Innovation Project Report

Does repetition deepen and develop understanding?

Participating Schools:

- **Lead School:** Harrow Gate Primary Academy, Stockton (Enquire Learning Trust)
- St Mark's Church of England Primary School, Stockton (1 Excellence Multi Academy Trust)
- Ash Trees Academy, Stockton (Ascent Academies Trust)

Rationale:

Dahlin & Watkins (2000) assert that the traditional Asian practice of repetition can create a deep impression on the mind and enhance memorisation, but they also argue that repetition can be used to deepen and develop understanding. This innovation research project aimed to investigate whether using 'sentence stems' as part of routine teaching enhanced children's conceptual understanding of different areas of mathematics, notably fractions and time.

Methodology:

The initial methodology was planned to involve using a control group and a treatment group, with pre- and post-assessments. In this scenario, the aim was to try to isolate the specific effect of using sentence stems on pupil's attainment. However, in reality, with a tight timescale leading up to statutory key stage one assessment, this wasn't possible for many of the schools involved in the project and three schools dropped out. The decision was then made to change the focus of data to collection to teacher and pupil opinion on the use of sentence stems. In hindsight, a standardised questionnaire would have provided more robust data, however valuable data was gathered from each school by speaking to children and teachers informally and recording their anecdotal findings.

Findings / Results:

<u>Time:</u>

All schools used sentence stems to practice reading the time from an analogue clock to the nearest five minutes. The sentence stem used was:

If the minute hand points to _____ then it is _____ .

One child remarked, "They helped me because we said the words over and over which reminded me about the different times." Teachers felt that this structured approach allowed children to reinforce the link between the numbers on the clock and the minutes to / past the hour (e.g. 2 being ten minutest past). When reading the time, pupils were able to use the sentence starter to determine the number of minutes to / past the hour and then use the hour hand to determine the hour. Teachers believed that this helped the children break down the process into two steps in their head: the minutes to / past and then the hour, thus making the process step-by-step and more manageable.

In the special school involved in the project, sentence stems were used to help children sequence the order of days in the week. The sentence stem used was:

If today is _____, yesterday was _____, and tomorrow will be _____.

Initially, teachers found that there was too much here for children to say independently, and trying to speak the sentence accurately detracting from learning the actual mathematics. Teachers used a pictorial display prompt to support children in their use of the sentence and after a few lessons, teachers felt children became visibly more confident and only needed minimal prompts to speak the sentences independently.

Fractions:

To support understanding of what a fraction is, two schools used sentence stems as a framework for getting to explain basic unit and non-unit fractions (example – Figure 1).

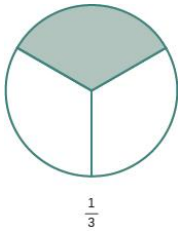

Figure 1 – One third

The sentence stem used was:

A _____ means a whole one split into _____ equal pieces and you have _____ pieces.

Teachers asked children to repeat this sentence stem for different visual representations of different fractions, specifically those detailed in the national curriculum for Year 2: one half, two halves, one quarter, two quarter, three quarters, four quarters, one third, two third and three thirds (GOV.UK, 2014). This included written completion of the sentence in exercise books as well as verbal. After the lesson that introduced the sentence stem, teachers later asked children to explain different fractions e.g. one half or one quarter. Teachers found that children independently used the sentence stem: it had been committed to memory. This meant that children could effectively explain what a fraction was independently. Teachers then asked children to draw what they thought some new fractions would look like, for example two sevenths or four ninths (these being taken from the KS2 curriculum). Teachers found that most children were able to accurately draw a diagram of these new fractions, despite never having seen them before. When asked, “How did you know what (for example) two sevenths would look like?” children explained that they thought it would be ‘a whole one split into seven equal pieces and you have two of them’. This suggests that repetition did lead to understanding for these children, as they were able to apply their learning to new information. Additionally, there were many different representations of the whole used (e.g. circles, squares and bar models) indicating deeper understanding rather than reliance on one particular representation.

Multiplication:

Year 2 children were introduced to the concept of multiplication through studying equal groups. They began by looking at images of equal groups (Figure 2)

Figure 2 – Example of imagery used to show ‘equal groups’

The sentence stem used was:

There are _____ equal groups of _____ . This is _x_.

Again, children had to repeat these out aloud and write them in their exercise books. Teachers found that later during the unit, children would see unfamiliar multiplication number sentences (such as 3 x 6) and would say “so that’s 3 equal groups of 6” before drawing a diagram (such as figure 2, or an ‘array’) to calculate the answer. Teachers believed that using the sentence stem had developed children’s conceptual understanding of what multiplication was. Teachers also found that children were able to reason about multiplication effectively, using knowledge gained from repetition of the sentence stem. For example, when presented with this reasoning task (Figure 3), a child responded, “Because there aren’t two equal groups of 3. One has two and one has four.”

Why does this image not show 2 x 3 = 6 ?

Figure 3 – Example reasoning task

Conclusions:

Although the methodology was not as robust as originally hoped, the anecdotal evidence provided is promising. Teachers believed that using the sentence stems allowed the children to gain a deeper understanding of the mathematical concepts that they were exposed to, and to apply this to new situations (for example to new fractions, as detailed earlier). Importantly, teachers also believed that rehearsing the sentences improved children’s ability to verbal reason about mathematics (for example the reasoning task in Figure 3). This is interesting, as it was not part of the original hypothesis of the research.

As part of further investigation, it would be beneficial to structure the research in a more specific and focussed way, to move the findings from anecdotal to more robust and generalisable. For example:

- The use of control groups in two-form entry primary schools.
- The use of pre- and post-assessments on the topics covered, for treatment groups and control groups.
- The examination of the impact of sentence stems on children’s verbal reasoning abilities.
- A structured set of interview questions, so that each school involved in the research was asking the same questions of teachers.
- All schools involved in the project using the same year group and same specific domain of maths e.g. fractions.

References:

Dahlin, B. and Watkins, D. (2000). The role of repetition in the processes of memorising and understanding: A comparison of the views of German and Chinese secondary school students in Hong Kong. *British Journal of Educational Psychology*, 70(1), pp.65-84.

GOV.UK. (2014). National curriculum in England: mathematics programmes of study. [online] Available at: https://www.gov.uk/government/publications/national-curriculum-in-england-mathematics-programmes-of-study [Accessed 2 Jul. 2018].