

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

Do Low Entry High Ceiling activities reduce maths anxiety and positively impact upon progress?

Chater Junior School

Context

Chater Junior School is an average-sized, two-form entry primary school located in the Watford district of Hertfordshire. Pupils at the school are from a wide range of minority ethnic backgrounds and the majority speak English as an additional language. The school was rated as 'outstanding' by Ofsted in June 2013.

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 Raj Khindey, Assistant Headteacher and Maths Subject Leader at Chater Junior School.*

After having spent many years teaching, I have always questioned why certain children have a fear of mathematics. I was one of these children and always thought that I was 'no good.' After attending Jo Boaler's conference, The 'Great Maths Con' in London, I was truly inspired and after reading both her books, '*The Elephant in the Classroom*' and '*Mathematical Mindsets*', I realised that maths is not a performance subject but a growth one. However, it is important to remember that it takes time and effort is very important.

The children in my current class enjoy maths. However, there are a group of four who were working at age-related expectations at the end of Key Stage 1 but have struggled during their four years at junior school despite targeted intervention. I decided to question these children in an environment where they would give honest answers. They were given a list of statements and had to decide whether they agreed or disagreed. An iPad was left in the room to record their responses and the children were aware of this. Once finished, they were told to come and get me so we could hear and discuss their answers. The interview didn't surprise me so I questioned them further about their response and the content of maths lessons. Three out of the four children commented that they enjoy lessons which had problem-solving activities.

This took me back to the week of Jo Boaler's 'Inspirational [Maths activities](#)' when this particular group of children were engaged and confidently speaking in front of the class about their maths learning. So I decided that my focus question would be: ***Do low entry high ceiling activities reduce mathematics anxiety and positively impact in children's progress?***

Description of my approach

I started with a reasoning activity from David Cook's 'Reasoning Rich Classroom - Upper Key Stage 2' course. It was a simple activity which involved children counting triangles in a pentagon. However, children were challenged with their reasoning of the strategies they used.

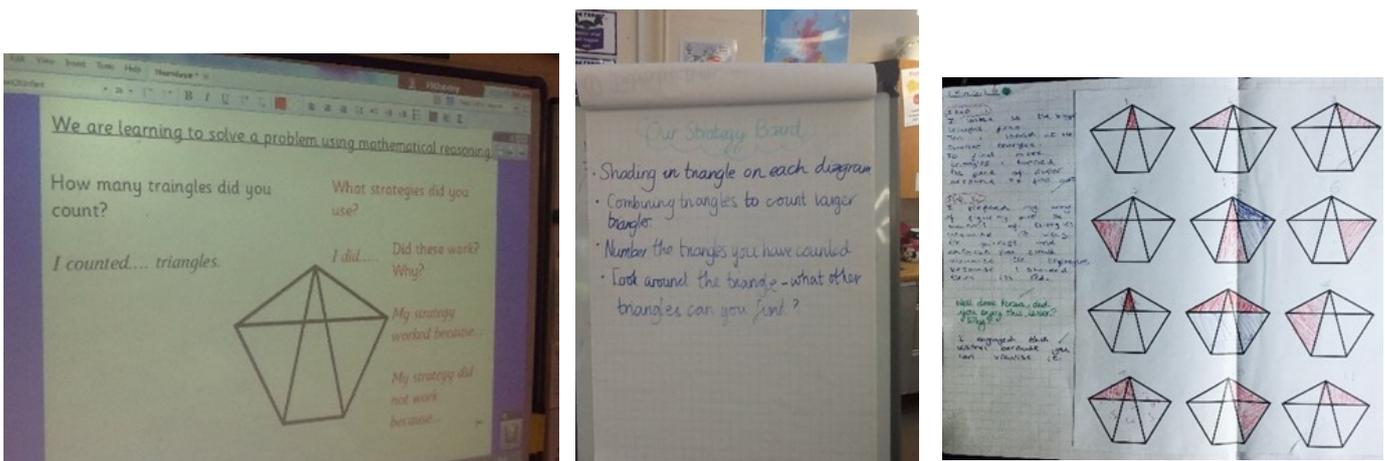
To ensure that the children were comfortable with this activity (after they had said in the pupil interview that they are scared to put their hand up and ask the teacher for help because they didn't want to look silly in front of their friends), I used the strategy board. This consists of gathering children's ideas on how they would approach to solve the problem as a result it helps those children who have difficulty finding a starting point.

All four children enjoyed the activity and said the following:

Child A said, 'I enjoyed this lesson because you can visualise it'.

Child B said, 'I enjoyed this lesson because it is different to what we have done before'.

As a result, this led me to think that these children believe maths is all about number and calculations. So I made a conscious effort to find activities which would be creative and fun! NRICH have an amazing range of these. The article [Using Low Threshold High Ceiling Tasks in Ordinary Classrooms](#) provides further information on how to use these in the classroom.



Fifteen maths lessons involved low level high entry ceiling tasks such as:

- Playing maths games such as NRICH doty six, Strike it out and Magic Five.
- Cross curricular maths and art (optical illusions - Jo Boaler Activity from www.youcubed.org).
- Creating their own maths game linked to Euro 2016.
- Maths in real life activities such as planning for a whole school [Food Enterprise Competition](#), researching and planning costings for an end of year trip to Kidzania which was then shared with the parents.
- Maths workshops such as [NatWest Money Sense](#) in which the children learnt how to budget for a birthday party.

Impact and recommendations

These photos show how Child C's mathematical reasoning has developed through the 'how many triangles' activity to the 'missing shapes' activity. It is evident that Child C is developing the ability to write an elegant mathematical explanation by not including too much description.

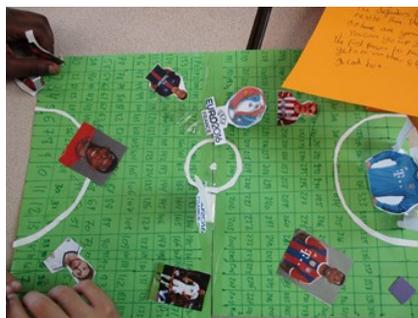
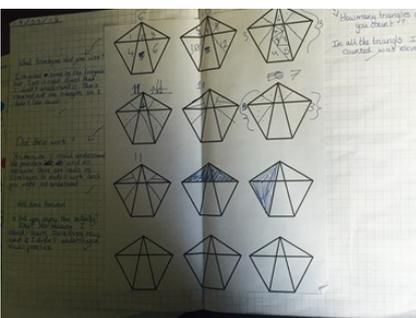
I have observed that all four children are a lot more engaged and enthusiastic in maths lessons - not only them but the rest of the class! Child D's mathematical reasoning is developing and is beginning to contribute more in class. In addition, Child D is enjoying the activities especially when designing a maths game for Euro 2016 compared to before when Child D would disengage and give up when a mistake was made.

At the end of the research I asked the children a variety of questions to identify further impact. The below are some of their responses.

- Child B enjoyed the times shapes activity because it was a challenge and she said I like challenges.
- Child D said I enjoyed the game strike it out because you have to use your maths skills in a fun way.
- Child C said I enjoyed the Chater food enterprise because we used maths skills in a fun way even though we didn't win we made lots of money!
- All four children said that they would prefer more of these types of maths lessons because they are really fun and challenging. They also commented that they enjoy maths more and their confidence has increased. In particular Child D is a lot happier.
- Child B said that I concentrate more and because the lessons are fun and more interesting. Child C said I am confident now but I wasn't at first because I didn't really understand what Miss was saying.
- When asked if they were worried when they make mistakes all children said no because now I learn from them, I will now ask how to do it. Child C said I am not worried because I will correct them and still have fun!

It is evident from listening to the children that these maths activities have had a positive impact on them, especially their view of maths. Since the beginning of the research, these children lacked confidence and were worried when they made mistakes.

As mentioned earlier, these four children were working at age-related expectations at the end of Key Stage 1 but were, however, struggling since joining the junior school. Now two out of the four children have achieved the expected standard at the end of Key Stage 2. The recent SATs and teacher assessment showed that three out of the four children have achieved the expected standard



Widening the approach

I am very lucky to teach in a wonderful two-form entry school. My colleague, who is also the English subject leader, shared her views with me.

She has also seen a real difference in the children's attitudes towards maths since we started teaching using more low entry high ceiling tasks. All of the children are very enthusiastic about these types of tasks as they are accessible to all levels of achievers. She has seen many children in her class grow in confidence since introducing these types of investigations, particularly when it comes to sharing their reasoning ideas. These types of tasks have really helped children to develop their growth mind-set and a 'can do' attitude in maths; she feels that this is down to the accessibility of the tasks set, children really feel like they can achieve and do well in them. In addition, she has seen some very under-confident children really shine in maths lessons recently. Those who would not have previously been confident enough to share their ideas are now much more engaged and feel proud to share their work.

These types of investigations are also really great for the higher achieving children in the class as they do not put a ceiling on their learning. The tasks allow them to be adventurous with maths, explore different possibilities and, at the same time, it really gets them to think about their reasoning. My colleague often found that her higher achieving children can be very 'right or wrong' when it comes to maths. However, these tasks have really made the pupils see that there is not always a final correct answer and often the correct answer lies in really good reasoning.

Overall, my colleague believes the children really enjoy doing these types of investigations and she has really enjoyed teaching them. In addition, my other colleagues have been using a variety of low entry high ceiling tasks and often share these with me for our whole school maths display. Every fortnight each class teacher chooses a piece of maths work from their class to celebrate their effort and achievement. It is not always the high achieving children chosen but those who find maths difficult. I believe that this will show all children that maths is not a subject to fear but enjoy and that everyone can be good at it.



It was very interesting and pleasing to read my colleague's views and the positive impact it has not only had on my class but hers as well. I believe that it is very important for the children to view maths as a creative subject not just a list of calculations to solve which only have a right or wrong answer. I have realised that it is important to maintain a balance; there is more room in our maths lessons for creative activities. I have enjoyed planning these activities and, more importantly, seeing the children's learning develop. In the next academic year, I will develop this further by planning and teaching more reasoning activities in oral mental starters using such resources as the NCETM's reasoning questions.

Being a Year 6 teacher, I understand the pressures of preparing children for SATs. But, I understand that with a greater emphasis on low entry high ceiling tasks being taught on a regular basis will further help the children develop their mathematical reasoning and problem-solving skills as well as enjoy maths!

As the DfE, *New Primary Maths Curriculum (September 2013)* states:

'A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity of the subject.'

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Reading and website references	<p>Boaler, J. (2015) <i>Mathematical Mindsets: Unleashing Students' Potential Through Creative Math, Inspiring Messages and Innovative Teaching</i>, John Wiley & Sons.</p> <p>Boaler, J. (2009) <i>The Elephant in the Classroom: Helping Children Learn and Love Maths</i>, London: Souvenir Press Limited</p> <p>Clarke, S. (2014) <i>Outstanding Formative Assessment: Culture and Practice</i>, London: Hodder Education</p> <p>NRICH, <i>Using Low Threshold High Ceiling Tasks in Ordinary Classrooms</i>, www.nrich.maths.org/7701</p> <p>You Cubed (Jo Boaler activities): www.youcubed.org/tasks</p> <p>Natwest Money Sense: https://natwest.mymoneysense.com/home</p> <p>School Website: http://chaterjm.herts.sch.uk</p>

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