

LESSON FROM MATHS 'HIGH PERFORMERS'

REPORT TO GOVERNORS (May 2013)

Background:

One of the headteacher's appraisal targets set for 2012/13 was to:

Investigate and explore pedagogical approaches in other European countries and the lessons for teaching and learning at Maryland.

This was put into the context of improving standards in mathematics at Maryland, so became a focus for the research. As part of the research, countries to visit needed to be selected.

Finland and the Netherlands are the 2 highest attaining European countries in maths according to the PISA tests done every 3 years (at 15 years old). Further investigation into these tests, revealed the following:

- Maths attainment in England is roughly average in the study out of 65 countries.
- Tests measure mathematical literacy, '*competence to address real-life challenges... (not) ... the mastery of the school curriculum.*' (Source PISA), rather than higher end knowledge & skills, so higher ability pupils are not reflected in results. The mathematical degree of difficulty is comparatively low.
- In a country with homogeneity, such as Finland, pupils are likelier to get easy questions correct.
- In the report on England, it was found that some pupils were finding the high requirement for reading in the tests and the contextualisation challenging compared with GCSE papers.
- Schools may elect to take the test, however the England sample was large enough and representative of the country.
- Pupils with special needs or limited language are filtered out of the selected sample and do not take the tests.
- Awareness of the test is higher in some countries than in others.

Given the caveats stated above, not comparative study for primary aged pupils and the lack of another reliable benchmarking mechanism internationally, the data was considered reliable enough and accepted by the profession to use as a basis for choosing which countries to research in.

Differences in UK/Finnish context

1. Teacher training 5 year course, 3 years of it majoring in education studies. All gain masters degree. Difficult to enter teaching (approx. 1 in 10 who apply). Teachers are trained to teach a wide age range, i.e. 7-13, then upper secondary. High status job valued alongside law and medicine but not highly paid. 24hrs of teaching, approx. 2500€ per month, with 5% increase after several years and a lower % increment after several more years. Extra pay for any additional hours worked. Subject knowledge extremely good.
2. '*Education system based on trust and responsibility*' (Source: *Finnish education in a nutshell* leaflet). Inspections abolished in early 1990s.
3. Start formal education at 7 yrs with a pre-school year at 6 yrs. Pre-school test determines whether chn get accelerated or kept back. "*Our children are children for longer.*" (Petra – Eng & craft teacher)

4. FAL chn spend 1½ years separated from peers before integrating and have a shorter day regardless of age (1pm finish). Not all schools have these 'regional' units. After a year might be dispersed to other schools.
5. Mobility is very low in Vantaa (Helsinki?). Typically, schools educate 2nd, 3rd & even 4th generation of a family.
6. Moving towards greater inclusion in all schools, so in future not 'regional units' in some schools and special schools.
7. There is a prescribed programme of work in all subjects with expectations clearly defined about what pupils should be expected to know at each grade. Schools can teach this in any way they choose. *'We are told what to teach, but not how to teach it.'* The current core curriculum is being redesigned at present as part of 10-year review.
8. Number (arithmetic) is the primary maths curriculum focus. Geometry and data play a part, but number is always integral.
9. Presentation of work on squared paper is noticeably standard, i.e. one digit per square standardised layout for calculations, use of books with margins. Pupil workbooks also have squared backgrounds for exercises that require them.
10. The intensive support for SEN results in a very small gap between low and average attainers, and low and high attainers (as the more able are not achieving as well as they could within current core curriculum framework and pedagogy). SEN teachers specialise in their studies from early on in teacher training. One teacher said of the more able, *'..those children become frustrated.'* Higher ability are stretched only much later in their education.
11. Few teacher assistants (teachers' aids), help with SEN chn and a floating TA *'to do other things'*. Ancillary staff are few.
12. Pupil support is holistic, i.e. medical, psychology, social trained professionals all on site. Children do not wear shoes inside the school as walking in stockinged feet is considered good for the children (teachers changed into slippers in one school adding to the relaxed atmosphere)
13. Class sizes average at 20.
14. Teaching hours increase with pupil age to a maximum of 24 hours at 13yrs. Grades 1 & 2 start with 19 hours per week.
15. 187 teaching days per year. 3 INSET days usually one at least used for planning at the start of the year. 10 week summer closure.
16. 'Hobby' subjects after school, e.g. some sports, music.
17. Text books-cum-workbooks are used in all subjects for school work and homework, including for the teaching of reading from Grade 1. They are devised and written in collaboration with practising teachers. Textbooks section work into 2 terms (1 book for each term). There is no third 'summer' term as we know it. The books contain some useful, loose pupil resources, such as conversion charts and column headings chart.
18. UK schools are much better equipped for ICT, e.g. pupil:computer ratio. Interactive whiteboards in every classroom are relatively recent. No separate ICT curriculum. Visualisers are in every classroom and very effectively used by teachers. The *Fronter* portal was seen being used effectively for homework.
19. No compulsory national tests, no league tables. Tests 'for fun' for benchmarking nationally every few years have revealed that no significant differences in attainment regionally. Teacher assessment, short regular tests recorded in mark book for all subjects. No teacher marking seen in any books – pupils mark own work from whole class marking together or from answer book they check against when work is finished.
20. Curric. emphasis on practical subjects of craft and technology, with schools extremely well equipped and specialist highly skilled teachers. Maths skills and problem solving are applied & are integral to these tasks, eg measuring, angles, proportion, arithmetic, perimeter, area, shape. High quality, practical items made for a purpose are produced some of which are pupil's own resources eg equivalence board and tangram board produced in carpentry, small individual

blackboards to write technology targets on, shopping bags. This integration appears to put Finnish pupils at a great advantage over UK counterparts in application of maths knowledge...

21. Independence and resilience are fostered early on in all aspects of home and school life, eg cycling and walking to school, taking responsibility around the school, self-assessment in all subjects and personal characteristics as students, discipline about homework (every day). Could this be a key factor in later overtaking and sustaining attainment in secondary school?
22. EYFS. Pre-school is one year 6-7 yrs old. Teachers are fully qualified, but are not permitted to teach reading formally. If pupils 'show an interest' they may support them with early reading skills. They teach pupils to count to ten. Reading teaching is based on phonics, linking letter and sounds.
23. Environment. Security appears lax, but all classrooms kept locked for internal access and teachers have keys to limited areas of school. Classrooms large with high ceilings, IWBs used by all with slides projected from scheme CD. Did not see any teacher-made slides as with Active Inspire.
24. Generally teachers keep their students for the duration of their time in primary school therefore fostering a close and relaxed relationship between pupil and teacher, e.g. teachers and the principal are called by their first names. Sometimes this relaxed atmosphere leads to tolerance of low level disruption and pupils' lack of focus at times.
25. Municipal handout for parents equivalent to our home/school agreement, but with a heavy focus on pupil wellbeing and relationships.

Differences in UK/Dutch context

1. Teachers teach all subjects. Few teacher assistants and ancillary staff, e.g. all teachers are first aid and emergency trained to a high standard (all can use a defibrillator which is standard equipment in all schools). Don't provide lunch – volunteers who supervise in classes while children eat lunch brought from home.
2. Number (arithmetic) is the primary maths curriculum focus. The curriculum is less demanding in breadth, therefore providing time to concentrate on number skills, e.g. less algebra, geometry and data coverage by 11 years old. Geometry has only recently entered the curriculum. Up to eight years old, '*number sense and number knowledge*' is the prevailing teaching message. Overall the primary curriculum is also less demanding in breadth, eg little PE, art, no craft/DT, ethics/RE, releasing time for teachers to decide their own timetabling.
3. Prescribed curriculum, covered by using the textbooks progressively (2 terms, rather than 3), include flipchart and other resources. Pupil workbooks and tests in the testbook are differentiated. Maths achievement is better than success in literacy, possibly be attributable to lack of systematic phonic teaching. Instead they teach beginning & end sounds of words and word recognition follows. New phonic schemes are appearing in schools now.
4. Standard written calculation methods are embedded early, e.g. 6 year olds in pre-school are using worksheets with repeat examples for numbers up to 20:
$$\begin{array}{r} 13 \\ + 4 \\ \hline \end{array}$$
5. Presentation of work on squared paper is noticeably standard, i.e. one digit per square standardised layout for calculations, use of books with margins. Pupil workbooks also have squared backgrounds for exercises that require them.
6. Mental maths is a focus and pupils are adept at matching bonds to add, e.g. $8+6+3+9+4$ and are able to describe how they calculated 30. Emphasis is on '*handy maths*' and that is how they explain pupils' good acquisition of the basics. They then use it daily in real life contexts, eg 4-6 year olds are asked, '*.. today is Weds, what day will it be in 2 days' time? How old is your sister, how much older than you is she?*
7. Teacher training. 3 types of secondary school, lower (vocational), middle (lower professionals, including teachers), higher (prepares for university entrance). Teacher training is not a university degree course, but is full time college for 4 years, resulting in a teaching diploma. Recently more

academic qualifications are required to enter college, as a result of studying the Finnish model and wanting their teachers to have greater skills and subject knowledge. Despite only achieving a diploma, Dutch teachers are usually better able to teach all subjects than in the UK where only one year of education training is needed before entering schools to teach. 6 training days a year and after school INSET to bolster subject knowledge and pedagogy.

8. Appraisal. No formal appraisal of teachers, but inspectors judge teaching skills every four years. If they do make the skills grades, teachers, and sometimes the headteacher, are dismissed. Failing schools are given funding to improve and 2 years in which to do that. If they fail to improve, the money has to be paid back to the state.
9. DAL pupils with no Dutch go to a 'side programme' for one year to learn the language, then get integrated into schools.
10. Similar to Finland, pupils self-assess a great deal, some by going up to check their work against the answer book. They are expected to correct wrong work, but teachers imply that many just take the correct answer from the book. cursory teacher marking and comment is evident, but review and improvement of work is not. Most elements of AfL are absent.
11. Language is considered important in teaching and learning of maths, pupils are encouraged to explain how they arrive at their answers and articulate their understanding.
12. Lesson structure appears to be loose, ie no defined mental/oral or plenary evident. Teachers are not required to produce plans, but only to follow the scheme. Pupils work in both workbooks and exercise books.
13. No calculators until Class 7, 11/12yrs.
14. Dutch also use different symbols eg : for divide, comma for decimal point. Use multiplication sign as we do (Finns use \cdot , a dot, so $4 \cdot 7=28$).
15. Choice of written calculation methods is given mostly to most able, as they '*understand them*'. Others pupils are taught standard methods and practise them until they are proficient and get correct answers consistently.
16. Assessment. Teachers are generally not required to spend inordinate amounts of time with written assessment, especially in EYFS. After EYFS, they use end of unit tests in the maths scheme materials used. *Cito* is a body that has devised school tests for approx. 30 years. They are considered reliable for levelling pupils' attainment in reaching their 'end goals' defined by their curriculum statements. Schools submit teacher assessments which are published for 6,8 and 10 year olds in the benchmarking book for Amsterdam and Rotterdam – also available online. National testing in parliament at present.
17. A school is graded 'good' if 80% of pupils by the end of primary school reach their 'end goals' as described in the curriculum. The gap, between the lowest and the highest is therefore not as small as in Finland, but they do not have the same resources to support SEN and low achievers, so accept the gap. In schools with higher ethnic profile, schools may be graded 'good' or with lower than average results IF they can illustrate pupil progress is good. In the Amsterdam published booklet, the inspection grades are traffic light symbols, green for 'good', amber for 'weak' and red for 'fail'.
18. Generally teachers keep their students for about 2 years in primary school. There is a relaxed relationship between pupil and teacher, for example teachers and the principal are called by their first names. Sometimes this relaxed atmosphere leads to tolerance of low level disruption and pupils' lack in focus at times.

SCHOOL 1, Vantaa:

- 482 pupils 7-13 years (grades 1-6), 21 classes & 31 teachers, incl 2 x SEN teachers, facilitating smaller groups and specialist teaching, 5 teacher aids.

-Some outdated practice seen, e.g. pupils queuing for help, stuck children not asking then going off task,

- Scheme requires marking yesterday's homework at beginning of lesson.

-Teachers still getting used to using whiteboards as standard equipment in classrooms, but use visualisers frequently and effectively, e.g. showing pupil work.

-Pupils sit at desks in a row, some partnered, some elect to sit by themselves. No structured partner work seen.

-‘E’ text/workbooks used for less able pupils (same work at a lower level).

-3 parent meetings per year, one of which is 1:1.

SCHOOL 2, Vantaa:

-321 pupils 7-13 years (grades 1-6), 17 teachers incl 2 x SEN teachers, 2 x teacher aids. 1 day's ed psychologist per week, part-time social worker, nurse.

-Scheme requires marking over yesterday's homework at beginning of lesson, consistent with school 1.

-Grade 5 mental maths session, ICT based, to test speed/rapid recall of number facts.

-‘E’ books used by SEN teacher exclusively.

-More prompts seen eg map of Europe, metre stick, sound chart, alphabet chart. Flipcharts had boy-friendly images.

-Assessment. One x 1:1 meeting with pupil and parent at beginning of the year to explain expectations for that grade and what child needs to do to achieve it e.g. for grade 8 pupils have to progress through 3 Finnish language books.

SCHOOL 3, Amsterdam:

-Follow Helen Parkhurst *DALTON* methodology and complete scheme written for Dutch schools that wish to adopt (some prefer Montessori). It requires extra study for teachers to deliver. Part-time, weekly for 2 years. The ethics are summarised as ‘Independence, working together and responsibility/freedom’. Very evident in all classes.

-510 pupils, 35 staff, 19 classes. 1% SEN equivalent to SA+, one special needs teacher who withdraws groups of up to 5 pupils, 3 hours per week. Comes with additional funding – the ‘*back pack*’. Also have SEN assistants who support in class. 30 pupils per class, some with 31. HT teaches Thurs a.m. arithmetic to 9/10yrs to facilitate splitting class into 2, so more able can study Spanish as an enrichment subject and SEN grp can be withdrawn.

-School closes 12 noon on Weds to provide PPA and training time.

-Homogenous community with no mobility, 1% SEN in middle-class neighbourhood. Low ethnic minority profile.

-For INSET days and staff training, consultants and senior staff are used to train teachers – similar to UK model. Also, teachers go on courses depending on the needs of the school.

-Head & deputy try to do lesson observations of teachers, but are time limited, so rely on drop-ins (quick visits) to assess quality of teaching.

-EYFS. Age 4-6 taught together with youngest paired with oldest. 28 pupils, no teacher assistant. Pupils start in Class 1 the day after their 4th birthday. Teach to a scheme called *Onderbound*, divided into maths, motor skills and language, matching the statutory curriculum. Assessed 3 times a year, final in June. Practical teaching methods. Learn to write number at 6 yrs, but are counting and playing with them constructively and with understanding earlier. 4 & 5 year olds use pegs cards, bricks, fingers, singing, rhymes to learn number, but do not write the numbers until 6 yrs old. Visual timetable was evidence of very young children managing their own activities and behaviour. Progress recorded on progress card which lists attainment statements. No homework assigned at this age. DAL pupils in EYFS have Dutch lessons after school, which parents pay for.

-More able pupils are usually grouped together in maths lessons and are catered for within the published scheme, i.e. workbooks and extensions. Can skip parts of practice work. Once a week they are offered an enrichment activity which could be learning another language (Spanish in this case). An enrichment day each week, where able pupils from several schools come together to do investigative and enrichment activities. Overall the more able have their curriculum broadened rather than progressing to a higher level. They embed fewer mathematical concepts, and encounter them more frequently, which is better because the end goals are more secure.

-Independence. From the earliest ages this was evident, e.g. in kindergarten (4-6yrs), pupils were expected to do their weekly tasks in rota and they did. When completed, they recorded the completion of their task and on which day, on the class task board. They followed on with a free choice task from a range offered and worked independently or with the help of their peers diligently, with resilience and perseverance to complete tasks exceptionally well displaying advanced fine motor skills. Only asked for help when a 'dangerous' task was needed, e.g. stapling. The teacher used a traffic light, so when on 'red' she was not disturbed while working with a focus group for at least 15 minutes. The older pupils supported younger ones very well during this time. Elsewhere in the school, pupils working alone outside classrooms on construction art tasks or core curriculum games, self-marking in class, even playing on climbing equipment unsupervised, was evident. 'Independence' aspect of Dalton ethos is clearly embedded in school life.

-Homework is assigned once weekly on Friday, some of which is to complete any unfinished work from class that week.

MATHS CURRICULUM DIFFERENCES – key examples

Concept	UK (draft curric)	Finland	Netherlands
Informal teaching, counting, number play	4yrs	6yrs	4yrs
Formal teaching of maths starts (written)	4yrs	7yrs	6yrs
'Easy' times tables, 2,5,10	6/7yrs	7/8yrs	7/8yrs
Tables up to 10 x 10	8/9 yrs (12x12)	9/10 yrs (grade 3)	9yrs onwards
Number bonds, fast and 'locked in'	5/6yrs	8yrs (end grade 1)	6yrs (bonds to 10)
__ x __ (short mult std method)	7/8yrs	9/10 yrs (grade 3)	8/9yrs
__ x __ (long mult std method)	10/11yrs	10/11 yrs (grade 4)	10/11yrs
Addition & subtraction std methods up to 3 digits	7/8 yrs (from 6/7 yrs '+ & - in columns')	9/10 yrs (grade 3)	8/9yrs
Calculation with decimals (not incl money)	9/10yrs	12/13yrs (grade 5)	10/11yrs
'Bus stop' std method division by one digit	8/9 yrs	10/11 yrs (grade 4)	11/12 yrs
Algebra, eg if $x=0.5$, $y=\frac{1}{2}x$, what is $3x+y$	10/11yrs	13/14yrs (grade 7)	After 12 yrs

CONCLUSIONS

It is general knowledge that Finland and Holland significantly outperform other countries in Europe in maths. This view is accepted at all levels of pupils' education. We need to be careful about interpreting data available and accepting received wisdom. You have to drill down for clarification and explanation about how the data was arrived at. Once you do this, you find the picture is very different.

What we don't know for sure, but have some evidence to assume:

- Our pupils are ahead in overall maths attainment at 11 years old, albeit some basic concepts aren't as securely embedded. National attainment of 11 year olds in mathematics in 2012 level 4+ was 84%, not dissimilar to Finland and higher than Dutch 80% expectation. Attainment drops off noticeably in secondary schools in England (all schools in England 2012, 53% 5+ A*-C GCSE including English & Maths – source DfE), but **PISA tests test at 15yrs**, with no earlier benchmarking. It is worth noting the Level 4+ 2012 attainment in Maths and English combined was 79% - source RAISEonline.
- Do our more able achieve higher than both Finland and Netherlands at 11 years old? We believe so, as their knowledge is at a higher level at that age, as the curriculum demands.

What we do noticeably well:

- We **attain** in Maryland and in Newham generally extremely well in **primary** maths, given the challenges of mobility, deprivation and inclusivity, mobility of teaching staff, class sizes, broader maths and crowded curriculum.

- Provide for **more able** pupils within the school day & therefore they achieve level 5 and even 6 by 11 years old (but after school enrichment could be improved).
- Teacher **planning, style and methodology** is more engaging for pupils, partner work keeps pupils focussed and behaviour management maintains a purposeful, orderly learning environment.
- Formative aspects of **assessment for learning** communicate clearly to pupils what is expected that lesson and measures their success, i.e. learning objectives and success criteria and deciding next steps.
- Without the exceptional **SEN/lower achievement** resources of the Finns, we still provide very well for these pupils, in school (setting, TAs, LSAs) and after school (booster).
- Provision and use of **ICT** and particularly whiteboards. These were very poorly used in all schools observed. Mainly for displaying flipcharts from the scheme CDs (which are of poor quality except for a few interactive exercises, eg shape sorting).

What is not replicable, whether or not desirable:

- Quality of intake into the profession
- Length and quality of teacher training
- SEN and child welfare professionals resourcing (presents the question about how ELSE we can narrow the gap in attainment, btw lowest and the AVERAGE)
- Segregation of SEN pupils
- new FAL/DAL pupils in language units for a year or more before integrated into schools
- Removal of formal, national assessment and benchmarking
- Acceleration or later start at EYFS transition.
- Class sizes less than 30 (other than being able to use anon-class-based staff to set)
- Flexibility of timetable and statutory school day
- Optional EYFS curriculum
- Cultural attitude to education, national love of reading,
- Status of teachers and trust in their professional judgement and practice by the authorities....
- little emphasis on national testing, league tables
- Homogeneity of culture, language, population, attitudes to education, national pride
- Balance of curriculum
- Streamlined curriculum

What is replicable, but not consistent with or desirable in our current practice:

- 45 minute lessons
- Lack of partner engagement
- Lack of pupil/teacher dialogue through marking and other AfL elements
- Reliance on text books and the schemes' matching flipcharts
- Relaxed relationships between teacher and pupils, because of the behaviour issues that result.

What is replicable and is likely to impact on attainment in the long term:

- Greater emphasis and frequency of teaching of number concepts and skills, especially in EYFS and KS1, to the point of calling the subject 'arithmetic' to indicate the importance and focus
- More integrated approach to teaching some concepts
- The application of maths in D&T (and science- new curriculum indicates greater integration anyway).

- Standardised teaching approach of some key concepts and written standard methods, such as measure conversions.
- Quality of D&T offer
- We already set and band pupils, using SLT expertise and HLTA capacity to increase the number of teaching groups.
- In EYFS a more integrated approach to number in the curriculum delivered, and acquiring resources to do so, e.g. touch screen computer.

Next steps:

- Impending maths staff meeting and INSET day to focus on how we **integrate number into all aspects of work** and plan in more cross-over of concepts.
- Deciding on **balance given to number** in the curriculum we deliver.
- Complete **overhaul of D&T/craft** units of work to provide a real and desirable purpose to apply maths.
- Decide which concepts to **standardise methodology of teaching**, eg measure conversions, standard methods and in which staff meetings this will be done by DHT1 & maths co-ordinator.
- Investigate differentiated student **workbooks** and discuss with staff how these can best be integrated into our lessons and for homework.
- Ensure the **new planning format** (currently in development with consultant) builds in daily mental maths time for bonds and tables.
- Review current **homework** in mathematics, its relevance, monitoring and how we can improve it across the school to impact on:
 - pupils' basic number skills
 - pupils' independence, resilience and perseverance to solve problems (consider maths projects for holidays or term time, eg ahead of a concept, ask chn to investigate, "What is a square number? Why isn't 12 a square number?")
- Maths **exercise books** – smaller squares and margins.
- For **EYFS**, purchase or develop resources eg use of i-Pads, large touch screen monitor to support independence , *GYMSY* interactive software (or more use of *Espresso* if similar).
- DHT1 to complete and publish **mental maths home book** for parents and present it to them in a series of meeting/workshops.
- Further develop HT's 2013/14 appraisal target to improve teachers' (mathematical) **subject knowledge** following teacher audit that has already taken place.
- Address with staff the lack of **pupil independence, perseverance and diligence** so that we hear and see less of 'I'm finished!', 'I can't do this.' Explore further self-assessment devices.
- Audit **support staff's subject knowledge** with similar questionnaire to teachers, with a view to possibly taking an approach similar to our grammar initiative providing adult self-improvement workbooks.

What this means for the leadership of the school:

- HT vision must emphasise improving pupil independence and engaging parents in this pursuit.
- To become as well known for maths innovation as we are for reading.
- Continue investigative/diagnostic approach in trying to raise maths standards in the school.

BIBLIOGRAPHY and research sources:

- OECD (Organisation for Economic Co-operation and Development) PISA (Programme for International Student Assessment) research. <http://www.oecd.org/pisa/>
- OECD. *PISA: Achievement of 15 year-olds in England*. Bradshaw, Ager, Burge, Wheater.
- Freudenthal Institute 'realistic mathematics' approach used in The Netherlands & Belgium <http://www.fisme.science.uu.nl/fisme/en/>
- CIEB Centre on International Education Benchmarking *The Netherlands Overview* <http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/netherlands-overview/>
- 2010/11 study implementing RME in N & S Ireland by Moffet & Corcoran <http://scotens.org/wp-content/uploads/An-evaluation-of-the-implementation-of-Realistic-Mathematics-Education1.pdf>
- Mathematics education in the Netherlands: a guided tour*. Van den Heuvel-Panhuizen.
- Finnish pupils' success in maths* Ofsted report 2010
- Finnish education in a nutshell* leaflet produced by Ministry of Education and Culture, Finland.
- England attainment data source DfE/RAISEonline
- www.daltoninternational.org and *Education on the Dalton Plan* Helen Parkhurst
- Smithsonian Magazine Sept 2011 "Why are Finland's schools successful?"