Lessons from lessons: the teaching and learning of mathematics in East Asia

Recently there has been close study of the learning and teaching of mathematics in East Asian schools, in Shanghai in particular. Experienced UK teachers have joined lessons and observed Chinese teachers and pupils; their analysis of the teaching and learning refutes many of the inaccurate generalisations made about mathematics teaching in China and other "high performing jurisdictions" (HPJs) in East Asia. Although clearly there are cultural and societal differences between the UK and China, one in particular being the status of maths and mathematicians (think how many Chinese party leaders have science or engineering degrees), the findings from these recent studies are not dependent on the socio-economic context in which they were made. In particular, there's no evidence that HPJ pupils are *a priori* more intelligent, but it is unequivocal that **the teaching they receive is continually being honed to be maximally effective**. The professional learning culture of HPJ teachers is founded on their shared commitment to improve continually their skills: it has been called a culture of "ongoing perfecting". Furthermore:

- HPJ **teachers at all curriculum stages have deep structural knowledge** of the mathematics they are teaching: their own academic qualifications are at a high level (in Shanghai, all are maths graduates), and their training (initial, and ongoing) ensures **secure, rounded and specialist understanding**.
- **Precise questioning** during lessons ensures that pupils develop **fluent technical proficiency** and think deeply about **the underpinning mathematical concepts**. There's no prioritisation between technical proficiency and conceptual understanding in HPJ classrooms; the two skills are developed in parallel.
- **Focused discussion** of successful solutions and strategies **makes explicit the mathematical structure**, and little time is spent discussing incorrect approaches that aren't illuminating.
- Issues and misconceptions are identified through **rapid formative assessment** and addressed quickly with **same-day intervention**: there are few "closing the gap" strategies, because there are very few gaps to close.
- Textbooks and resources present **sequences of carefully constructed tasks and exercises**, which make explicit the underlying structure of the mathematics, thereby encouraging and supporting pupils to make mathematical connections. Both **classwork and homework provide intelligent practice**, not mindless "by rote" repetition.
- A **variety of representations** is used to introduce and explore a concept, and related concepts are always discussed together to **make explicit the mathematical relationships** between them and thereby strengthen the pupils' mathematical connectivity.
- All the teachers expect that that **all the pupils can succeed in mathematics and as mathematicians**. Teachers are clear that their role – their professional duty – is to teach in a precise way that will make it possible for **all pupils to engage with tasks at the expected level of challenge**. Differentiation is seen in support and intervention (in particular, the questioning and scaffolding of individuals as they are working through the problems), not in the teachers' expectations of the levels which subsets of pupils will reach.

There is substantial evidence, from lesson studies as well as from external data such as PISA tests and TIMSS analysis, that **mathematics teaching in HPJs achieves the key aims of the new UK National Curriculum for mathematics**: that all pupils "make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems", and that "teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions". From September 2014, it is an expectation in the UK that "the majority of pupils will move through the programmes of study at broadly the same pace … decisions about when to progress should always be based on … their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be … offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent … should consolidate their understanding, including through additional practice, before moving on." This 'mastery' curriculum will encourage deep understanding; note how it aligns very closely with how mathematics is already taught in the HPJs. Further immersive study, such as that of the England-China Maths Education Innovation Research Project, led by the NCETM through the Maths Hubs, is therefore timely, and the impact of this research will be far-reaching and long-lasting.