs" below for details – parts of graph magnified below

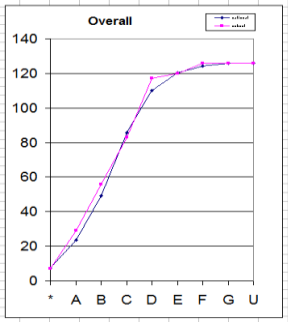


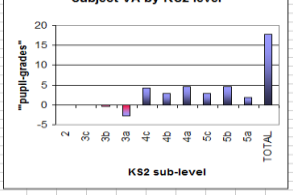
"good" if school (pink) is above national (blue)



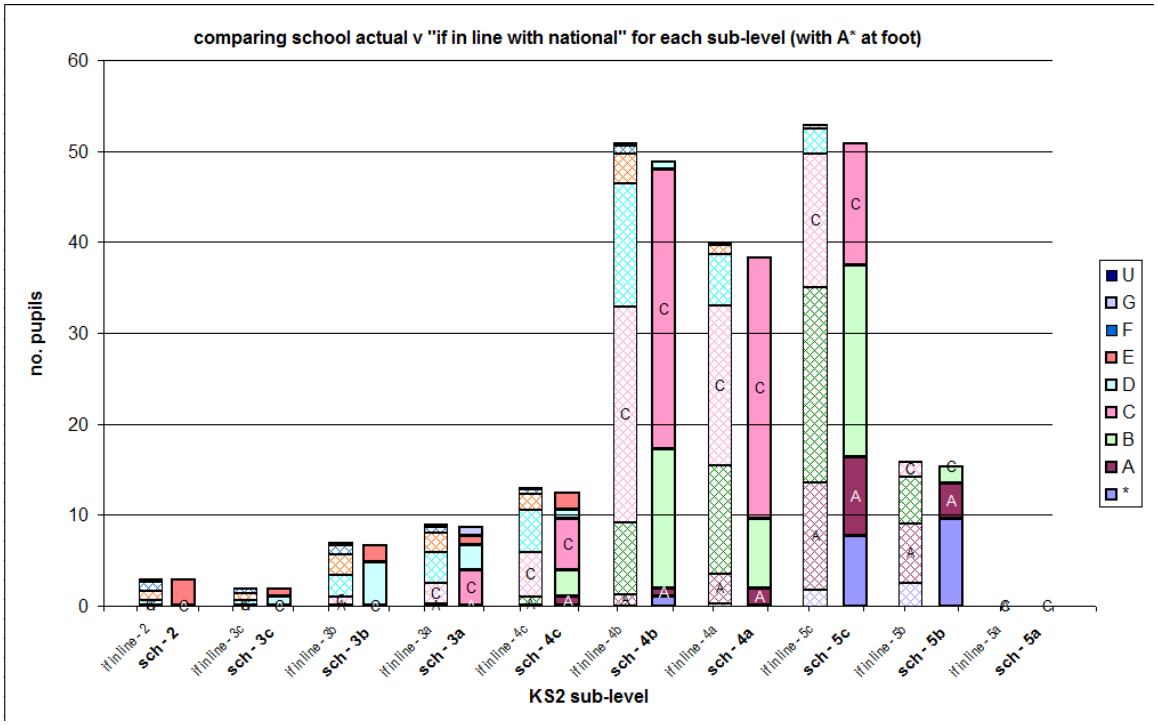


Overall, by final grade and by KS2 level:
"ahead of the curve" : because these are cumulative graphs beginning at A*, it is "good" for a school to have more cumulative pupils than if "in line"; i.e. pink to be above blue i.e. rising more sharply i.e. "ahead of the curve"





Stacked column graphs



school "if in line with national"

- taking into account entry profile;

ber in each cell = sub-level total from school x % each grade a

*	0	0	0	0	0	0	0	2	5	1	*
A	0	0	0	0	0	1	4	12	12	1	A
B	0	0	0	0	1	4	16	22	10	0	B
C	0	0	0	2	3	13	24	15	3	0	C
D	0	1	1	3	3	7	8	3	0	0	D
E	0	1	1	2	1	2	1	0	0	0	E
F	0	1	0	1	0	0	0	0	0	0	F
G	0	0	0	0	0	0	0	0	0	0	G
U	0	0	0	0	0	0	0	0	0	0	U
	2	3c	3b	3a	4c	4b	4a	5c	5b	5a	
Tot	1	3	3	9	9	28	54	55	30	2	194

l actual figures **GCSE English**

	2	3c	3b	3a	4c	4b	4a	5c	5b	5a
*undary	0.01	16	20	22	24	26	28	30	32	34
*	0	0	0	0	0	0	2	4	11	2
A	0	0	0	0	0	1	1	6	9	0
B	0	0	0	1	3	10	16	12	9	0
C	0	0	0	1	3	14	34	33	1	0
D	0	1	3	1	2	3	1	0	0	0
E	1	2	0	5	1	0	0	0	0	0
F	0	0	0	0	0	0	0	0	0	0
G	0	0	0	1	0	0	0	0	0	0
U	0	0	0	0	0	0	0	0	0	0
	2	3c	3b	3a	4c	4b	4a	5c	5b	5a
.v mid-pt	15	19	21	23	25	27	29	31	33	35
Tot	1	3	3	9	9	28	54	55	30	2

CUMULATIVE difference:

school actual - school "if in line with national"

FOR EACH INPUT sub-level, CUMULATIVE numbers getting AT LEAST... GCS

*	0	0	0	0	0	0	2	2	6	1
A	0	0	0	0	0	0	-2	-4	3	0
B	0	0	0	1	2	6	-2	-14	2	0
C	0	0	0	-1	2	7	8	3	0	0
D	0	0	2	-3	1	3	2	1	0	0
E	0	1	1	0	0	1	1	0	0	0
F	0	0	0	-1	0	0	0	0	0	0
G	0	0	0	0	0	0	0	0	0	0
U	0	0	0	0	0	0	0	0	0	0
	2	3c	3b	3a	4c	4b	4a	5c	5b	5a

The stacked column graph is a powerful way of comparing the school actual figures with what they would have been "if in line with" national. The stacking starts from A* for the same reasons as in the explanations for the cumulative approach above. This means then that "higher" is "better". So for example looking at the KS2 sub-level 4a numbers:

A*: 0 if in line; 2 actual, so in cumul diff on right A* = 2 (and green as "good")

A: 4 if in line; 1 actual, so A*-A: 4 if in line; 2+1 = 3 actual , so in cumul diff on right A*-A = -2 (and blue as "below") – NB rounding challenge!!, and in the graph the solid "actual" A is below the "if in line", but then for A*-C grade is 8 above.

And similarly for all the other grades and KS2 starting levels. Because they are stacked graphs, they automatically, become cumulative. And the heights represent the actual numbers of pupils.

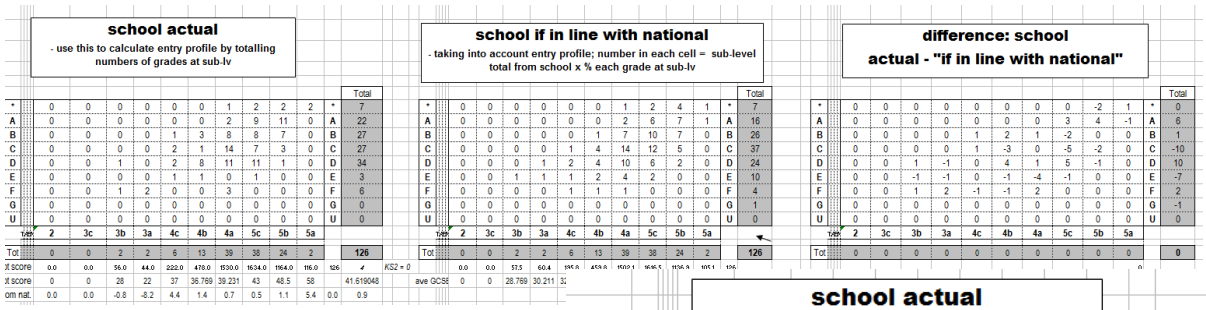
How to interpret the information

How is the school subject data compared with national subject data

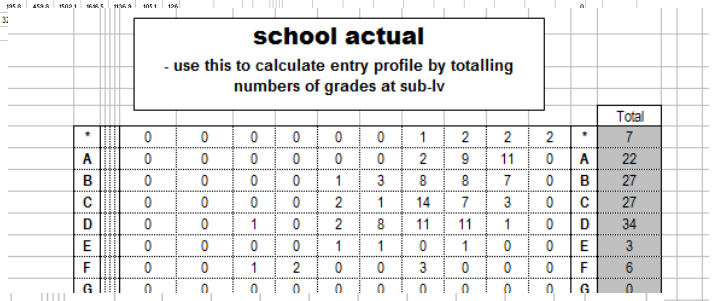
To use the information for **valid comparisons,** we must take into account the ability profile in each subject in each school.

The grid of numbers is then copied into the VA sheet within the workbook and labelled "school actual". We now need to calculate what it would have been if it was in line with National figures. The crucial step in this is to calculate on a sub-level by sub-level, the number of pupils at the school at that sub-level, and then use the national figures to calculate the "expected" GCSE grade distribution for that number of pupils.

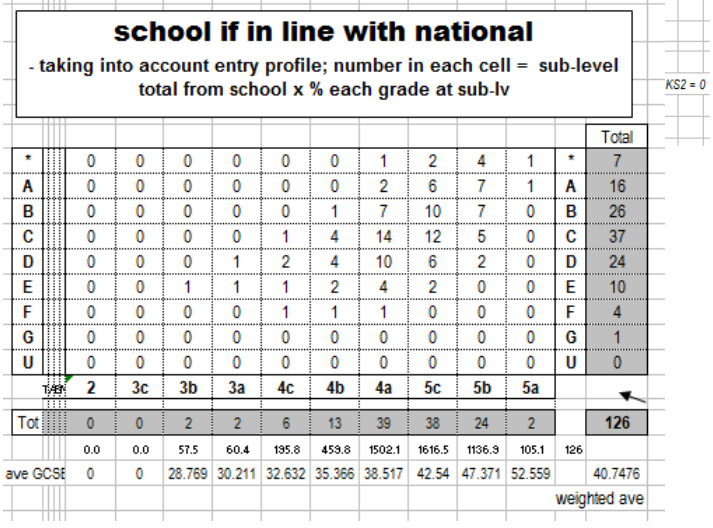
And then a difference table can be created.



On the right / below are the numbers of pupils (from an **example school**) in the same subject (totalling 205 pupils). So for example, of the 38 pupils in that school with a KS2 sub-level of 5c, 2 gained A*, 9 A, 8 B, 7 C, 11 D, 1E.

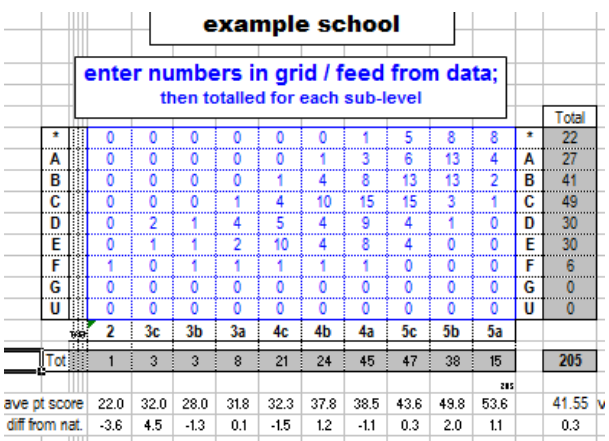


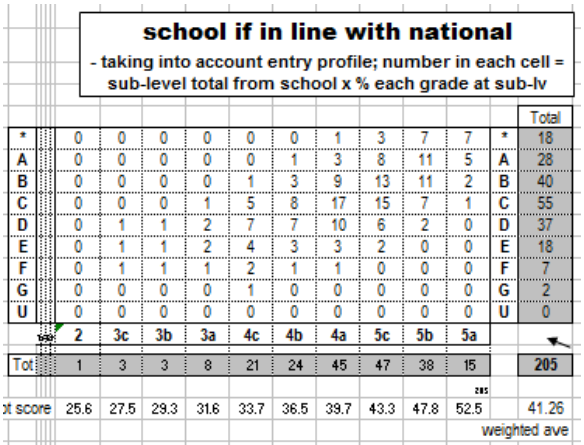
We then need to calculate what the school distribution would look like if it were in line with the national distribution FOR EACH SUB-LEVEL, so we use the percentage national distribution for each sub-level and the actual number in each school with each KS2 sub-level. For example, at sub-level 5c, 6% of 38 (= 2) would gain A*, 15% of 47 (= 6) would gain A, etc



How do we make the comparisons?

For this explanation, I'll use some examples from a different subject with 205 pupils





We can then make comparisons:

You can then see that this school had:
- a similar average score,
- had more A*, but fewer A than national (but A+A* same),
- the median was almost the same
- had fewer D , but more E than national (but D+E same)

												Total
*	0	0	0	0	0	0	0	2	1	1	*	4
A	0	0	0	0	0	0	0	-2	2	-1	A	-1
B	0	0	0	0	0	1	-1	0	2	0	B	1
C	0	0	0	0	-1	2	-2	0	-4	0	C	-5
D	0	1	0	2	-2	-3	-1	-2	-1	0	D	-7
E	0	0	0	0	6	1	5	2	0	0	E	12
F	1	-1	0	0	-1	0	0	0	0	0	F	-1
G	0	0	0	0	-1	0	0	0	0	0	G	-2
U	0	0	0	0	0	0	0	0	0	0	U	0
	2	3c	3b	3a	4c	4b	4a	5c	5b	5a		
Tot	0	0	0	0	0	0	0	0	0	0		0
pt score	-3.6	4.5	-1.3	0.1	-1.5	1.2	-1.1	0.3	2.0	1.1		0.29

On the right is the difference between the school's actual figures and the school's figures if in line with the national profile of reach sub-level

In this example the school had more A*, but fewer A than national (but A+A* same), which would be regarded as "good" (ie some A grade pupils had gained A*), but just looking at the numbers for the difference, there is a +2 for A* and -2 for A

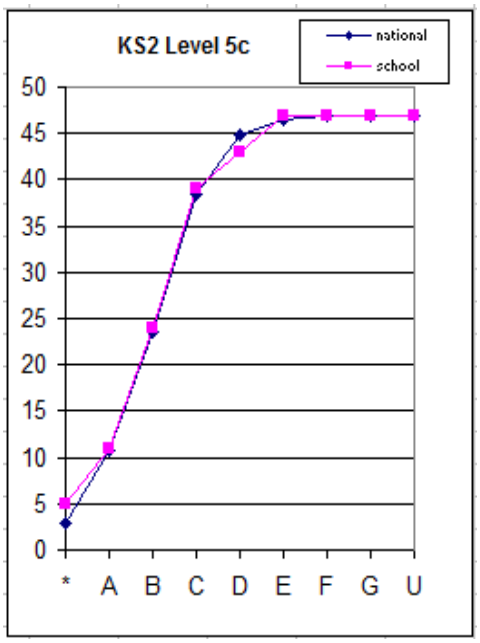
Similarly, the school had fewer D , but more E than national (but D+E same), which would be regarded as "not good" (ie some D grade pupils had slipped to grade E), but just looking at the numbers for the difference, there is a -2 for D and +2 for E

The situation is more easily interpreted by considering the cumulative number starting from the top (i.e. A* grades). In this example

diff. nat-school; +ve = "good"

c FOR EACH INPUT sub-level, CUMULATIVE numbers getting AT LEAST... GCSE

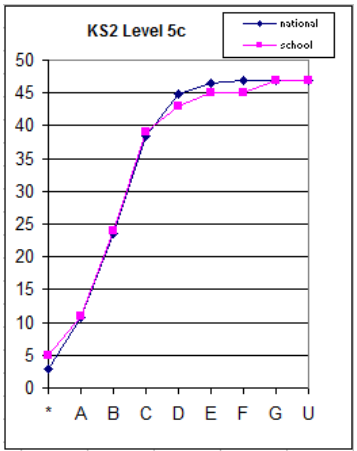
												Total
*	0	0	0	0	0	0	0	2	1	1	*	0
A	0	0	0	0	0	0	0	0	3	1	A	4
B	0	0	0	0	-1	1	-1	0	6	0	B	3
C	0	0	-1	-1	-2	3	-3	0	2	0	C	4
D	0	1	0	1	-4	0	-4	-2	1	0	D	-1
E	0	1	0	1	2	0	0	0	0	0	E	-8
F	0	0	0	0	1	0	0	0	0	0	F	4
G	0	0	0	0	0	0	0	0	0	0	G	3
U	0	0	0	0	0	0	0	0	0	0	U	0
	2	3c	3b	3a	4c	4b	4a	5c	5b	5a		9
	-1	2	-1	0	-5	5	-9	2	12	3	9	205



So **cumulatively,** school 5 for A*, national 3, so cumul diff = +2, so green (good) colour. But then **cumulatively,** school 11 for A* & A, national 11, so cumul diff = 0, ie school back in line with national. The school stays in line with national until **cumulatively** school 43 for A*-D, national 45, so cumul diff = -2 so blue (= bad) colour. But then **cumulatively** school 47 for A*-E, national 47, so cumul diff = 0, ie school back in line with national.

We can sum these to get a quantitative measure of the difference between the school's distribution and the national

How do the figures / diagrams vary if a pupil slips from a) D to E (as above) or b) D to G (i.e. a bigger drop)



												Total
*	0	0	0	0	0	0	1	5	8	8	*	22
A	0	0	0	0	0	1	3	6	13	4	A	27
B	0	0	0	0	1	4	8	13	13	2	B	41
C	0	0	0	1	4	10	15	15	3	1	C	49
D	0	2	1	4	5	4	9	4	1	0	D	30
E	0	1	1	2	10	4	8	2	0	0	E	28
F	1	0	1	1	1	1	1	0	0	0	F	6
G	0	0	0	0	0	0	0	2	0	0	G	2
U	0	0	0	0	0	0	0	0	0	0	U	0
	2	3c	3b	3a	4c	4b	4a	5c	5b	5a		
Tot	1	3	3	8	21	24	45	47	38	15		205
pt score	22.0	32.0	28.0	31.8	32.3	37.8	38.5	43.1	49.8	53.6		41.43
from nat.	-3.6	4.5	-1.3	0.1	-1.5	1.2	-1.1	-0.2	2.0	1.1		0.2

2 pupils have a grade G and 2 with grade D in comparison with the national expectation of 4 getting grade D and none below

diff. nat-school; +ve = "good"

FOR EACH INPUT sub-level, CUMULATIVE numbers getting AT LEAST... GCSE

												Total
*	0	0	0	0	0	0	0	2	1	1	*	0
A	0	0	0	0	0	0	0	0	3	1	A	4
B	0	0	0	0	-1	1	-1	0	6	0	B	3
C	0	0	-1	-1	-2	3	-3	0	2	0	C	4
D	0	1	0	1	-4	0	-4	-2	1	0	D	-1
E	0	1	0	1	2	0	0	-2	0	0	E	-8
F	0	0	0	0	1	0	0	-2	0	0	F	2
G	0	0	0	0	0	0	0	0	0	0	G	1
U	0	0	0	0	0	0	0	0	0	0	U	0
	2	3c	3b	3a	4c	4b	4a	5c	5b	5a		5
	-1	2	-1	0	-5	5	-9	-2	12	3	5	205

You can see how the impact is shown, with the gap extending across grades D to F. The quantitative measure has also been affected, dropping from 9 to 5 (because 2 pupils have dropped 2 more grades)

Extending this idea to get a graphical representation needs rescaling so that we are dealing with absolute numbers, and then having a series of "snakes of different heights" to show the extent of the over / under- achievement. There are a variety of ways in which the information can be displayed graphically. Even in the example grid above, one simple variation would be to have say dark blue and dark green representing greater variation from zero and light blue and light green representing less variation…….

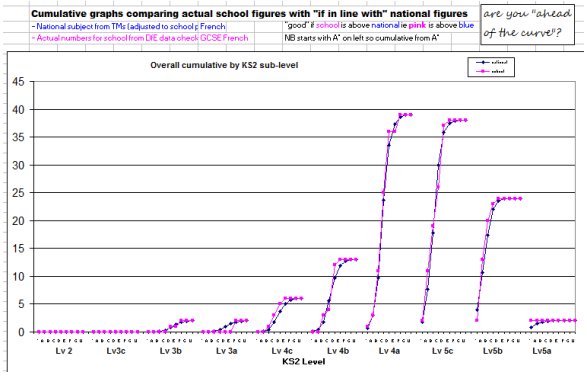
Why do are the cumulative graphs used?

The key reason is that the cumulative graph enables you to see easily how many grades a pupil has dropped i.e. to distinguish clearly between the two situations above a) D to E and b) D to G. The cumulative graph has blue in column "level 5c" for grades D and E and F in the latter, whereas just comparing the number of grades would give -2 for D, 0 for E and F, and +2 for G.

Consult the "worked example" section to go through by yourself to gain a clear understanding.

Interpreting the graphs

The sections above describe how to interpret the "snake graphs". On the right here, the graphs for each of the sub-levels is brought together in a single diagram which as the advantage of showing the relative size of the numbers in each sub-level against a common axis. So, in this example, you can see that sub-levels 4a and 5c have the greatest number involved



The graphs below all show the overall information in several different ways. The grid in the left gives a high level of detail, showing for example, strengths for more able and less able grade outcomes, with a dip at grade C. The strength at grade B is clearly seen in the overall "snake diagram". And the bar chart on the right, with its colour shading highlighting the difference between +ve and –ve by sub-level, you can see the drop at sub-level 3a, albeit for 3 pupils.

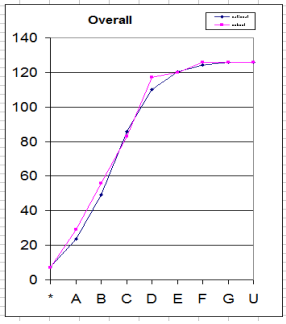
cumulative from A*; +ve = "good", -ve = under

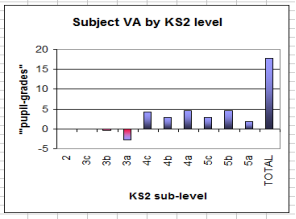
N.B. these are calculated numbers (i.e. "2" maybe 1.5) and so may not appear to add exactly to total in r-h

FOR EACH INPUT sub-level, CUMULATIVE numbers getting AT LEAST... GCSE grade

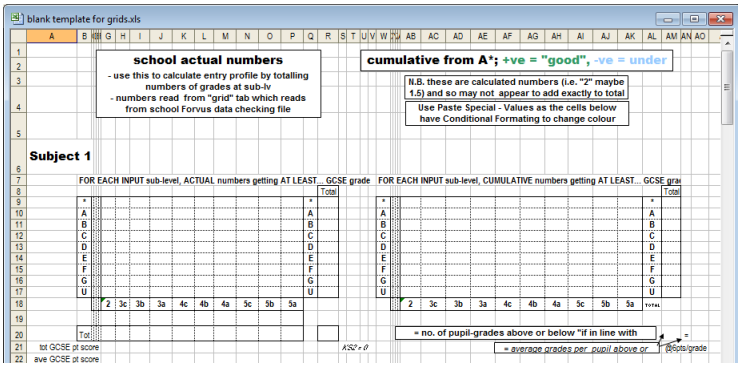
												Total
*	0	0	0	0	0	0	0	0	-2	1	*	0
A	0	0	0	0	0	0	0	3	2	0	A	5
B	0	0	0	0	1	1	1	1	3	0	B	7
C	0	0	0	0	1	-2	1	-4	1	0	C	-3
D	0	0	0	-1	1	2	2	1	0	0	D	7
E	0	0	0	-1	1	1	-1	1	0	0	E	0
F	0	0	0	0	0	0	0	0	0	0	F	2
G	0	0	0	0	0	0	0	0	0	0	G	0
U	0	0	0	0	0	0	0	0	0	0	U	0
	2	3c	3b	3a	4c	4b	4a	5c	5b	5a	TOTAL	18
	0	0	0	-3	4	3	5	3	5	2	18	126

= no. of pupil-grades above or below "if in line with national" 14% = 0.9 @6pts/grade





Using the supplied blank template



In order to assist in compiling an overview for all the main subjects in a school, a blank template is included to make it easy to cop-and-paste the grids for each subject from the master spreadsheet to a recording sheet.

The most informative grids are the "cumulative difference" and the "school actual". In the main spreadsheet, select the relevant grid starting at the top-left with the * cell – Copy, and then Paste Special – Values into the blank template. Because there is Conditional Formatting already embedded within the cells in the template, the colours will appear if the cell values are +ve or –ve.

Worked example

Make a safety copy of the supplied test data file!!
Make sure that French is selected in the National Transition Matrices
On the overall cumulative graph "French" and "GCSE French" should be displayed in blue and pink.
Position the windows so that you can see the overall cumulative Grid and the combined cumulative snake graph, and the test pupil data.
In the test pupil data, look at column BD – French.
Change row 4 from C to D; nothing changes! Why? well scrolling left to col V, X etc you see that these pupils do not have a KS2 score, and so are not included in the VA calculation (as was with CVA)
Look at row 12; change from D to C and look both on the Grid and the snake plots at Level 3b. The cell for grade C goes green with a 1, and the pink snake rises above the blue snake. Now increase the grade progressively to B, A. This makes it clear why the cumulative figures are used because you get an immediate picture of the increasing difference. Then go to row 14 and increase the progressively (it is also Level 3b).
During this, with each increase of grade, the overall figure in the bottom right of the grid (originally 18) is increasing in steps of 1, as there is a 1 grade increase.
Close the data file and the other files WITHOUT saving your changes

How to analyse the information

It is vital to stress that the great strength of the grids is that they show an overall picture to show the detail which can get lost in the "average". However, averages are useful indicators, but the crucial skill is learning how to use, compare and contrast the different averages. In practice, you should find that there is an underlying consistency, and indeed, if there isn't, then that in itself is important. When comparing with RAISE, there are usually small differences, as there are many different ways of deciding who exactly to include / exclude in the calculation.

Tot	Overall			
	no KS2	Tot	%	cum.%
19	0	19	10%	10%
17	1	18	9%	19%
51	2	53	27%	45%
86	2	88	44%	89%
11	1	12	6%	95%
9	0	9	5%	100%
0	0	0	0%	100%
1	0	1	1%	100%
0	0	0	0%	100%
194		200	100%	
+	6	no KS2		
	200			
	Overall school ave			
43.37		43.36		ave

Averages (see Front Panel on spreadsheet and Overview on p.2-3)

On the r-h side of the **"school actual"** are the "without KS2" figures (for which VA is not possible), and the cumulative grade percentages, and also

the average point score (incl and excl no KS2), to enable comparison with RAISE (see right).

At the foot of the **"school actual"** grid are the average point scores for each KS2 sub-level, which can be compared with the national average for each KS2 sub-level.

	2	3c	3b	3a	4c	4b	4a	5c	5b	5a	194		200
mid-pt	15	19	21	23	25	27	29	31	33	35	+	6	no KS2
Tot.	1	3	3	9	9	28	54	55	30	2		200	
					KS2 sub-level					194		Overall school	
score	28.0	30.0	34.0	30.7	39.3	41.9	42.6	43.9	52.0	58.0	43.37		43.36

The difference between the two (school actual v school "if in line") is given at the foot of the top r-h graph on the Front Panel. Note that the **difference** grid MUST sum to zero for each sub-level, and overall.

	2	3c	3b	3a	4c	4b	4a	5c	5b	5a		0.0	
	these totals should each be ZERO as checksum									0	0		actual sch ave
Tot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	nat ave	if in line	43.37
nat ave.	25.6	28.0	30.2	32.6	35.6	38.3	41.5	45.2	48.5	53.9	40.46	42.33	average
ave diff in pt score	2.4	2.0	3.8	-2.2	3.8	3.6	1.0	-1.3	2.5	4.1	2.91	1.04	diff with actual

The national average is given for the subject (which should relate to the figure in RAISE), but as most schools differ significantly from the national average, a more useful figure is the average"if in line", as that takes account of the ability profile.

Another way of considering the subject profile for each school is to look at the KS2 scores of those doing the subject.

KS2 profile for pupils taking subject

std error of mean (s.e.) = school s.d. / √ n

	2	3c	3b	3a	4c	4b	4a	5c	5b	5a	ave	s.d.	sch n	s.e	diff as no. s.e.
sch	1%	2%	2%	5%	5%	14%	28%	28%	15%	1%	29.14	3.24	194	0.23	5.4
nat	2%	2%	4%	7%	12%	18%	21%	20%	13%	2%	27.88	4.09	194	0.29	4.3
diff	-1%	-1%	-3%	-3%	-7%	-3%	7%	8%	3%	-1%	1.27				= diff / std. error

Another useful average comes from looking at the Cumulative Difference Grid, although again, it must be stressed that the real value of this is tho look at the grid itself.

In the example supplied within the spreadsheet, it is clear from the grade average, the this subject in this school has done well for A* and C, but there is a dip in between for A and B grade students.

This would immediately pose the question as to whether the school was concentrating on getting C grades at the expense of B and A grades.

There is also an overall figure (here 33) which represents the overall number of pupil-grades above or below "if in line", and this can be divided by the number of pupils to get the overall average. Given that 6 points = 1 GCSE grade, multiplying by 6 gives the overall average in terms of points. An interesting exercise for a school is to plot these figures against those in the Relative Performance Indicator (Table 4.1.15) in RAISE Summary Rpt. Informal indications are that there can be a good correlation. However, it is important to remember that the RPI is RELATIVE within the school and therefore must average to 0, whereas

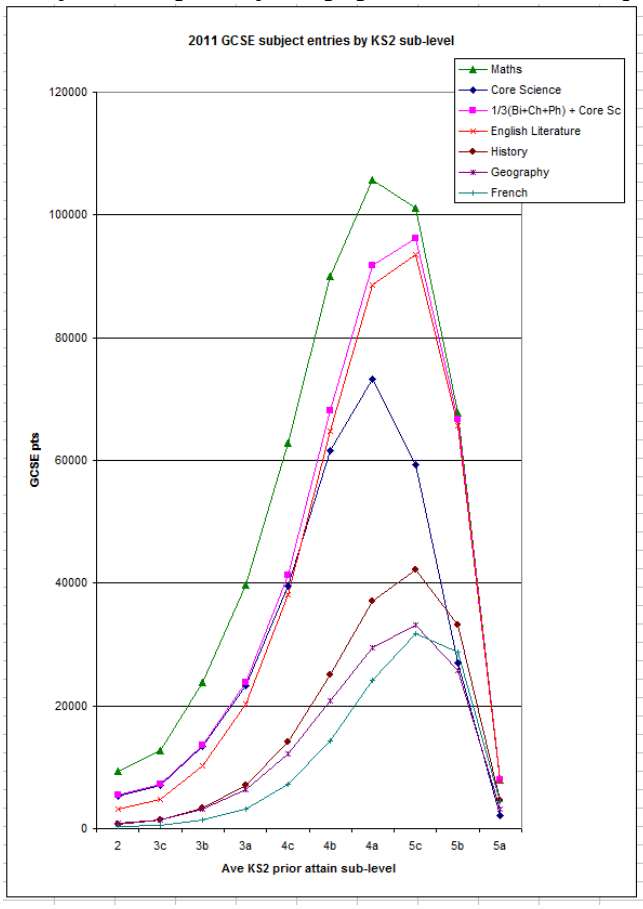
SE grade	Total
*	11
A	-2
B	-5
C	20
D	4
E	4
F	0
G	1
U	0
TOTAL	33
33	
= 194	0.17

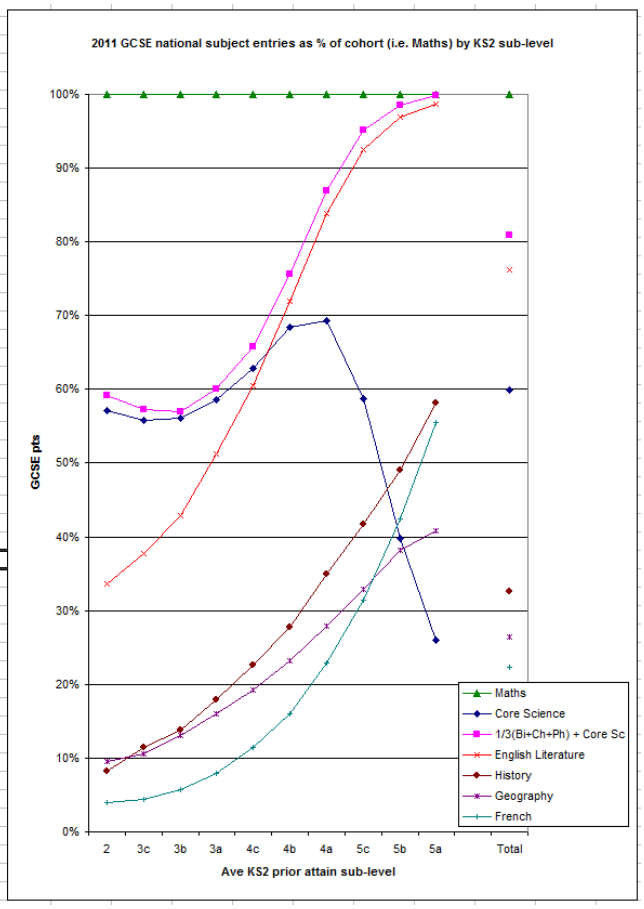
the Subject TM figures are relative to national, and so overall can be positive, negative etc depending on the performance of the school.

2	3c	3b	3a	4c	4b	4a	5c	5b	5a	TOTAL	33	national"
0	1	2	-3	6	17	9	-12	12	1	33		
									number of pupils =	194	0.17	= 1.0 pts
									= average grades per pupil above or below			@6pts/grade

National entry patterns

One of the other important factors to bear in mind is whether the entry pattern in a subject at a school is comparable with the national pattern. Care needs to be taken in ensuring that "like is compared with like", for example, is the subject an option subject at many schools whereas it may be compulsory for pupils at the school in question. This then leads to what can be described





as "mid-term filtering", ie on eis using KS2 as the input to the VA, and yet a decision is made on performance (usually at end of KS3) as to the likely final grade. For example, those likely to get below a C grade (irrespective of their initial KS2 score) may be directed to / may choose another route / qualification.

The graphs above illustrate this for the main subjects. The l-h one gives the number of pupils nationally for each subject in the June 12 National TMs for each of the starting KS2 sub-levels. As you can see clearly, there are varying numbers for each KS2 sub-level

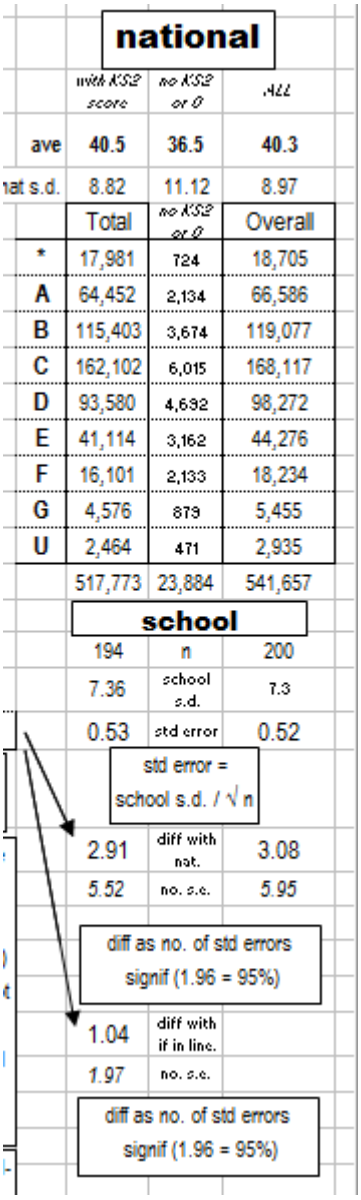
To help with interpreting the figures, the r-h graph, then gives the % for each subject relative to Maths (as a proxy for the number for each KS2 sub-level sitting exams at the end of KS4). They show clearly that for those pupils with KS2 Level 5, nearly all of them also do English

Literature, and either Core Science or Triple Science, but then the numbers fall away at Level 4 as pupisl are entered for BTEC Science etc. The most dramatic drop is in French.

Significance and other estimates

Please read the document "Understanding significance and confidence intervals in RAISEonline.doc" downloadable from the same page on the ASCL website as the other Subject TM and RAISE files. This gives an explanation of how significance operates for attainment scores (as in RAISE) rather than modelled VA.

For each subject, the national average (with and without those with no KS2 score) and national (population) standard deviation are calculated. The figures on the right are for English (GCSE English + English Language). So for those with KS2 score (who are the ones featuring in the Subject TMs), ave = 40.46 (40.5) and std dev = 8.82.



0		actual sch ave
nat ave	if in line	43.37
40.46	42.33	average
2.91	1.04	diff with actual

The school actual average is 43.37, so difference with national = 43.37 – 40.46 = 2.91

The school average if in line with national (taking into account the subject KS2 profile for the school's is 42.33, so difference with school actual = 43.37 – 42.33 = 1.04
1.96 * 0.53
So std error (std dev of mean) = 7.36 / √194= 0.53. This would be used in RAISE (± 1.96 s.e. = ± 1.96 x 0.53 = ±1.04) to determine if school English was significantly different from national. In other words, does the school mean lie between 40.46-1.04 and 40.46 + 1.04, i.e. between 39.42 and 41.5 – this is called the "confidence interval". In this case, the school average is 43.37, ie outside the confidence interval and so the school would be "sig+" in RAISE with a green box!

However, this method inherently favours schools with a higher KS2 profile taking subjects, and so a "better" method which gives a value-added approach, is to look at the difference between the school actual and the school "if in line", as this takes into account the KS2 profile. In other words, does the school mean (43.37) lie between 42.33-1.04 and 42.33 + 1.04, i.e. between 41.29 and 43.37 – in this case it does (just), so it would not be significant

N.B. there is a question as to whether the school or national std. dev. should be used for this calculation, but currently it is the school one.

The "cumulative difference" grid itself

What about the "cumulative difference" grid itself? There is an Expected value for each cell (school "if in line" with national), and an Observed value for each cell (school actual). We can then treat this as a "non-parametric" distribution i.e. we are not doing modelled VA etc where there is an equation based on a parameter (KS2 score). It is then possible to apply **Pearson's chi-squared test** (χ^2) and assess significance. Although some arbitrary assumptions have been made in the spreadsheet (e.g. cells with Expected <2 not included, and Yates' correction not

applied – see http://en.wikipedia.org/wiki/Pearson's_chi-squared_test for more information), in practice, the test and values have been helpful and usually not inconsistent with the other test and statistics.

goodness of fit test = $\sum (O - E)^2 / E$ and then tested against **chi-squared** with 9-1 degrees of freedom, excl if E<"min value" (as test loses accuracy with small E). This looks at school actual v "if in line" - slightly diff from cumulative

min value		2	3c	3b	3a	4c	4b	4a	5c	5b	5a	Totals	Every cell
2	$\sum (O - E)^2 / E$	0	0	0	6.5	0.5	10.1	13	31.7	11.1	0	44.8	73
	no. cells in calc	0	0	0	3	2	3	4	4	4	0	7	20
test statistic (signif if <0.05)		-	-	-	0.039	0.478	0.007	0.005	0.000	0.011	-	0.000	0.000

colour orange if signif different from expected pattern (in any direction)

As an example, look at the two columns for KS2 sub-level 3a and 4c.
Just looking at the numbers, we can see that there is a closer fit for 4c (which is not signif), than 3a (which is - just)

By each KS2 sub-level

By totals for each GCSE grade

By each cell in the grid

	actual		If in line	
*	0	0	0	0
A	0	0	0	0
B	1	3	0	1
C	1	3	2	3
D	1	2	3	3
E	5	1	2	1
F	0	0	1	0
G	1	0	0	0
U	0	0	0	0
	3a	4c	3a	4c
	23	25	9	9
	9	9		

As well as applying the calculation to each cell in the whole grid, it is possible to apply it to each KS2 sub-level. Do note that the test is simply establishing whether the Observed values are consistent with the Expected. It does not judge the direction, and so the significance colour is orange so as not to confuse with the green / blue from RAISE which have an associated direction ("good" / "under")

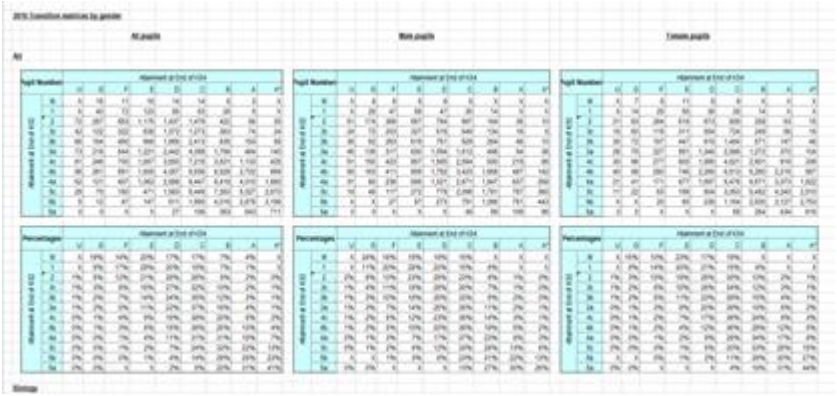
National Transition Matrices - location???

If you wish to obtain the original National TMs or previous years
Go to the R??.

Then select "Transition Matrices" and download the "Transition Matrices for Key Stage 2 to 4" – you do not need to be logged in for this

This is regularly updated with the TMs as they become available, including for example, by disadvantaged.

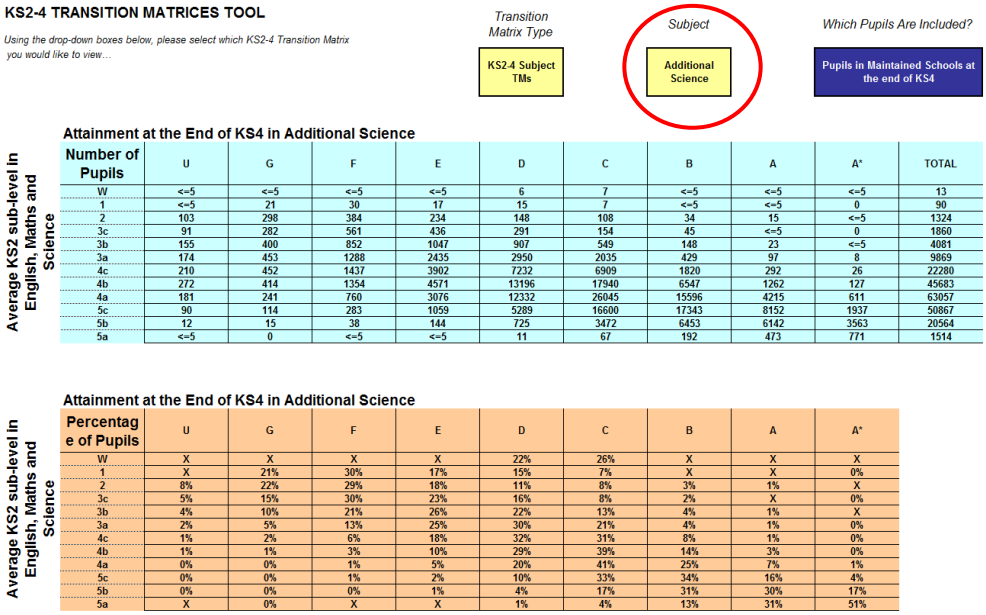
The 2016 by gender ones are in a long series with the top set of grids for each subject giving the numbers



and the second set of grids the percentages gaining each GCSE grade from a given starting KS2 point

In previous years (2015 and before, there are drop-down boxes) - see below right

The two yellow boxes are drop-down boxes – clicking in them displays the range of options. Check that the first is set as above, and then click in the Subject box and select the subject of interest. It is this sheet which is used by the Subject VA spreadsheet as a source for the national subject data, so the correct subject must be selected here. NB for English and Maths Level of Progress information, you need to select English or Maths TMs in the first drop-down box instead of "KS2-4 Subject TMs"



KS2-4 TRANSITION MATRICES TOOL

Using the drop-down boxes below, please select which KS2-4 Transition Matrix you would like to view…

Transition Matrix Type: KS2-4 Subject TMs

Subject: Additional Science

Which Pupils Are Included?: Pupils in Maintained Schools at the end of KS4

Attainment at the End of KS4 in Additional Science

Average KS2 sub-level in English, Maths and Science

Number of Pupils	U	G	F	E	D	C	B	A	A*	TOTAL
W	<=5	<=5	<=5	<=5	6	7	<=5	<=5	<=5	13
1	<=5	21	30	17	15	7	<=5	<=5	0	90
2	103	298	384	234	148	108	34	15	<=5	1324
3c	91	282	561	436	291	154	45	<=5	0	1860
3b	155	400	852	1047	907	549	148	23	<=5	4081
3a	174	453	1288	2435	2950	2035	429	97	8	9869
4c	210	452	1437	3902	7232	6909	1820	292	26	22280
4b	272	414	1354	4571	13196	17940	6547	1262	127	45683
4a	181	241	760	3076	12332	26045	15596	4215	611	63057
5c	90	114	283	1059	5289	16600	17343	8152	1937	50867
5b	12	15	38	144	725	3472	6453	6142	3563	20564
5a	<=5	0	<=5	<=5	11	67	192	473	771	1514

Attainment at the End of KS4 in Additional Science

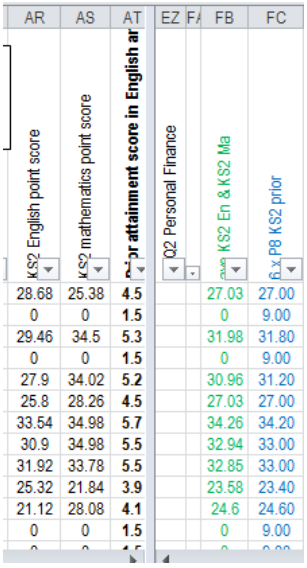
Average KS2 sub-level in English, Maths and Science

Percentage of Pupils	U	G	F	E	D	C	B	A	A*
W	X	X	X	X	22%	26%	X	X	X
1	X	21%	30%	17%	15%	7%	X	X	0%
2	8%	22%	29%	18%	11%	8%	3%	1%	X
3c	5%	15%	30%	23%	16%	8%	2%	X	0%
3b	4%	10%	21%	26%	22%	13%	4%	1%	X
3a	2%	5%	13%	25%	30%	21%	4%	1%	0%
4c	1%	2%	6%	18%	32%	31%	8%	1%	0%
4b	1%	1%	3%	10%	29%	39%	14%	3%	0%
4a	0%	0%	1%	5%	20%	41%	25%	7%	1%
5c	0%	0%	1%	2%	10%	33%	34%	16%	4%
5b	0%	0%	0%	1%	4%	17%	31%	30%	17%
5a	X	0%	X	X	1%	4%	13%	31%	51%

KS2 prior attainment

Progress 8 KS2 prior attainment

In the sample data supplied with the spreadsheet, two columns have been added at the right-hand end to show the difference between the Progress 8 KS2 calculation and the fine score used for TMs. It is not that one is right / wrong, but there might be a few apparent discrepancies, and it si as well to be aware.



AR	AS	AT	EZ	FA	FB	FC
KS2 English point score	KS2 mathematics point score	Prior attainment score in English and Maths	Q2 Personal Finance		KS2 En & KS2 Ma	Δ x P8 KS2 prior
28.68	25.38	4.5			27.03	27.00
0	0	1.5			0	9.00
29.46	34.5	5.3			31.98	31.80
0	0	1.5			0	9.00
27.9	34.02	5.2			30.96	31.20
25.8	28.26	4.5			27.03	27.00
33.54	34.98	5.7			34.26	34.20
30.9	34.98	5.5			32.94	33.00
31.92	33.78	5.5			32.85	33.00
25.32	21.84	3.9			23.58	23.40
21.12	28.08	4.1			24.6	24.60
0	0	1.5			0	9.00

See below for a longer discussion and graphs on the differences and how it links to sub-levels

2015 boycott issues

Remember that for Year 11 in June 2015, they took KS2 test as Year 6 in June 2010 (En & Ma) + boycott; (Y11 Jun'14 = KS2 Jun '09) (En, Ma & Sc)

The KS2 prior attainment for a pupil is calculated using fine scores from Eng & Ma tests (detailed rules apply if test not taken for any reason) and then converted to a Level, and a Band of Prior Attainment (as used in the Performance Tables and RAISE)

- **"Low"** = below Level 4 (ie Level 3 and below) - approx 15% nationally (so matches "lowest 20%")
- **"Mid"** = Level 4 (approx 50% nationally)
- "**High**" = above Level 4 (ie Level 5+) (approx 35% nationally)

The link between the 1 decimal place average, the fine score, sub-levels and fine scores are illustrated in the two slides on the right

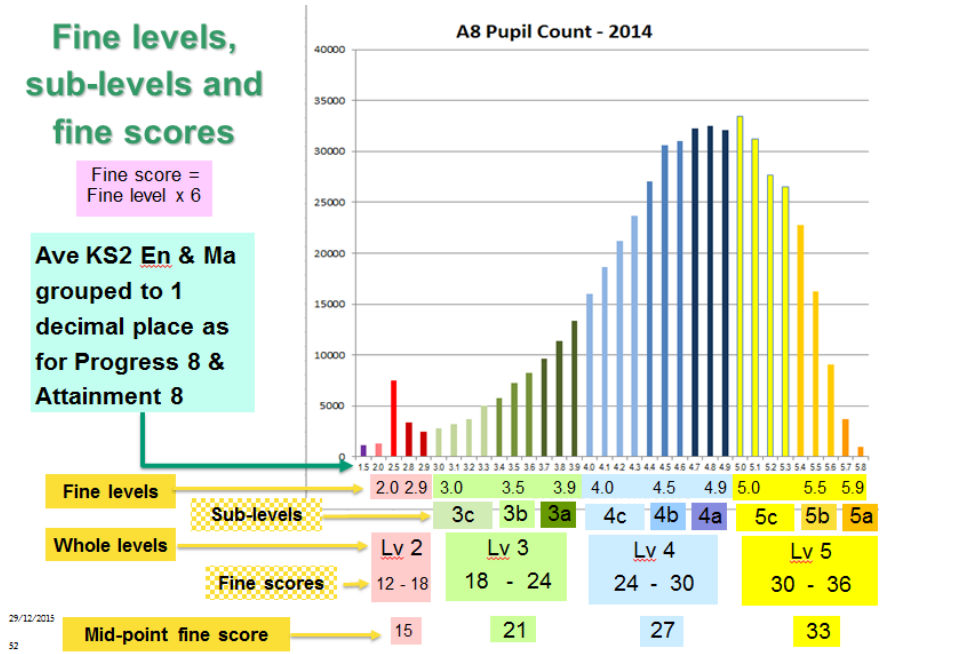
The top graph gives the numbers of pupils (say in region of 20K - 30K) in each of the 1 d.p. bands from prior attainment e.g. around 34,000 pupils had an average KS2 En & Ma fine level of 5.0 in 2014

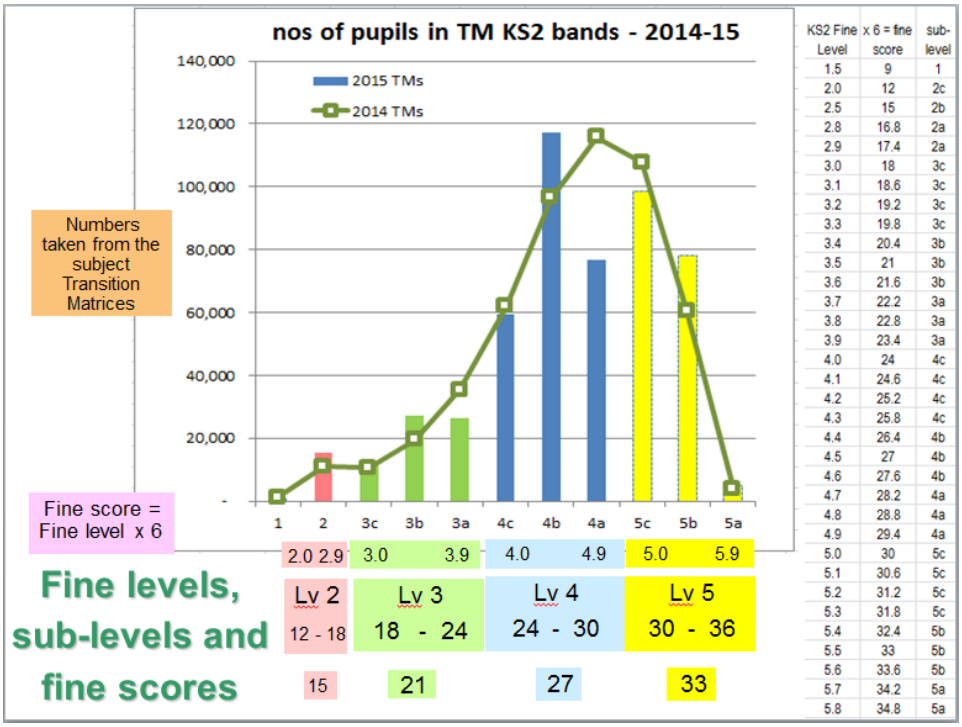
Fine score conversions given below:

Level 3 = 18-24;
mid = 21;
18-20 = 3c;
20-22 = 3b;
22-24 = 3a

Level 4 = 24-30;
mid = 27;
24-26 = 4c;
26-28 = 4b;
28-30 = 4a

Level 5 = 30-36;
mid = 33;
30-32 = 5c;
32-34 = 5b;
34-36 = 5a



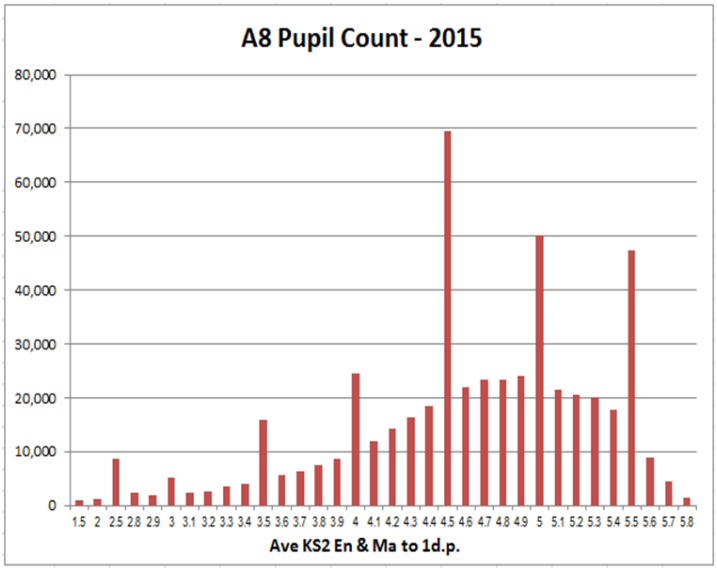


The graph to the right gives the number in each of the sub-levels. There are 3 or 4 1 decimal point bands in each sub-level and so there are around 60K - 100K pupils in each sub-level.

Impact of boycott

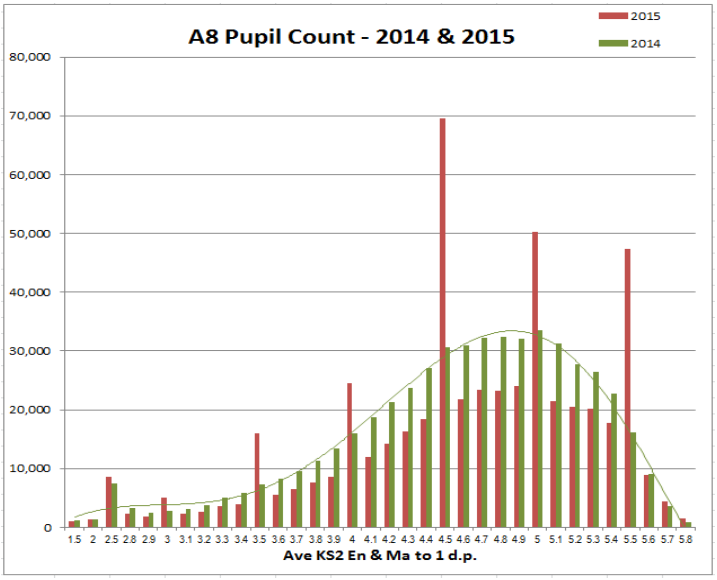
Over the years, the DfE have developed rules to use Teacher Assessments (TAs) for normally just the few % of pupils where TA used because they have not done the test for some reason.

For example, Level 5 TA = 5.5 etc so a pupil getting Level 4 in En (=4.5) & Level



5 in Ma (=5.5) gives ave of 5.0, and counts as “high” prior attainment

You can see clearly in the graph on the right the large increase at 4.5, 5.0 etc in 2015 from pupils where TA used because of boycott (25% overall)



And the contrast with the figures from 2014 (in green in graph on right). Because the overall number of pupils is virtually the same in 2014 and 2015, note decrease in values other the 4.5 etc in 2015 relative to 2014 resulting from increase at 3.5, 4.0, 4.5, 5.0 etc

In the graph on the previous page, the green line represents 2014 with the characteristic shape. You can see the distortion in the numbers in the sub-levels, with 4b (which includes 4.5), and 5c (which includes 5.0) being higher than usual, and the others being lower.

The particular problem at Level 5 is that if you look at the distribution curve, you can see that it is very skewed, and so the national average of pupils getting Level 5 is actually 5.3, not 5.5. So by arbitrarily assigning pupils who have not done the test to 5.5 instead of 5.3 you are giving them an artificially high prior attainment, or to put it another way, their average "output" is likely to be lower than a "genuine" 5.5 pupil. This is what leads to the blips on the progress 8 charts and has a distorting effect on the national transition matrices.

Disclaimer

This spreadsheet has been prepared by David Blow (Headteacher of The Ashcombe School) on behalf of the ASCL Data Group as an open, unprotected spreadsheet to assist schools in calculating and analysing subject VA data. This spreadsheet is offered in good faith but will need to be adapted for each school. No responsibility can be accepted for any errors or omissions. Copyright is retained by David Blow, but the spreadsheet may be copied and shared provided no charge is made and acknowledgement made of its source.