



Date	March 2017
Key stages	KS2
School type	LA maintained, primary
Themes	Mathematics

Do Low Entry High Ceiling tasks reduce anxiety in mathematics?

Aboyne Lodge School

Context

Aboyne Lodge School is an average-sized primary school located in the St Albans district of Hertfordshire. The school was rated 'good' by Ofsted in December 2014.

The focus

On Friday 18th September 2015, the Herts for Learning maths team hosted a national conference with Jo Boaler, Professor of Mathematics at Stanford University, as the key note speaker. Many Hertfordshire teachers attended the conference to find out more about developing mathematical mindsets and were inspired to continue improving opportunities in mathematics for their pupils through an action research project. The purpose of the project was to explore some of the themes covered by Jo Boaler and research different ways of developing mathematical mindsets. *This case study has been written by Deryn Grisenthwaite, Year 6 Teacher and Maths Subject leader at Aboyne Lodge School.*

Since September, the whole school has been promoting Growth Mindset. This has been a priority on the School Development Plan this academic year. Teaching in maths has been consistently good or outstanding (as evidenced in lesson observations) and the children are generally high-achieving. However, in spite of this, in Year 6, the children when asked to 'traffic-light' their work after an activity, often marked it as amber, even when they had been able to do the work. Too many of the children were admitting that they did not enjoy maths or that they were not very good at it. This needed to change. To ensure pupils had the opportunity to develop a growth mindset, I explored different mathematical activities and tasks to be used during lessons.

Description of my approach

Growth mindset had been introduced to the staff during INSET and had been successfully received by staff, parents and the children. The children were shown 'The Learning Pit' and referred to it often during lessons. Tough Tortoise (resilience), Super Squirrel (resourcefulness), Wise Owl (reflectiveness) and Buddy Bee (reciprocity) were gradually presented to the children and every class had a set of their own toys to use.

An article on the NRich website entitled '[Using low threshold high ceiling \(LTHC\) tasks in ordinary classroom](#)' was central to the project and helped develop my approach.

Materials and resources used

The following resources were used to support the project (see links on page 4 for further details):

- Various NRICH tasks
- Open ended tasks searched online e.g. King Arnold (Primary Strategy Materials), Digital Roots etc.
- Felt tips and large sheets of paper, practical apparatus where possible.
- Growth mindset Survey
- Maths Questionnaire (before and after the project)

Learner's responses and changes over time

As the project progressed, the children appeared more relaxed in maths lessons. They were curious to find out what 'fun' maths activity they were doing each lesson. Looking at their work, they continued to assess their performance on each activity using the 'traffic light' system and these were more often green.

Throughout all of the LTHC activities, the importance of discussion amongst the children was evident. Without much effort, the children were collaborating with each other in order to reach their generalisations and they were also posing problems for each other to solve. The groups made conjectures as they worked. Some conjectures were proved 'wrong'; other conjectures were important to solve the problem and could be proved with examples. Boaler (2009) argues that giving children opportunities to ask their own questions and extend a problem keeps mathematics alive for them. The classroom was becoming an environment in which it was acceptable to make mistakes and learn from them.

Year 6 were asked to answer some questions about their maths learning at the start of the project and also at the end. On analysing this information their confidence and enjoyment of maths had risen and their belief in their own ability had also increased.

I found out from the questionnaires that the children felt that they were learning more when given the LTHC tasks. This evidence suggests that although the content of the activities may appear simple, it often requires a deeper level of thought and can be accessed at many levels, hence engaging more of the class.

I particularly noticed this when working on the NRICH activity [Arithmagons](#). An arithmagon is a polygon with numbers at its vertices which determine the numbers written on its edges. Some of the children were trying to solve how the values at the vertices determine the values on the edges whilst others were taking it to another level, using algebra. These children were then keen to share their methods with others using the board.

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8.

$$\begin{array}{l}
 a+b=8 \\
 b+c=13 \\
 c+a=9 \\
 \hline
 a+b=8 \\
 a+c=9 \\
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 (c+a)-(a+b)=9-8 \\
 c-b=1 \\
 \hline
 c+b=13 \\
 (c+b)-(c-b)=13-1 \\
 b+b=12 \\
 b=6 \\
 c-b=1 \\
 c=7 \\
 7+a=9 \\
 a=2
 \end{array}$$

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Widening the approach

Having started with a whole school focus on Growth Mindset, all members of staff are open to ideas to develop this further within mathematics.

I have discussed the project in my class with the Year 5 teacher as she is leading the Growth Mindset initiative throughout school. She uses LTHC tasks and promotes the use of these to raise maths enjoyment. We have both noticed that the children appear more confident in their maths lessons and that they are happier to make mistakes in front of their peers, whether in a small group or in front of the class.

By promoting the use of LTHC activities in school, I hope to see a decrease in maths anxiety throughout school. I hope that by the time the children reach Year 6 they will be confident in maths and able to explain their reasoning and ideas without worrying what others may think.

Impact and recommendations

It would appear that the children have enjoyed the maths lessons during the weeks of the project. They were keen to start the activities and work together. I attribute that to the LTHC activities which enable every child to reach success at some level.

I noticed that the children had a much more positive attitude to the LTHC activities. When faced with a maths task, one child turned to another and said, "Remember, everybody is a maths person." Another child was overheard stating that today his maths "should be a walk in the park."

More of the children were willing to have a go at the maths activities and they particularly enjoyed using large sheets of paper and felt tips to express their ideas. It seemed that they appeared more willing to write things down and cross them out if they were wrong. The classroom environment encouraged the acceptance of mistakes and the children knew that "mistakes grow your brain."

I found out that the children did not feel that their ability to explain their maths to others had changed during the project. It seems that, although, I had noticed that they appeared much more ready to discuss their ideas with each other and to explain their methods and understanding during these discussions, the children did not recognise this. I could have placed more of an emphasis on their explanations during the project.

I found that time was a huge factor in completing this project. Year 6 have many different demands and activities during the summer term which seemed to affect the project.

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Reading and website references	<p>Boaler, J. (2009) <i>The Elephant in the Classroom: Helping Children Learn and Love Maths</i>, London: Souvenir Press Limited</p> <p>Boaler, J. (2015) <i>Mathematical Mindsets: Unleashing Students' Potential Through Creative Math, Inspiring Messages and Innovative Teaching</i>, John Wiley & Sons.</p> <p>Growth Mindset Survey: http://survey.perts.net/take/toi?public_key=899f8aa33</p> <p>Websites:</p> <p>NRICH: http://nrich.maths LTHC in the Classroom - Real Stories: http://nrich.maths.org/8176 Low entry, high ceiling article: http://nrich.maths.org/7701 Arithmagons activity: http://nrich.maths.org/2670 School website: http://www.aboyne.herts.sch.uk/</p>

If you have an aspect of interesting practice that could be shared or are interested in finding out more about a case study please get in touch by emailing exchangingexcellence@hertsforlearning.co.uk

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