A MATHS CONTINUUM: VISUALISATION VERSUS NUMBER AGILITY

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This work has been done in association with Cara Hood Clymping Primary School Liela Upchurch Wickbourne Infants School and Fiona Dowley Arun Vale Infants. (No test results from Arun Vale are currently included in the work)

THE CONTINUUM

A group of 11 local Maths co-ordinators have been working together over the past two years to support each other in the management of our subject. I work as an A.S.T. (advanced skills teacher) and use my weekly release day to co-ordinate our activities. As a group we decided that there should be a maths continuum for the mental maths similar to the reading continuum.

We used the Framework to start but also fed in other ideas from other sources e.g. Adrian Pinel 10day raising achievement in numeracy training. There are five main continuum cards the one, which interests us most being the holding continuum. This is based on the principle that to develop confidence in maths you must first develop agility with number. Part of this agility is based on an ability to hold a number in your head whilst performing another operation. This ability to hold is what we are interested in trying to develop with children. It is a bit like creating parking spaces in the brain to allow numbers to be parked during mental operations. We devised activities which teachers could practice with their children at every age to help develop this agility.

Necessarily so in this process we made several assumptions and ignored several interesting questions. This abstract represents the work we are doing in trying to unpick some of those assumptions and answer some of those questions. As you will see we merely found more questions. It is hoped to conclude this work in the coming year. This does not mean that we will have found all the answers by then just that we have run out of time.

Anyone wishing to find out more about The Continuum contact rustingtonsc001@btinternet.com

The Continuum: some assumptions

Firstly that there is a positive connection between the ability to hold numbers and numerical ability. If we improve one we will improve the other. Secondly that holding is something that can be learnt and is not something which just comes

naturally.

To test these questions and to act as success criteria we decided to devise two types of test which the children could take at the beginning of the academic year and again at the end of the academic year. These two types were meant to test visualisation ability and numerical ability. All year 2 and year 5 pupils in the four schools, numbering some 250 children took the tests. These results have been put onto a grid and will give each child a position in that grid. The follow up tests will give each child a second position, which can be joined to see the progress.

The Tests

The visualisation axis was found by using the 'How Many' activity on the Calculightning discs. These are a series of dot patterns, which flash briefly on the screen, and the child then has to indicate how many there were. There is a series of these and the total time taken to complete the task gives the result in seconds. The results lay between 35 and 450 seconds. I myself can usually manage about 40 seconds.

Notes on testing.

The test was done with year2 and year5 but in addition to this I tested a small sample of reception children.

With the reception children it was noticeable how the children were split into two groups. Those that did the task quite quickly and those which could not do it. Those that were capable held their own against many of the year twos. These children used a nodding system. Whilst looking at the screen they nodded the correct amount of nods which correlated to the pattern of dots which had appeared on the screen. I conclude from this that the children were retaining a picture of the image on the screen and the physical use of their head was a way of marking each dot as being counted. One child used their finger on the screen to count the dots on the screen where they had been. Those children which were not successful some of them looked down at their fingers and were counting silently, pause then look up slightly confused as if they were trying to remember the pattern but were unsuccessful.

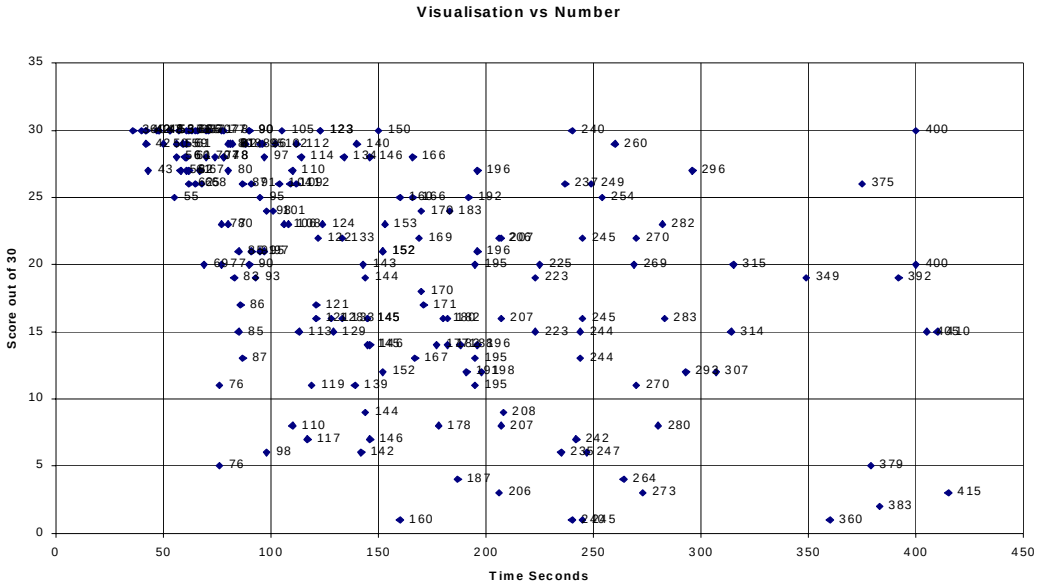
With the older children it was noticeable that the children who were successful did so partly by instant recognition of a known pattern or if there were a small enough pattern of dots then they would subitise. The patterns, which confused the children, were the ones where the dots were in a straight line. They did not seem to be able to instantly recognise the length of the line and there was not enough time to count them. I suspect some amount of estimation was occurring here.

Again the distinction between those that were successful and those who were not was mainly between those children who were retaining the image either on the screen or in their head. There were a lot more children who seemed to identify set patterns instantly the older the group of children. By set patterns I mean mostly dice

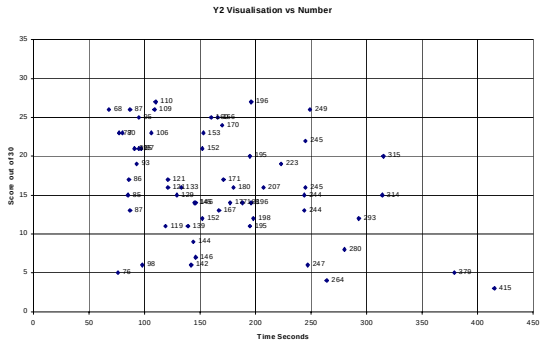
patterns. Those patterns, which were circular in nature and contained, more than 5 dots were some of the hardest to correctly recognise.

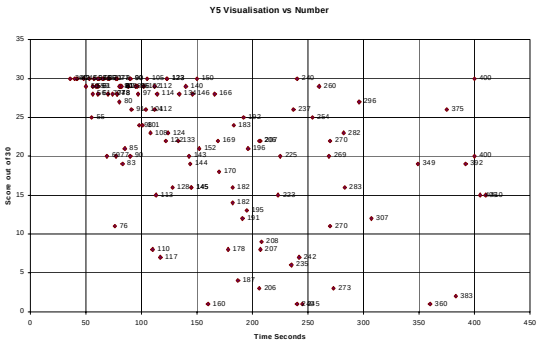
The Numerical tests were a set of 10 addition and subtraction sums presented in three different formats. Each format contained the same questions in the same order. Each test was done on a different day of the same week. The three formats were firstly number stories asked orally and the children wrote the answer. Secondly the sum was presented on an open number line and thirdly presented as a straight sum 2 + 7 =. The sums can be seen in the tables that follow.

The Results

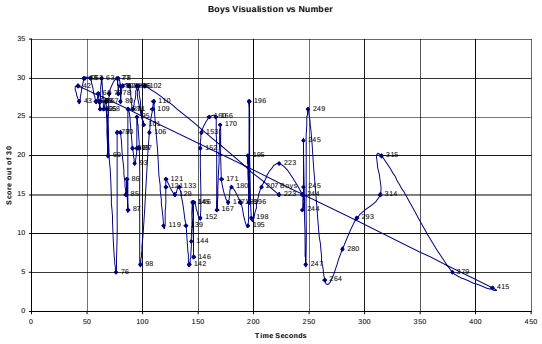


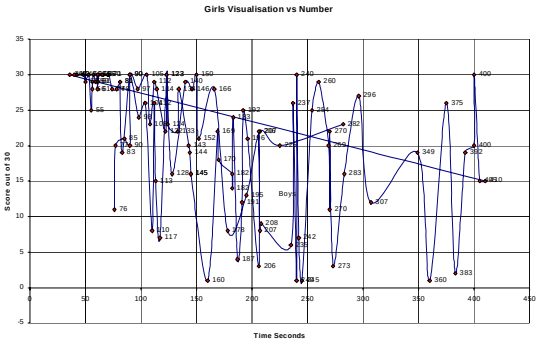
These are all the results from all children. This indicates that there is a cone of development starting off quite wide but narrowing to the top left where children have scored well in both tests.





Apart from the shift towards the point of the cone from year 2 to year 5 it also seems that the younger children have done relatively better in the visualisation test. Neither group had any prior practice with the test format so this might suggest that the younger child uses the visualisation more as a part of their learning development and discards it later as their numerical knowledge develops. This may refer to James Askew's debate surrounding known facts.





Boys Girls

We did look at differences between girls and boys but there were no significant differences except in the average visual score. It seems to indicate that boys are reaching the cones point from a more visual approach and the girls from a more numerical approach. This would not surprise the average teacher as it is generally excepted that boys have a better spatial awareness than girls do. However this may indicate a better approach to take with boys who are struggling. It must also be noted that boys may be just more motivated to use a computer rather than pencil and paper. We hope to test this further this year.

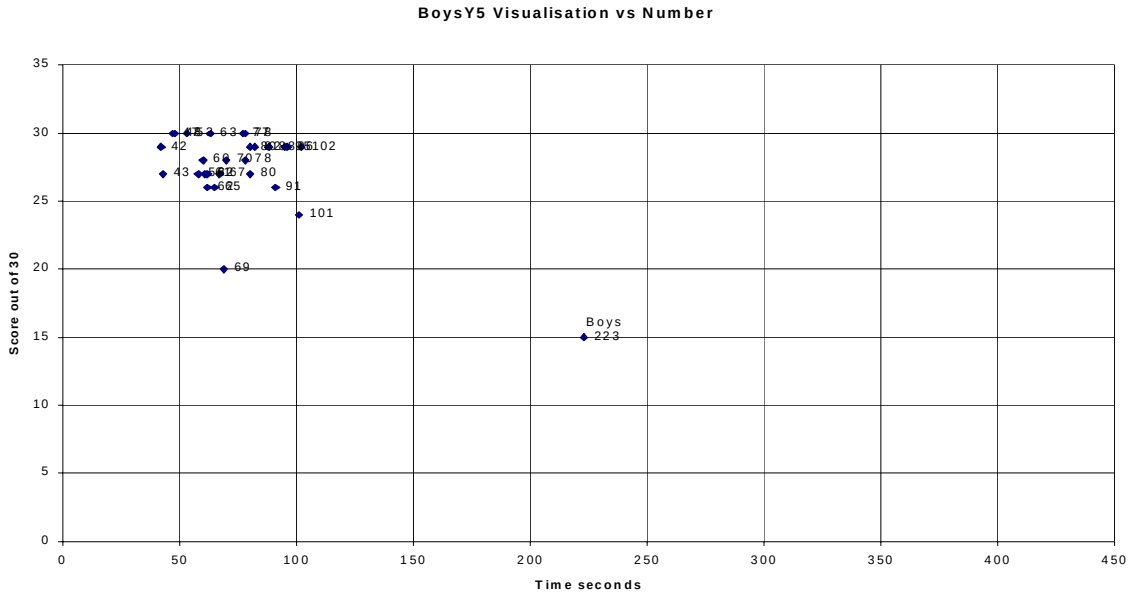
The main objective is to now focus our resources on the outliers. These are the children who fall into the top right bottom left and bottom right corners of the graph. In other words those children that are either poor at number but good at visualisation or good at number and poor at visualisation. What will the affect of our continuum be on these two groups? Also those children that are poor at both will visualisation skills help them to develop quicker than others around them.

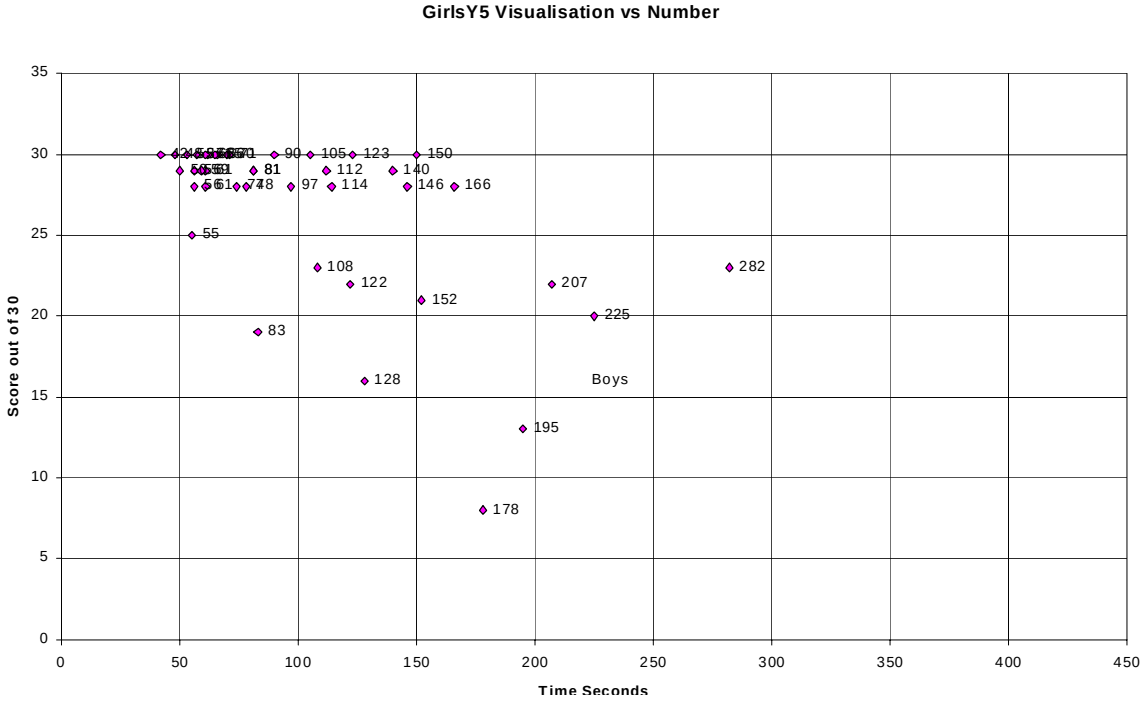
When we looked more closely at the outliers we realised that the outliers who are good at visualisation and poor at number are mostly boys and those that are good at number but poor visualises are mostly girls.

Is this a genuine result or does the format of the test effect the results?

In looking at the results other issues which we had not anticipated became clear. In looking at year 5 girls and boys it seems that the girls are capable of reaching a good score on the number without a good score on the visual. The boys on the other hand do both. The children that fall behind in the number scores are greater with the girls. They also score poorly in the visual test. Would extra work on the

visualisation help these girls to develop their number skills more quickly?





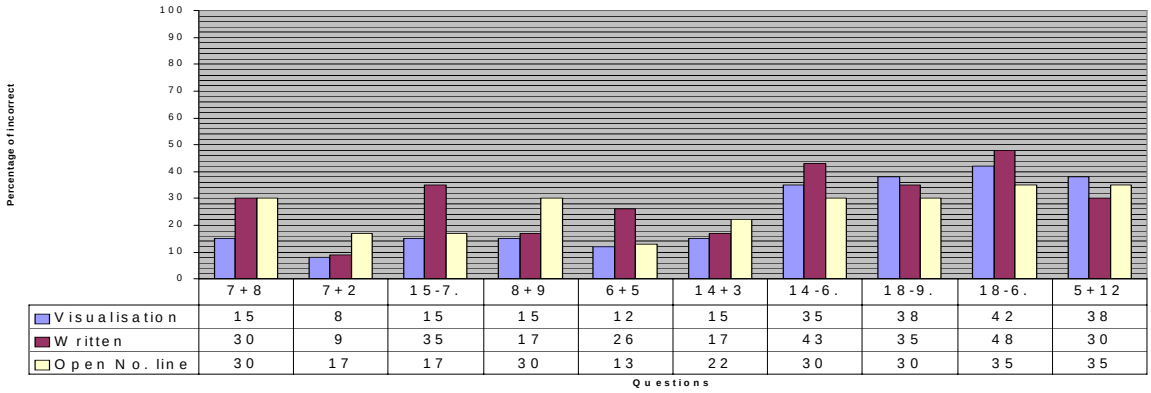
Format

In this section I am looking at the differences between the schools differences between year groups and differences between formats of questions. In looking at the year groups it was clear that the development of number is as anticipated a step up by year five.

In looking at the differences in schools it was clear that the intake of the school was the biggest factor in the differences. Rustington had the best results with

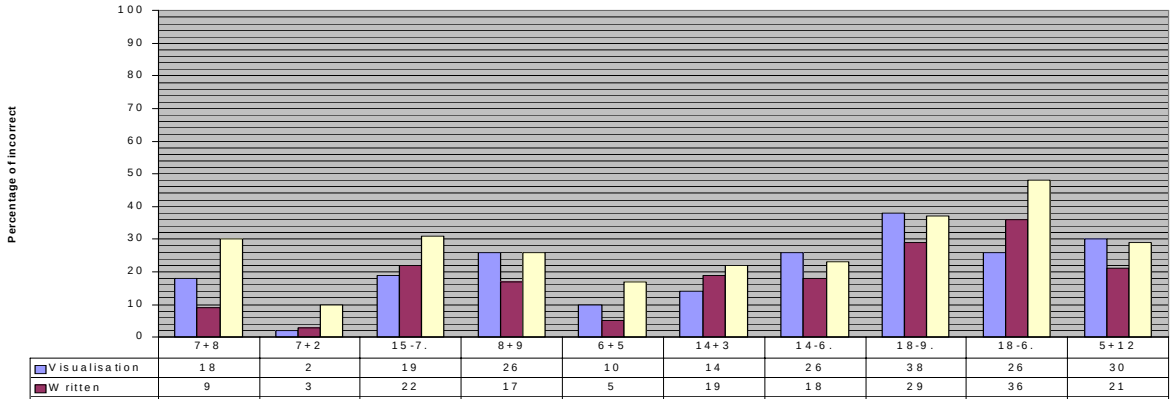
Clymping closely behind and Wickbourne some distance behind. This can be explained by looking at the percentage of children on the stage 2 of S.E.N.

Number of incorrect answers Clymping



	7+8	7+2	15-7.	8+9	6+5	14+3	14-6.	18-9.	18-6.	5+12
Visualisation	15	8	15	15	12	15	35	38	42	38
Written	30	9	35	17	26	17	43	35	48	30
Open No. line	30	17	17	30	13	22	30	30	35	35

Number of incorrect answers Rustington



	7+8	7+2	15-7.	8+9	6+5	14+3	14-6.	18-9.	18-6.	5+12
Visualisation	18	2	19	26	10	14	26	38	26	30
Written	9	3	22	17	5	19	18	29	36	21
Open No. line	30	10	31	26	17	22	23	37	48	29

Rustington=6% Clymping=8% Wickbourne=31%

It can be seen from this that Clymping children have performed better at the open number line than the oral test but the reverse is true in Rustington. This I am sure is not down to the children but the preferred style of the school and the emphasis the maths co-ordinators have had on their schools.

Again many interesting points have come out such as the fact that 18-6 caused more errors than 16-8 which is odd because crossing the tens barrier is supposed to be harder. Why is this?

At Rustington 7+8 was done surprisingly well until you consider that through the advisory training both national and West Sussex 7+8 was used commonly as an example. I certainly repeated this in my school and did teachers then repeat it in their classrooms? Is this a case of known facts?

My conclusion will be written at the end of the coming academic year.