

Changing lives and providing equity through pre-teaching and assigning competence

Ruth Trundley explores the impact of an action-research project supporting vulnerable children to be active and influential participants in mathematics lessons.

The impact has been extraordinary. We have had the privilege of witnessing teachers change children's lives through this project. Children who had no belief in themselves as learners in mathematics now believe in themselves, and are actively involved in their own learning and in the learning of others. (Trundley *et al.* 2017, p.3)

The current focus on teaching for mastery within primary mathematics has brought a number of things into the spotlight. One of these is intervention. Askew *et al.* (2015) identified one of the key aims of teaching for mastery as being to ensure that all children have:

... a *deep* understanding of the mathematics they are learning so that:

- Future mathematical learning is built on solid foundations that do not need to be re-taught.
- There is no need for separate catch-up programmes due to some children falling behind.
- Children who, under other teaching approaches, can often fall a long way behind, are better able to keep up with their peers, so that gaps in attainment are narrowed whilst the attainment of all is raised. (p.5)

The main strategy to support children to “keep up”, identified within the National Centre for Excellence in the Teaching of Mathematics (NCETM) literature, related to teaching for mastery in mathematics, is “rapid intervention”, a practice common in Shanghai. I would argue that there are some limitations with using rapid intervention in England including:

- Children who still experience class lessons as a time when they do not understand and ultimately fail, leading to wasted time and a lack of self-belief.
- The need for remedial intervention can be seen as a reflection of a lack of ability and lead to the labelling of children.
- Rapid intervention does not address the inequities that exist due to diverse experiences outside of school.

In *Learning for mastery* (1968), Bloom identifies a

critical assumption within mastery, “ ... that, given time enough, all students can conceivably attain mastery of a learning task.” (p. 3) The phrase “given time, enough” contains a challenge: The challenge of providing additional time for children who need it in a form that will maximise impact whilst minimising disruption to the rest of their learning.

As a team of mathematics advisers, we had worked on a research project related to teaching for mastery during 2015/6 and an alternative way to provide additional time was identified by some of the teachers involved: pre-teaching. The project also explored “complex instruction” and in particular the idea of assigning competence in order to raise the status of certain children in mathematics lessons. The potential for using pre-teaching and assigning competence together to support children who struggle to be involved in mathematics lessons led to the setting up of our project, which ran during 2016/7. The project involved thirty-four teachers from seventeen schools across Devon teaching across the primary phase. Each teacher selected three vulnerable children as their focus children for the project, which was jointly funded by Devon County Council, Jurassic Maths Hub and Cornwall and West Devon Maths Hub. It was led by the primary mathematics advisory team within Babcock Education in Devon (Babcock LDP). Our key research question was: How can pre-teaching and assigning competence be used to effectively support children to access age-appropriate mathematics and be active and influential participants in maths lessons?

Pre-teaching

Remediation is often a terrible way to help kids catch up. Pre-teaching is more effective and more fun ... For the same 20-minutes investment of time, we can change the way a child sees himself (*sic*) as a reader, thinker, or mathematician. We can give Manuel the rare experience of being the kid who gets it first, who helps the other kids figure it out, who is ready with the answer the moment he hears the question. (Minkel, 2015, p4)

We found that research into pre-teaching, and specifically pre-teaching in relation to mathematics, was limited and there was no exploration of different

types of pre-teaching. We used the article above, written by an elementary class teacher in the USA, as a starting point with the teachers in the project.

Assigning competence

The notion of assigning competence comes from the work of Cohen, Lotan and others at the Stanford School of Education (Cohen *et al.*, 1999). They developed an approach, called “complex instruction”, which aims at achieving equity in co-operative learning classrooms. Assigning competence is about raising the status of low-status children through identifying publicly something they have contributed from which everyone can learn. The importance of assigning competence within our project was two-fold. It seemed to have the potential for supporting children to be actively engaged by identifying significant contributions they were making to everyone’s learning and it could be used to directly link pre-teaching to the lesson. Too often, when children are given additional time, especially when it is through some form of intervention, it does not directly benefit learning in the class lesson because the children experience the intervention and the class mathematics as separate and distinct episodes of learning. The reason for focusing on assigning competence alongside pre-teaching was to overcome this issue and replace disconnection with explicit connection.

Project findings

Pre-teaching was most effective when run by the class teacher: This was the main finding in terms of the success of pre-teaching. The children and class teacher have a shared experience, which gives them a shared understanding and common references that they take into the whole-class lesson. There was a sense of the children wanting to work hard in the lesson because they had been given the extra small-group time with the teacher; the children value the time because it is with their class teacher. This had an impact on participation. The additional time with the class teacher was seen as a privilege by the children, rather than something to be disappointed about having to do. It was something that was enviable within the class. This is in stark contrast to the attitude towards remedial interventions run by someone other than the class teacher. An issue that was raised early on was the status of interventions in schools and how this has a knock-on effect in terms of the status of the children attending the interventions. For some of the older children, initially, they were unhappy at having been identified for the group but this soon changed

when they realised this gave them time with their class teacher and that this helped raise their status in the mathematics lessons.

The main challenge has been totally rethinking the way that I see intervention working in my class. (Y6 teacher)

For the teachers, the pre-teaching allowed them to really get to know the children, their ways of thinking, and how to get the best from them. This then transferred to the classroom:

I feel I know my children far better in terms of what interests them and how they learn, which has enabled me to engage them better in the class lesson. (Y3 teacher)

Now I really know why they are not on track. (Y6 teacher)

It also provided teachers with an opportunity to reflect on the planned lesson in advance, as the pre-teaching often revealed things that prompted adjustments to make the lesson more effective. In effect it was a pre-teach for the teachers as well as for the children, both of whom were then more focussed at the start of the lesson.

Pre-teaching and assigning competence maximise learning in lessons: By having class teachers provide the additional time and putting it before the learning happens in a mathematics lesson, rather than after it, children are provided with even more additional time and opportunities for learning than just in the pre-teach. This is because it makes the lesson a meaningful experience for the children, rather than them experiencing it as a time when they do not understand and feel they have failed. Teachers are then better placed to support their learning in the lesson.

Pre-teaching and assigning competence have a positive impact on children’s confidence in themselves as mathematical thinkers: This was demonstrated by:

- *Engagement from the start of the lesson:* Both the focus children and the teacher benefit from pre-teaching in terms of their focus and engagement with the mathematics at the start of the lesson.
- *Offering contributions and being ready to respond:* The children offered contributions more frequently, which demonstrated a shift in attitude and resulted in positive feedback, which then led to further participation. The teachers were alert, looking for the children to contribute.

- *Asking different questions and seeking out a challenge:* The children were able to think more mathematically in the lessons because they were less anxious and therefore paying less attention to their emotional wellbeing. This resulted in the children being prepared to ask questions that focused on the mathematics, rather than emotional reassurance, and to want to tackle challenging mathematics.
- *Accessing resources independently:* This included children using their pre-teach journal as an aide memoire; using working walls; and mathematical equipment.
- *Explaining thinking:* The pre-teaching meant the children were better able to explain their thinking. This in turn meant they had the opportunity to deepen their understanding, through explaining their thinking.
- *Supporting others:* This included using resources, drawing and explaining.
- *Active participation in conversations:* The children became willing to challenge others, including high-status children, and defend their own thinking.
- *Changes in behaviour and attitude outside of the classroom:* Parents reported positive changes in terms of children's interest in, and attitude towards, their learning, reflected in an increased willingness to talk about their learning at home.

Pre-teaching can have different structures and focus on different things: Key to pre-teaching sessions being successful, along with them being taught by the class teacher, are the following:

- *Pre-teaching provides children with access to the mathematics in the lesson:* This allows children to actively participate. Pre-teaching is not about being able to replicate in the lesson the mathematics from the pre-teach session, nor is it about teaching the whole lesson in the pre-teaching session. It is about preparing the children to engage in the struggle of the mathematics in the lesson by removing any additional barriers.
- *Teachers identify things that will allow the children to access the mathematics in the lesson.* These could include:
 - Introducing new mathematics, new contexts and new contextual resources.
 - Rehearsing prior learning.

- Rehearsing language.
- Allowing confusion to happen.
- Using misconceptions.
- Using images/resources (especially those being used the first time).

- *Timing:* Most teachers found that having the pre-teaching session on the same day as the mathematics lesson worked best, although some did run sessions at the end of the day in advance of the lesson the next day. Some teachers liked to run the session immediately before the lesson, whilst others liked a gap as it allowed them time to reflect on how they might want to adjust the lesson in light of the pre-teaching session.
- *Frequency:* Teachers varied in terms of how frequently they ran pre-teaching sessions with many running two or more a week. At least weekly seemed to work best. For vulnerable children, there is a need to provide regular sessions at least in the early part of the year. These children benefited from being involved for the whole year. Flexibility may be important in terms of making pre-teaching work in the long term, with the option to vary at least some of the children who are involved, but the impact, on the focus children in this project, relied on their sustained involvement in the pre-teaching sessions for the full year.
- *Length:* There is no set length for a pre-teaching session, the important thing is clarity about the purpose of the session and taking the time needed. Fifteen-minute sessions were often needed, for example, when the focus was on introducing a new piece of mathematics, but, sometimes, a few minutes immediately before a lesson prepared the children for participation, through rehearsing language, say. The average length of a session was around ten minutes.

Assigning competence is a powerful tool but can be more challenging for teachers to use effectively: The following strategies were found to be important for teachers to consider:

- Be subtle. Mathematics is not about a performance and is not a memory test.
- Comment on the thinking or the idea not the child.
- Use simple phrases to draw attention to valuable thinking.
- Anticipate and monitor.

- Support other children to publicly state how they have been helped by a class member.
- Subvert hierarchies that exist in the classroom.
- Attend to classroom and school culture.

Impact

The impact of the project on both teachers and children can be summed up with the following two stories. In one school, an 11-year-old child who had been part of the project was asked what a mathematics lesson would be like without pre-teaching, to which she responded:

A better question would be what would my year look like without it? I would still think I couldn't do maths. What would secondary school look like without it? Scary.

In another school, a Year 6 teacher told the following story of her three focus children:

The three children began the year with little confidence in maths and very little confidence in themselves. Their first assessment in December showed them scoring 33%, 28% and 34% respectively. The SAT's [high-stakes national tests] showed the children being incredibly confident in their ability. One child is quoted as saying, "I love SATs" and another saying as the week ended, "Actually that was really fun." The children's attitude in their own ability had completely changed and they felt that they could answer the questions ... There were smiles on their faces the whole week and at no point in any of the tests did they give up or feel negative towards their own ability.

This change in attitude was matched by a change in attainment. The end of KS2 tests in England result in a scaled score. Any score ≥ 100 indicates that a child has met the expected standard. The three children had scaled scores of 100, 106 and 107. Their entry into their next stage of education had been transformed by the experiences their class teacher had provided through the use of pre-teaching and assigning competence.

Professional development for teachers

It is important to recognise that, in addition to the findings above, the year-long project allowed teachers to engage in a sustained piece of professional development, which had a direct impact on them in their work. The two elements of the project identified

by the teachers as being most influential on their own practice were the collaborative lesson-research cycles and the support of a knowledgeable other, in this case a mathematics adviser. It was important that any professional development was planned into the school day, so that it was valued both by participating teachers and by their senior leadership team.

Next steps

Findings have been shared with the schools who are involved in the maths-hub intervention work groups this year and we are currently running a project looking at whole-school approaches to using pre-teaching and assigning competence, in particular how teachers can be supported by senior leaders to find time to fit in pre-teaching sessions. There is interest in using this approach with learners of different ages and from student teachers and parents.

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