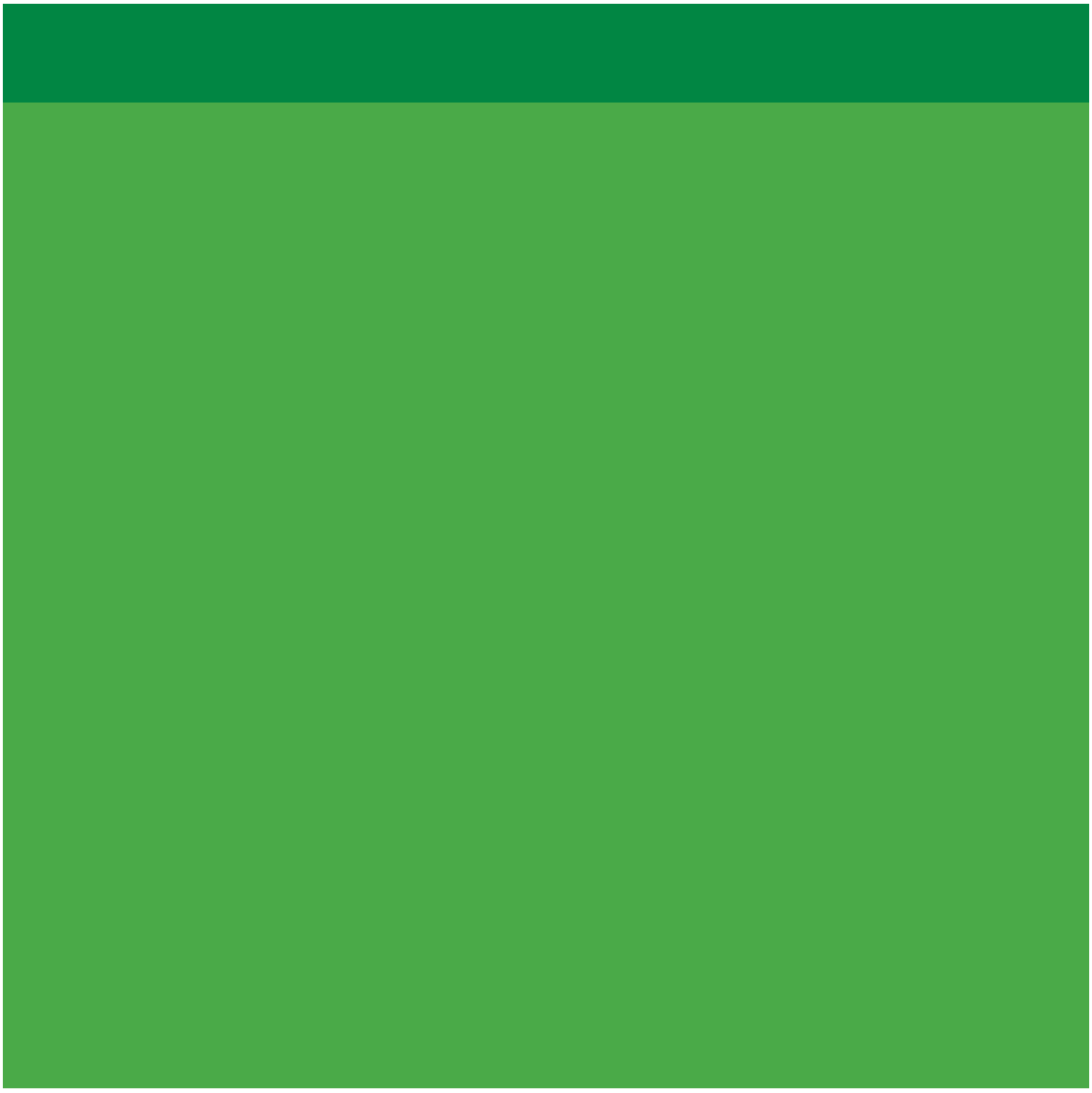
National College
Working internationally

Interim Implementation Report National College China Research Programme (Phase 1) December 2013



This Interim Report provides a summary of strategies being adopted by schools and alliances in England, following research into the teaching of Maths and Science in the Shanghai and Ningbo regions of China by NLEs and SLEs in January 2013.

Implementation plans are detailed in section 11 (pages 33-47) of the National College Report on Maths and Science Teaching in Shanghai (January 2013).

Changes have been introduced in the following areas:

1 The curriculum
2 Teaching, learning and pedagogy
3 Staff professional development
4 School organisation
5 School culture

This report also describes impact across alliances or networks; and, in addition, some proposals which were considered but not implemented.

A full report of progress and impact will be produced towards the end of the academic year when evaluations have been made over a longer timescale.

1 Maths Teaching in England

After observing Maths teaching in schools in Shanghai and Ningbo, high performing, specialist Maths teachers listed the problems to be address within the system in England. These are acknowledged by NLEs/SLEs as:

- Lack of applied, practical assessed units in the curriculum
- Too many strategies which confuse
- Attempts to make the subject too easy
- Unacceptably low expectations and targets
- Insufficient time to practice
- Basic skills in counting, number bonds and multiplication tables not cemented
- Weaknesses in oral work and explanations
- Insufficient use of physical resources
- Low subject knowledge of some teachers, especially in the primary sector
- Defeatist attitudes to the subject
- Lack of clarity about progression.

2 Curriculum changes

After analysing the curriculum, many schools felt that their current Maths courses did not meet, or respond to the needs of their children. A number have introduced more practical and applied units of work. Several have increased the amount of practice provided with a focus on procedural fluency, conceptual understanding through visual tools and the development of mental maths skills. Some have increased the amount of time for teaching the subject whilst considering ways to increase the status of Maths in their schools.

The variety of changes include:

- Increased emphasis on teaching basic skills on transfer from KS1 to KS2
- Repetition and practice, as distinct from rote learning, promoted in schools as a feature of outstanding mathematics teaching
- Multiplication tables as standard practice until fluency is achieved
- Development of mental maths skills
- Earlier introduction of advanced topics with more opportunities to re-visit and revise
- Mathematics Curriculum re-written to include optional, applied units being trialled in Year 7 with more varied applications of mathematics
- Reduction in number of strategies used for mathematical computation
- Calculation Card scheme trial with year 5 and 6 classes: all pupils (Level 3/4) moving their calculation skills to 4 digit numbers (add, subtract, multiply) and 3 digit numbers (divide). A number of pupils moved to calculating with decimal numbers in all 4 operations within two months of starting the skills practice in lessons
- Developing a differentiated scheme for monitoring progress in times tables understanding
- Assessed application units incorporated into the KS3 curriculum- e.g. cryptography, personal finance, graph theory, school timetabling and computer game design; assessments are used to plan the following year's courses, responding to student needs
- Increased content for Higher achieving students in Year 10: dual mathematics certification to gain greater depth and understanding- GCSE and AQA L1/L2 Further Maths
- Additional options at KS4 include qualifications in financial literacy and statistics
- Focus on sustained 'practice' instead of 'pace' with an additional teaching hour at KS4
- *Numicon* multi-sensory interventions for those with low ability in numeracy
- Use of set individualized and independent 'follow on' work after marking
- Resources for short activities and a new approach to teaching calculation strategies
- Daily short, motivational mental maths exercises
- Arithmetic focus in KS3 to include greater use of connectives and visual aids with an algebra focus in KS4; 'practice to perfect' strategy of Rainbow Arithmetic
- Development of online support videos: *SAFmaths,* YouTube resources and *edmodo* discussion boards to enable out-of-school study.

3 Teaching and Learning Changes

Changes are the result of significantly enhanced professional development through collaborative research/study groups and new forms of observation; and also changes to the curriculum. The majority of alliances report significant changes in teacher approaches and teaching styles with some reporting marked improvements across alliances in lesson observation gradings. Some of the improvements are:

- Long division without bus stop or chunking methods. Pupils report how much easier it is. ('Why didn't you teach us this before?')

- Observable increase in practice and consolidation in lessons with benefits for pupil confidence
- Teachers have a greater understanding of the progression towards formal written methods for each of the four calculation operations
- Teachers have a clearer understanding about the routes through calculation, including progression to formal methods and strategies leading to efficient mental calculation
- Manipulatives are being used more effectively, resulting in a higher proportion of pupils who are confident in using formal methods with understanding. Teachers recognise the value of continuing to use manipulatives throughout KS2, with pupils of all abilities, to embed conceptual understanding
- Teachers feel confident in providing pupils with opportunities to practise methods to develop procedural fluency
- Teachers have a clearer understanding of the importance of the use of manipulatives to support the development of calculation procedures
- Teachers are more likely to teach the formal algorithm to groups of pupils, to whom they would not previously have introduced it
- Pupils are more able to choose from and use efficient and effective calculation strategies
- Requirement for planning and differentiation for the more able so that challenge and pace remain high
- 'Flipped' lessons: these allow effective student preparation for lessons as they pre-view, for homework, a prepared video on the next lesson focus; this enables students to do the easy parts of topics at home without support, allowing more time for the difficult elements in class with support
- Creation of videos for 'flipped' lessons
- Use of 'over-learning' homeworks, calculation practice schemes and place value counters; resource bank of 'overlearning' materials produced
- Sets of low-level, large scale, wipeable white boards, enabling children to model and demonstrate Maths working to other children, a collaborative learning style observed in China
- A pilot model classroom introduced with more space for children to move around and interact with their peers during lessons
- Place-value' counters purchased and sets for thousands to hundredths made for schools in the alliance; used with Year 5 and 6 classes; students create video, using the counters to solve problems and investigate place value in numbers
- Use of 1:1 or 1:2 coaching with low achievers, using a highly structured approach and paired numeracy, using volunteer 6th formers to help weaker students
- Additional problem-solving sessions for targeted pupil groups e.g. starting secondary school with level 4c
- Ten minute calculation practice section introduced to each maths lesson, including a literacy element with problem solving
- Increased use of practical resources in lessons with the aim of allowing pupils free access to manipulative resources to support calculation
- Improved mental agility in Maths
- Calculation now taught as a continuum by ability not age
- Revised approach to calculation is supporting accelerated learning in number application
- Use of student review of their work during dedicated reflection time in lessons

- To encourage students to apply teacher feedback and take responsibility for improvement, all students in one school are issued with a purple pen, enabling teachers to spot and monitor the students' own reflective contributions. (*The Purple Pen of Progress*)
- Student-led research with students invited to join staff discussions on the use of technology in teaching and learning
- Gifted pupils designing help videos on selected topics using iPads.

4 Professional Changes

The focus and time allocated to professional dialogue in China is striking, with teachers having significantly less contact time and far more professional development time than in England. Many alliances are seeking to replicate the professional learning features of schools they visited, including opportunities to develop specialist knowledge in Maths and teach repeat lessons (as seen in China) to focus on improving teaching. Where schools have introduced these changes there has been an improvement in teaching, a marked increase in subject knowledge and higher levels of trust and confidence.

Three aspects of professional development are notable:

(i) Alliance Research Groups

Set up in almost all the alliances, these have been effective drivers of professional development, leading to improvements in teaching quality and raised standards with particular impact reported where practice is shared across schools:

- Established generally with university partners
- Some universities are considering possible masters accreditation for teacher research
- One alliance has engaged a visiting professor to support staff in accessing and undertaking research, including action research studies
- Training provided for staff on learning community facilitation, with teacher-generated protocols based on 'appreciative enquiry' methodology
- Sessions are most effective when regular and systematic with timetabled and scheduled meetings
- Trialling Chinese methods e.g. work sharing and oracy
- Examples of research areas include: improving number skills competency; increased individual tuition based on need; increased use of physical resources; enabling children to develop verbal explanations for peers; increased time devoted to core skills
- Working across networks with status and time to report findings: one alliance gives research leaders four half days each year
- Action research activity may form part of the performance management system for teachers but it is usually separate
- Teachers complete one research project a year with published findings in one example
- Collaborative lesson planning is producing deeper conversations on pedagogy
- Use of professional development 'triads' *within subject* with a focus on Mathematics teaching and learning
- Adaptation of the 'lesson study' approach in which colleagues co-plan and then take it in turns to teach, observe and reflect

- Teachers whilst working with pupils on calculation have developed video materials. These clips have facilitated reflection, discussion and analysis within alliance research groups
- In an alliance of 21 schools, teachers draw on a range of published research materials and their own experiences to plan teaching calculation. Cluster group members are regularly involved in the observation of teaching and learning in each other's schools. The dialogue around teaching and learning in mathematics has altered significantly across the alliance
- Subject leaders are becoming more analytical with discourse focusing on pupil learning, shifting from a top-down/dissemination model to a collaborative one experimental/experiential model of professional learning
- Calculation has been made the focus for mathematics development across some alliances. Subject Leaders have collaboratively developed whole school calculation policies outlining the key concepts related to each of the four operations, providing a clear progression towards the standard algorithm in each. Some detail effective models and images at each stage. This work enables schools to use manipulatives consistently to introduce the use of compact written methods earlier, with understanding.

(ii) Learning Observations

This process of teacher development has been introduced in most alliances- a form of learning from peers as well as senior colleagues through non-judgemental observations. The results have been significantly positive:

- Senior and high performing teachers offer open door access for less experienced staff to observe them, with time provided for colleagues
- Open door policy for all in some alliances on observations
- Non-judgmental peer observation to 'improve not to impress'
- Pre-lesson discussions held with the observed teacher, establishing a lesson focus and prompts on how to identify specific aspects.
- Observed teachers share the processes behind their lesson planning
- Group observations include another 'expert' teacher to facilitate the post-lesson conversation
- Teachers write action points for themselves on what they intend to try in their lesson, explaining why and how they will do this with an agreed deadline
- In one alliance there are weekly in-school observations and monthly cross-school observations
- One alliance has developed extensive protocols and informed case studies on this process

(ii) Professional development opportunities

One of the most striking findings from the Shanghai research was the Chinese focus on the support and development provided for teachers throughout their early years with most, for example, having two mentors, each offering strongly focused professional advice. Several schools are replicating these extended, early career induction programmes. Others are providing additional research time, promoting the creative use of new technology for professional development and following the Chinese approach to celebration and recognition of teachers:

- ‘Introduction of integrated CPD programme for the first five years of teaching to include shared observations and discussion time with improvements in coaching and mentoring
- *Recently Qualified Teachers: Maximising Impact* course developed across one alliance in response to the greater focus on support for new teachers in China; it comprises workshop-style sessions on learning theories, differentiation, assessment for learning, monitoring progress, creativity, and partnership-building.
- Additional time for professional reflection and work scrutiny with a specialist partner, ensuring peer evaluation and accountability
- Expectation of weekly professional reading, blogs and contributions to on-line discussion forums on the school’s VLE
- IPads are being used to record lessons and interaction between children for discussion in team meetings; using external audio speakers, a small teacher research group, 3 or 4 teachers and a phase leader, can gather around the iPads to watch and discuss footage
- Real-time mentoring to ensure there is a focus on non-judgemental development, usually separate from but parallel to the performance management and review systems already in place
- In another example, senior leaders undertake two discrete roles so that each teacher has both a nominated 'developer' and an 'appraiser'. Separation of these roles provides greater openness and clarity around accountability. The ‘developer’ sets targets and provides developmental support and feedback throughout the year. The ‘appraiser’ objectively reviews and assesses the quality of teaching and performance against targets at key points. The ‘appraiser’ draws on feedback from the ‘developer’ with the final performance judgement agreed through professional dialogue between the two senior leaders
- Logistical mapping of ‘developer’ and ‘appraiser’ roles takes account of staff workload, expected level of development and existing roles.
- Celebration of all staff in one school, as in China, now includes greater public recognition of success: certificates presented in staff meetings, invitations to lunch with governors, nominations to join ‘leading practice’ study groups; termly nominations made to the head teacher for personal recognition and praise.

5 Organisational solutions

There is some impressive work in schools which have found creative ways to replicate some of the Shanghai methodology. Some changes being trialled are:

- Reduction in teaching time for year 3 and 4 teachers across two primary schools, one outstanding and one requiring support; an additional 6 hours of professional non-contact time (8 and a half hours in total per week) has been achieved by increasing class sizes to 39 and employing four additional TAs
- Introduction of two hour-long, after-school enrichment sessions for pupils, one on literacy and one on numeracy- these are voluntary and replace homework; tasks are practical and active with high take-up in both the lead and the supported school: highly popular with parents and pupils (96% and 84% attendance respectively)
- School day re-structured in one case by consolidating registration/slack time to create 30-minute enrichment sessions, enabling ‘fast learning activities’

across the whole school; result is a punchier, more active start to the day, with a variety of activities
- Joint planning to develop resources for applied units, allowing main material to be taught through the applications
- Additional teacher recruited with freedom of deployment
- Several schools/alliances using 'gained time' in the summer term to enable observations and research groups to operate
- Shared funding across schools is delivering efficiencies of scale and reducing some costs
- Some staff-cover time designated for peer observations
- Two Inset days dedicated to learning observations
- Disaggregation of some Inset days to allow more flexible, frequent use of time in collaborative groups
- Pupil Premium funding to provide additional classes for students in small groups
- Additional non-contact time provided for lesson study time
- Staff meeting time devolved to facilitate lesson study groups

6 Cultural Change

This is the most taxing area and often viewed as insuperable. Nevertheless, many schools have intensified their parental contact and increased the number, range and type of parent evenings in an attempt to persuade them of the critical role they play in raising standards. Other strategies are:

- Development of 'growth mindsets' (Dweck) to change parental perceptions
- *Hard to Reach Families* intervention introduced with pastoral leaders and the home-school liaison officer to encourage greater communication with parents
- Developing interactive methods of parental engagement and involvement with their children's education
- Monthly emails to parents detailing progress and information about topics, resources and expectations.

7 Impact on schools in alliances

Early reports show that Maths is now a priority in many of the alliances with agreed principles for Maths teaching and a clear progression framework:

- Where schools have created additional teacher development time, there has been a marked improvement in teaching grades with lesson improvements of one grade on average, despite larger class sizes
- Teacher subject knowledge has increased noticeably
- Learning is designed to respond to children's needs rather than national frameworks
- Joint development of materials undertaken with other schools around the country (through twitter) and with schools in Australia and Canada
- Use of research adopted by the majority of schools within alliances: they now work in this way within their own schools
- Teachers have developed a greater understanding of how to use their lessons as the focus of research to inform professional learning and are more likely to change their practice as a result

- Teachers have a greater understanding of the progression towards formal written methods for each of the four calculation operations
- Manipulatives are being used more effectively, resulting in a higher proportion of pupils who are confident in using formal methods with understanding
- Teachers recognise the value of continuing to use manipulatives throughout KS2, with pupils of all abilities, to embed conceptual understanding
- Teacher feel confident in providing pupils with opportunities to practise methods to develop procedural fluency
- Time for repetition and individual support is improving standards
- Children are developing the role of Maths experts, offering explanations
- Children are more secure in number facts
- Online learning is being developed to bring about competition between schools, increasing participation and practice of mathematics out of school
- One secondary school is setting up primary networks which are developing a common calculation policy
- Much CPD is provided by SLEs within their alliances and networks: trials and sharing of resources, policy formulation and testing new methods
- Regional conferences led by SLEs with widespread interest and support.

8 Changes considered but not implemented

Although the group have been creative and problem-solving in their approach, cost or physical constrains have prevented the introduction of some initiatives. The creation of additional time for professional learning and Maths teaching, for example, whilst seen as priorities, are subject to the limitations of classroom size.

Pressures against larger classes, to allow teacher development time, have also been reported from some parents and governors, despite early evidence of the potential success of this approach.

- Additional teachers in most cases are not affordable
- Shanghai-matched time levels for collaboration, observation and teacher research, though a number of alliances have come some way in this
- Widespread development of specialists Maths teachers at primary level: in one alliance all wanted to teach the subject within the curriculum to develop cross-curricular links; in another there were cost implications. However, specialist training is the focus in one alliance
- Increased class sizes: teachers are capable and there is evidence to suggest that performance will be maintained; nevertheless, room size is a barrier in many cases though where this is being tried, there are already significantly positive results
- Career-long mentoring.

9 Conclusions

Early indications are that the Phase 1 cohort have reflected deeply on their learning in Shanghai and Ningbo, adopting strategies which impressed them, creatively implementing new practice in their schools and across their alliances.

The group is highly positive about the programme of implementation, describing the research in China as ‘life or career changing’. In areas where change is possible, these highly autonomous school leaders have taken decisions showing evidence of impact on the curriculum, teaching and pedagogy and staff professional development.

These early and wide-ranging indications of progress are being reported back to all members of the Phase One Group, enabling them to learn from different approaches adopted. The strategies and examples here are also being used to inform the development of the Phase Two Group (Maths SLEs) who begin their research in January 2014.