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Manipulating Variation


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During 2019, Dr Ruth Trundley and Dr Helen J. Williams worked in collaboration with Great Torrington Bluecoat Church of England Primary School, Devon, and St Ives Infant School, Cornwall, to investigate how variation theory (Marton & Tsui, 2005) might be applied to the teaching of early number in Y1 (children aged between five and six years old). Funding came from the BERA British Curriculum Forum, with additional funding provided by Devon County Council.

The project ran during the spring and summer terms of 2019 and involved three teachers in three year 1 (Y1) classes, two in Devon and one in Cornwall. Our early research question was:

How can variation theory be applied to the use of manipulatives to support understanding of early number?

The mathematical focus we chose was the move from 'counting-all' to 'counting-on', which research indicates is critical for numerical understanding (Nunes & Bryant, 2009). The decision to focus on counting-on led to a further decision to focus on Y1 pupils; our subsequent observations from the teaching sessions, linked to previous research in this area, resulted in a revised research question:

What are the key sub-skills of counting-on and how can variation with manipulatives be used to support development of these sub-skills?

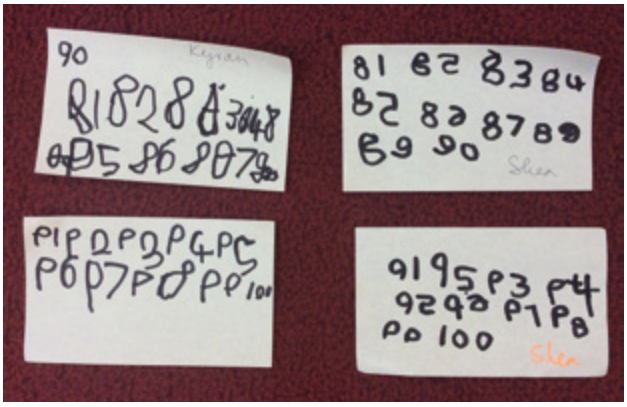
Each researcher worked with two trios of Y1 children selected by the class teachers. A different manipulative (ten-frames, Numicon©, bead string, counters) was used with each of the four groups of children. The starting point for the research was observation of the Y1 children. We sought to capture 'what is', rather than describing 'what changes', using a naturalistic methodology, rich in description (Tsamir, Tirosh, Barkai, & Levenson, 2018). During the teaching sessions, children were invited to make decisions, expected to explain their thinking and provided with opportunities to explore and reflect on their own understanding, through open mark making. Assessments were focussed on exploring how the children thought about, understood and made sense of the mathematics rather than just the numerical answers.

The movement from one data collection activity to another was preceded by analysis of the existing data, with the two researchers working on the analysis in collaboration. The activity with the trios in the Devon school happened a day or two after the same activity had taken place in the Cornwall school. This meant not only that the data analysis shaped the next activity but also that the data analysis from each school had an impact on the next data activity in the other school.

The data collection for this research was structured as follows:

Date	Activity	Participants
Spring Term Week 1	Assessments	Individuals – Y1
Spring Term Week 1	Meeting with the children and sharing the text	Trios – Y1
Spring Term Week 1/2	Three half-hour teaching sessions	Trios – Y1
Spring Term Week 2	Assessments	Individuals – Y1
Spring Term Week 7	Sharing of data analysis with teachers; teachers identify areas to explore	All teachers and researchers
Summer Term Week 8	Assessments	Individuals – Y1
Summer Term Week 8	Observation data collection from teachers	All teachers and researchers

All the data activities were recorded using video, allowing the researchers to make observations both in real time and through analysis of the recorded



data. These observations allowed the researchers to explore – in depth – understanding of the mathematics involved. This led to sorting of data, followed by defining and labelling. We met with the three class teachers mid-spring term and shared observations from the teaching sessions under the headings 'sub-skills of counting-on' and 'key teaching decisions'.

The teachers were invited to choose from our observations something that had interested them for further exploration in their classes; we came back together in the summer term for the teachers to share their observations.

It was interesting that, while we had focussed our attention mainly on the mathematics (our full report, to be published by BERA, analyses in depth the sub-skills of 'counting-on' which we identified as 'understanding cardinality and abbreviating the augend' and 'keeping track of position in the number system and the addend using entities'), the teachers were focussed more on the teaching decisions and, in particular, the deployment of a small world character – they were all familiar with using puppets in lessons, but a small world character offered something different. Observations of the impact of the character included the following:

- All children, including reluctant talkers, were keen to explain things to the character and wanted to help it understand the maths. It worked well in conjunction with sentence starters, encouraging the children to say whether they agreed or disagreed with the character.
- Children who wanted to play games within continuous provision, but didn't have another child to play with, played against the character.
- Working on positional and directional language, the children moved the small world character and had a better view of what was changing than if they were moving themselves. They were less worried about having a go and making mistakes.

The teachers also recognised we had made considered decisions around number representation. One teacher observed that the use of PowerPoint slides has led to a decrease in her writing numbers, which we modelled throughout our sessions. She chose to expose the children to writing every number that was mentioned, especially when counting up and down; the children explored their understanding of numbers through reading and writing them. This exemplifies the power of this project, which was in the collaboration between practising teachers and practising researchers. ■

REFERENCES

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