Can the RUCSAC method improve children's ability to reason and problem solve in maths?

Hoxton Garden Primary School, Lower Phase

Abstract

The aim of this study was to find out whether the RUCSAC method would support pupils to solve a range of reasoning and problem solving tasks in maths. To trial its effectiveness, the use of the RUCSAC method was embedded into all maths lessons in Year Two from February until May. The purpose of the study was to give the children a tool kit to use to solve reasoning and problem solving tasks across all areas of the maths curriculum, and so the problems taught related to broad range of national curriculum topics. The modelling of the method followed an 'I do', 'we do', 'you do' structure. Gradually, over time, there was less scaffolding used and greater opportunities to apply using the RUCSAC method more independently. The RUCSAC method was adapted half way through the study to be a 5 step method so that the children would find it easier to remember, but the core purpose of the research remained the same. To measure the impact of the study, scores were recorded from a past SATS maths reasoning paper in February, to be later compared with SATS results from the maths reasoning paper in May. Although increased SATS scores were not the purpose of this study, the tests gave a clear indication of progress made in reasoning and problem solving questions. Although this progress cannot be solely attributed to the RUCSAC method, teacher observations also supported the finding that the RUCSAC method enabled the children to solve reasoning and problem solving tasks in a systematic and overall more accurate way. Teacher observations also found that the use of the adapted RUCSAC method supported the children in reading comprehension tasks, increasing their ability to work systematically and therefore increasing the accuracy of their answers.

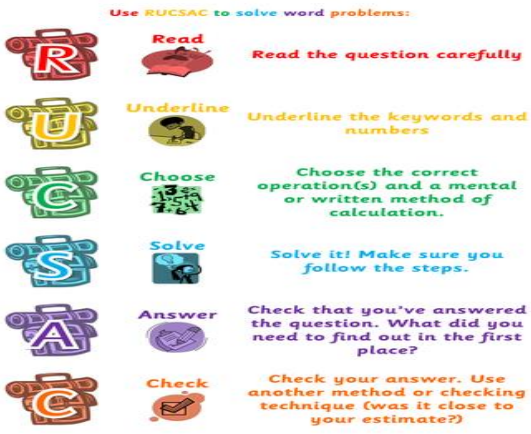
Introduction

Hoxton Garden Primary School is situated in the London Borough of Hackney, catering for pupils between the ages of three and eleven. The pupils come from a wide range

of nationalities, many are from minority ethnic backgrounds and many of them speak English as an additional language. At the end of Key Stage 2, the vast majority of pupils at Hoxton are meeting the expected or higher standard in Reading, Writing and Maths with sustained outcomes significantly above the national average.

According to the national curriculum all children should; ‘Reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.’ After a discussion around challenges pupils may encounter in this type of numeracy, lower phase teachers concluded that reasoning and problem solving tasks can often pose a challenge to pupils’ learning as they require pupils to read the problem, visualise, identify key vocabulary and the question that needs to be answered, solve the problem using a method they are familiar with and finally explain their choices. Knowing how to calculate and understanding key vocabulary is not enough to solve reasoning and problem solving tasks effectively. The main barriers to solving words problems in lower phase were that some children were not able to understand the problem in context, visualise it, know what to do systematically and explain their methods.

It was decided through this discussion that the RUCSAC method could give children a step by step approach to decode reasoning and problem solving tasks, which should improve children’s ability to solve these questions and check their answers. The steps in the method are to read, underline, choose your method, solve the question, answer, check your answer. This was shown to the children as the visual representation below.



Research Process

The first step was to explain the RUCSAC method to the children. Each step was explained in terms of what it meant and how it could be used to support the children to understand and solve the question. In each lesson maths lesson the RUCSAC method was displayed on the interactive whiteboard, next to the reasoning or problem solving task. Before each task was approached the RUCSAC method would be rehearsed as a class and the children would be reminded how to use the steps. The class teacher would then check that the children were using the method through questioning and observation. The children also had the RUCSAC method displayed on their tables as the visual above and were reminded to refer to it throughout the lesson.

The cold task was the practise reasoning and problem solving SATS paper, where the children had to solve reasoning and problem solving questions across all areas of the maths curriculum, without any adult support and without being taught the RUCSAC method.

After the cold task, the pupils worked with the class teacher every day to solve a range of reasoning and problem solving tasks using the RUCSAC method to support them. The first problem was to be carefully modelled by the class teacher (I do) and the second problem was to be solved as a group (we do), creating an additional opportunity for the adult to re-model or address any misconceptions. The third problem was an opportunity for pupils to apply the skills they have been modelled and independently solve the problem (you do). This process continued for 12 weeks and throughout it, the activities linked to different areas of maths, such as: addition, subtraction, multiplication, division and some problems related to fractions and varied in levels of challenge.

Due to teacher observations, there were small changes in the project. The 6 steps in the RUCSAC method were shortened to 5 steps so that the children would find the method easier to remember and could count the steps on their fingers. This enabled them to use the method more independently.

After 12 weeks, the children completed their reasoning and problem solving SATS paper. This was looked as the ‘hot task’ as the children needed to use their knowledge

of the RUCSAC method to solve problems spanning the maths curriculum without any adult support. The scores were then compared with the practise scores.

Findings

Initially the RUCSAC method gave the children a more systematic way of working through reasoning and problem solving tasks, which increased their success in solving these problems over time. The most effective steps in the RUCSAC method appeared to be ‘read’, ‘underline’, ‘choose’ and ‘check’. These steps gave the children time to decode the problem, identify the important information and reminded them that they must choose their own method to solve the problem. The ‘check’ stage also helped remind children to use the inverse to check a problem or just to recalculate to ensure that they had been accurate in their answer.

There was a noticeable difference in children’s ability to answer reading comprehension questions. The systematic approach that children were starting to apply in maths also translated to reading comprehension. The children were starting to read the text and question twice and to underline key information. They were also much more likely to go back and check their answer and cross reference it to the text. Subsequently, the introduction of a different version of the RUCSAC method in reading lessons to encourage this type of systematic learning was implemented. During shared reading steps were reinforced; read it twice, underline, answer, check.

As the research progressed, it was noted that the children were struggling to remember all the steps in the RUCSAC method and that ‘choose’ and ‘solve’ were essentially the same step. Consequently, the decision was made to adapt the RUCSAC method so that it was 5 steps and could be counted on the children’s fingers. The steps were refined to ‘read it twice’, ‘underline’, ‘stop and think’, ‘choose your method’, ‘check your answer’. Stop and think was added before ‘choose your method’ as it was noticed that the most common mistakes in maths reasoning and problem solving stemmed from the children choosing a method too quickly, before they had a chance to fully understand what the question was asking them.

After adapting the method, this was reintroduced to the children. Teachers also introduced the use into reading lessons but dropped the ‘choose your method’ step as it did not apply to reading comprehension. A marked improvement in the children’s ability to solve problems in maths and their ability to utilise their reading comprehension skills through a repeated and known process was noted. The amount of children using this method increased and teachers could see clearly in maths and reading where children had underlined key information and how it was reflected in their answers. The impact of this is clearly shown in the progress made in maths and reading comprehension scores in February compared to scores in May. As the line graph clearly shows below.

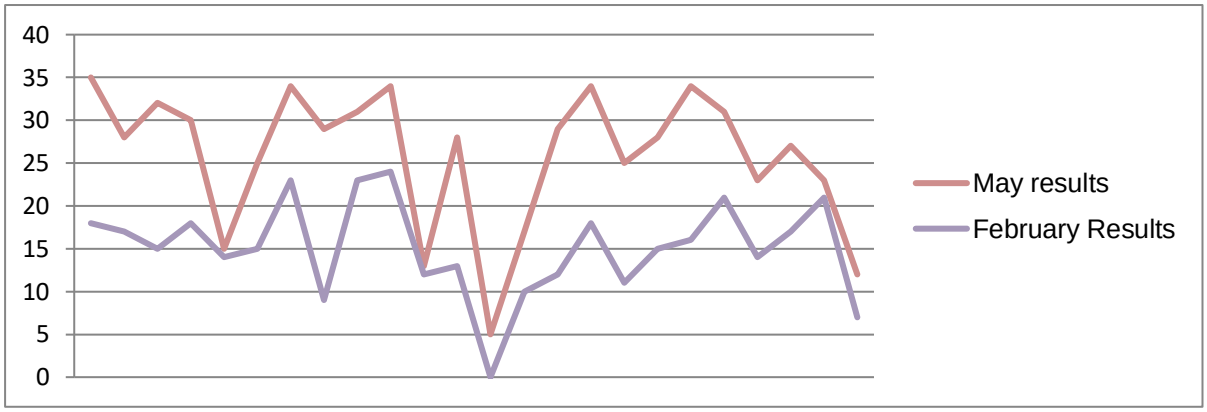


Fig. 1 Maths Results Comparative Graph February to May

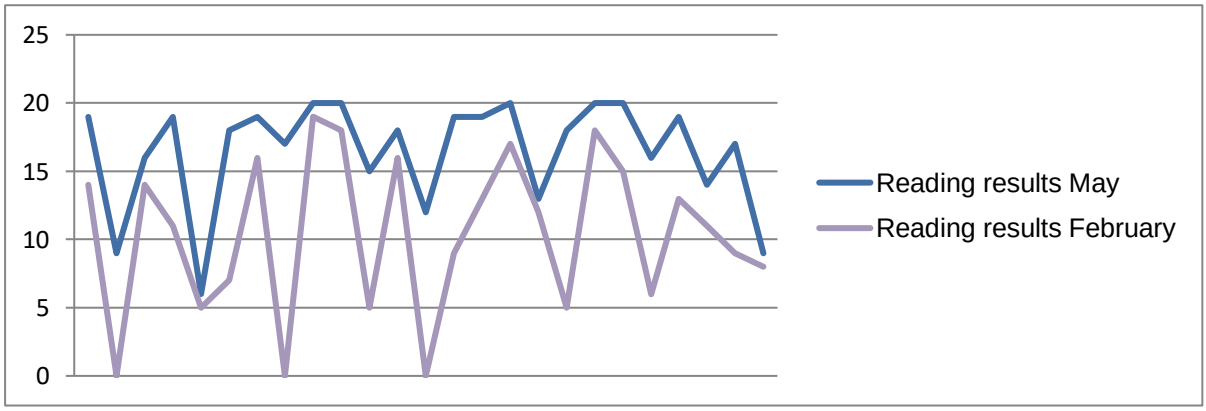


Fig. 2 Reading Results Comparative Graph February to May

It was noticed that accelerated progress was made by many children for whom English is an additional language or for whom English is not spoken at home. This is demonstrated in the graph below.

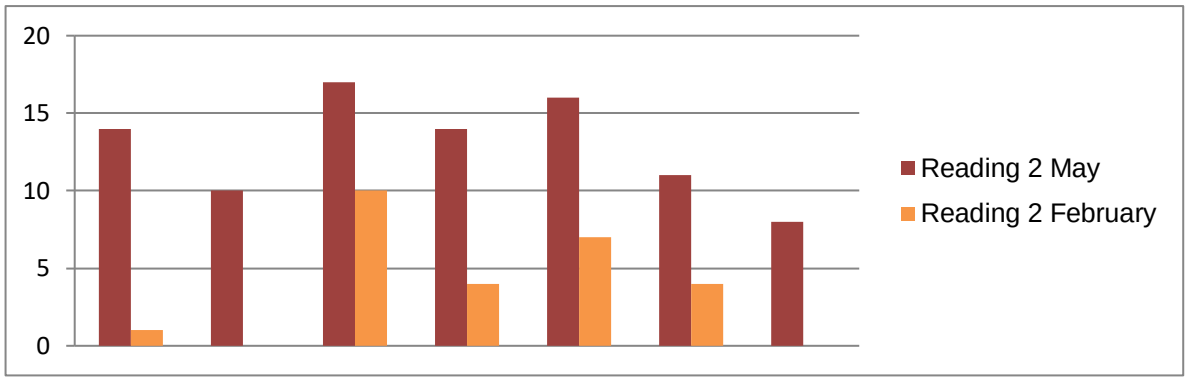


Fig. 3 EAL Reading Results Comparative Graph February to May

It was also noticed that lower achieving readers from ethnic minority backgrounds also made accelerated progress, which is shown in the graph below.

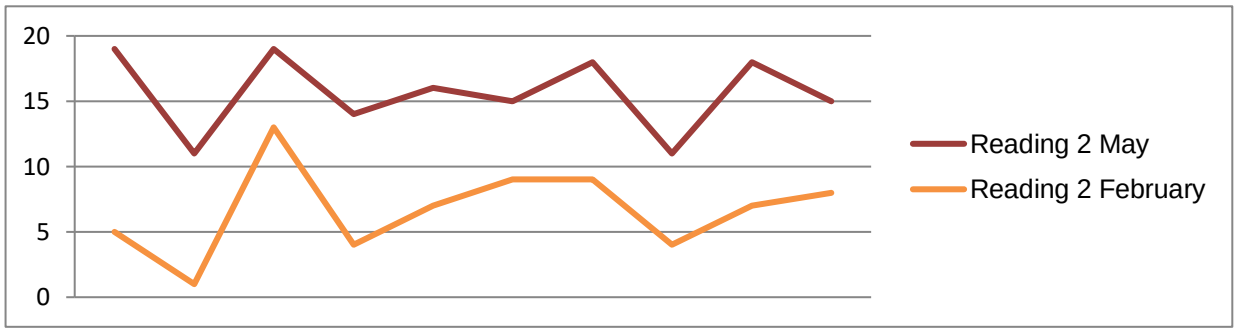


Fig. 4 Lower Ability EMB Reading Results Comparative Graph February to May

Impact and Conclusion

Based on the data and teacher observations, it is clear that using the 5 step adapted RUCSAC method had a positive impact on the children's ability to solve reasoning and problem solving questions in maths. The progress shown in these types of questions was accelerated in EAL children and lower attaining readers from ethnic minority backgrounds. Through discussion with lower phase teachers, it has been decided that the 5 step method (adapted from the RUCSAC method) will be used continuously to teach reasoning and problem solving tasks in maths. It is clear from the children's SATS scored and teacher observations that the method supports children in decoding and solving more complex maths problems. The 5 step method will be displayed on the interactive whiteboard throughout every lesson and will be consistently modelled by the teacher and teaching assistant. The 5 step method will also be displayed on the children's tables so that they can access it independently.

References

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