

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

How can the use of language influence children's attitudes to maths?

Nascot Wood Junior School

Context

Nascot Wood Junior School is an average-sized primary school located in the Watford district of Hertfordshire. The school was rated 'outstanding' by Ofsted in 2010.

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 Deborah Higginson, Mathematics Coordinator at Nascot Wood Junior School (NWJS).*

I have long held the belief that the attitude of many of our children, across all abilities, is more akin to lions at the zoo. They lounge around knowing that they will eventually be fed all they need. What I would like to see is more of the 'hunting' instinct where children are curious to know more and to seek out an answer to satisfy their curiosity.

Description of my approach

The pressures of league tables and Ofsted appear to have forced many schools to adopt the 'spoon-feeding' approach and to quote E.M. Forster, "Spoon feeding, in the long run, teaches us nothing but the shape of the spoon". However, through careful planning and outstanding professionalism, NWJS has maintained its ethos of educating children as life-long learners: nurturing a 'growth mindset'.

Unfortunately, I believe many of our children are being disadvantaged by a culture of tutoring for the school entry tests, where the passing of a test is seen as an ultimate goal.

Children, and their families, are judged on the outcome which tells them if they are 'good enough'. This is the embodiment of a 'fixed mindset'. We are very fortunate that we do not set maths homework - another potential source of introducing a fixed mindset from some parents / carers.

The below sentiments often reinforce this fixed mindset view of mathematics:

- You are good at maths
- You are clever
- I was never good at maths

We used videos during 'The Week of Inspirational Maths' (Professor Jo Boaler's youcubed resources: [Maths activities](#)) which showed how the brain is constantly growing and that there is potential for growth in all of us.

Class Dojo, a communication app for the classroom, has a programme of short video clips called '[Big Ideas: Growth Mindset](#)' which are child-friendly cartoons explaining the latest research on brain development.

These were used as starters in maths and during PSHE giving the opportunity for more discussion time. There are paper resources too which enabled me to complete a whole PSHE lesson.

I also shared some children's books with the class:

'Beautiful Oops' by Barney Saltzberg .

'Rosie Revere, Engineer' by Andrea Beaty;

'The Girl Who Never Made Mistakes' by Mark Pett and Gary Rubinstein;

The next step was to try choosing and using language to convey the growth mindset ideas such as:

- Mistakes are expected, inspected and respected.
- Challenges are valued.
- Hard work and effort grow new connections in brains.
- We are all mathematicians this lesson.
- We believe in you.

I began to use the following language both orally and in written feedback:

- Let's do something we can learn from, not something easy.
- This is hard - it's what I call fun.
- Share something you learned today.
- Who had a good struggle?
- Just imagine how many connections you grew today.
- Who thinks they made an interesting mistake that will help us all learn?
- How have you grown as mathematicians?
- Tell me how you have worked systematically/methodically/logically.
- You have shown great resilience by checking and correcting your work.
- You have shown great resilience by finding all the possibilities.
- You have explored a range of strategies, which one was key for you?
- You have set your work out clearly so that it can be reviewed by other mathematicians.
- What a super strategy - can you share it with everyone?

My starting point was with my whole class. There are many very able children in the class who were used to only achieving success. They were intimidated by each other and, in turn, they intimidated the less confident children. In maths, many children didn't value talk partners, preferring to work alone. So, maths lessons were very quiet and the atmosphere lacked passion.

The results have been dramatic.

After showing the Class Dojo videos and using a 'growth mindset' language approach, the first change that I noticed was in the written dialogue, as evidenced in pupils' work below:

Dialogue: I am still not confident at angles. My closest estimate was a 1°. I was struggling to use the protractor to find the answer. I know I got some wrong but I am learning from my mistakes so I am proud. I think next time I should make the lines longer!

Dialogue: I only found 2 fault free rectangles, but the all red rectangle was really hard. I was a good mathematician because I worked systematically, and I felt that I really challenged myself. This lesson was really fun.

4) I am going to try and use algebra!

$x = ?$ limit = 100 Great maths!

$\frac{n(n-3)}{2}$ $\frac{20(20-3)}{2} = \frac{340}{2}$	I copied this for future help. find plan!	Key: 20 side shape X Y Dialogue: I enjoyed this I am not good at algebra. But I think I worked my best!
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Dialogue: I found this a bit frustrating but in a good way, it made me more engaged. I made a couple of mistakes but I recognised them like. I put 12 hours instead of 24 hours because there's not 12 hours in a day there's 24. I enjoyed this. I was very close to the answer (504), I don't see where we've gone wrong but I think I got quite close. Me and ~~my~~ worked together at first and then we did different things. I worked systematically and I worked like a mathematician. And I enjoyed this and I like these sort of questions I would like to do more of them in the maths lesson.

does give
~~HT HT~~
 $= 16 \text{ times}$
 I've I really
 there's not 12
 and day of 24

Dialogue: I found it tricky at first but once I got the technique right for the first one I found it much easier to apply my skills to the others. I found it really helpful to watch the video of the GCSE drawing and I am proud that I have achieved a GCSE standard!

Dialogue: We are investigating how to know if a number is divisible by 7. We are at the early stage of it but we are going to carry this on next time. I am quite confident and I know what my next step is.

Well done, ~~you~~, you have presented your work clearly so that it can be reviewed by other interested Mathematicians.

Then I noticed the following change in the atmosphere during the lessons:

- Far more interaction between pupils.
- Greater resilience to try out new ideas.
- Children across all abilities readily drawing out and using manipulatives.
- More willingness to self and peer assess using moving on points.
- A sense of excitement and confident competitiveness.

Talking to groups of children, I noticed that they felt empowered as a group as well as individually. Pupils made the following comments:

'We knew we were right and were happy to prove it to the boys. They were convinced that they were right too and we could see how their way looked as if it worked and then we tried it and they tried our way. We found what we think is a mistake so our next step is to join up with them and look at both methods together.'

'[My partner] and me wanted to try different methods to see which was best. Then I heard [children on another table] who were doing the same as me so I went over to see what they'd got and I had ideas to help them.'

'I like that there are different ways to get an answer. I think different to other people but that's not bad, just different.'

'I think my maths has improved. I know that I use what I know to find out what I don't know and if in doubt I draw it out!'

Widening the approach

Having achieved such a transformation with my class, I wanted to share it across the whole school. I therefore held a staff meeting to share my question and the results that I had achieved. In order to establish a baseline, I asked the staff to ask their classes to complete the 'Growth Mindset Maths Questionnaire' devised by Helen Hindle. I then asked them to follow similar procedures to the ones that I had initiated and to record any changes that they noticed.

Colleagues were fascinated by the results of the 'Growth Mindset Maths Questionnaire' and made the following comments:

'My top table were all strongly fixed!' (Year 3 teacher).

'The majority of my class were showing a move towards the growth mindset, but 10 were fixed. These tend to be the most able at maths at the moment.' (Year 3 teacher).

'This is so interesting. Many of mine scored 16, which just put them into the 'cannot be categorised' section, but I believe they are fixed. It will be interesting to see if I can move them forward.' (Year 4 teacher).

'My very fixed mindset chap really shows it in sport.' (Year 4 teacher).

'I knew [he] was a fixed mindset as he finds it difficult to enjoy P.E. When the teams are chosen, if he perceives himself to be on the weaker team he will not play – even though he loves sports.' (Year 5 teacher).

Impact and recommendations

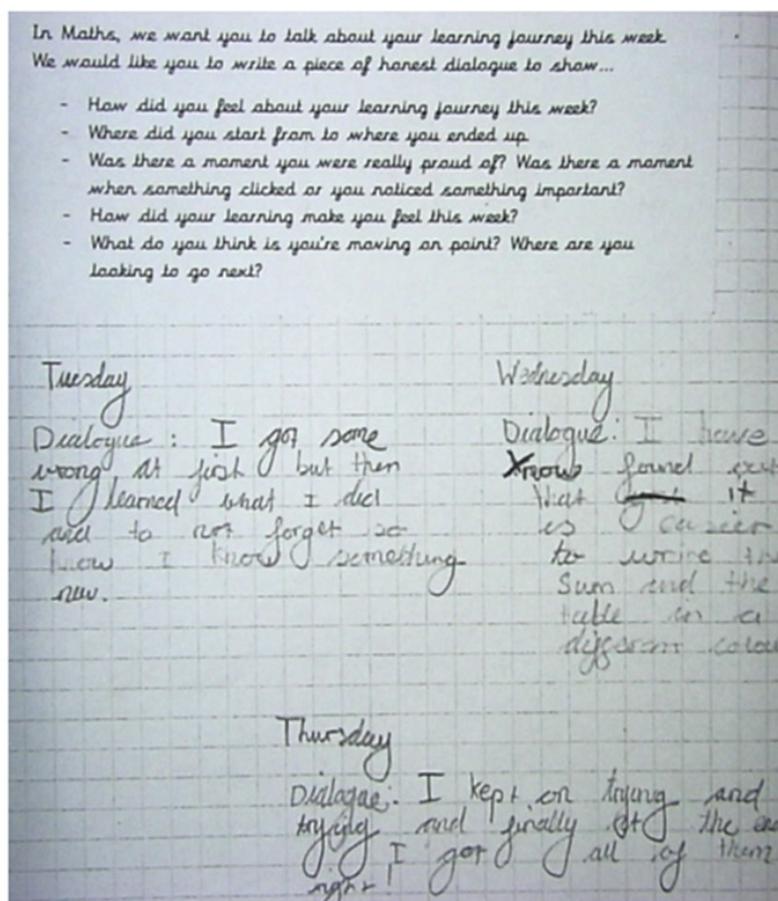
Over time, in my own class, I started to explore other curriculum areas where a 'growth-mindset' could be reinforced. As a year group, we took part in the 'Fiver Challenge' competition as part of 'Young Enterprise' and we shared this sketch note by Sylvia Duckworth as an illustration of how a successful business is created.



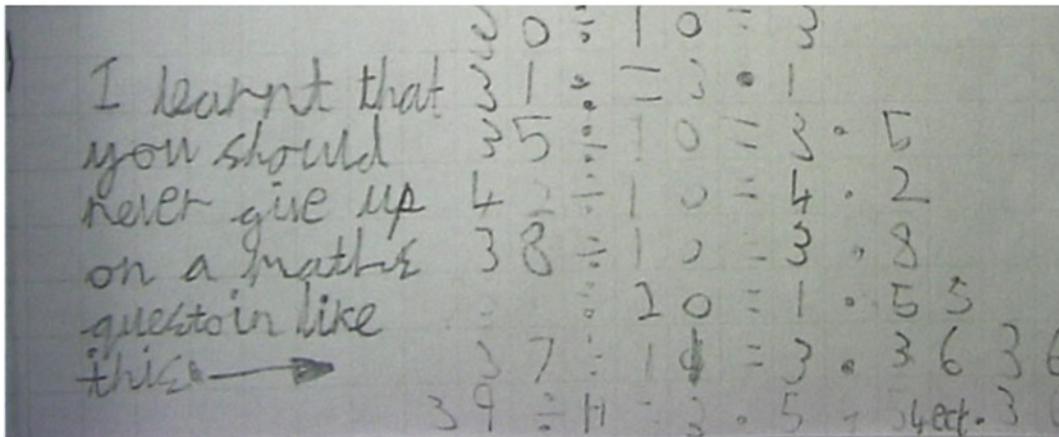
The children immediately recognised it as a 'growth-mindset' idea and were very excited to see a 'real-world' application of a concept they had been embracing.

Meanwhile, anecdotal evidence from the other year groups started to emerge as teachers were finding a similar growth in enthusiasm and resilience in maths. The dialogue in books reflected this:

Year 4 child:



Year 3 child:



Year 6 found it too difficult to fit in a 'growth mindset' programme in which they could devote sufficient time to because of the pressures of the changing SATs. However, there will be a continuation next year with the other year groups and there are plans to introduce it to the new Year 3's from September.

In visiting the 'Growth Mindset Maths Questionnaire' devised by Helen Hindle again, it was found that the children who were not able to be categorised in the initial assessment were now more likely to have migrated towards the 'growth mindset' score (85%). Those with a strongly fixed mindset, however, remained in that region. This is by no means a scientific analysis. Everyone appreciates that where a particular concept or idea is promoted, children, who love to please, will adapt their response to what they think will be an approved 'correct' answer.

To sum up, class teachers who introduced the 'growth mindset' ideas during PSHE and used the language of 'growth mindset' in their mathematics lessons found that the children responded positively to the messages. The atmosphere in maths lessons and evidence from their dialogue suggests that many children embraced the key ideas of: learning from their mistakes; resilience and effort. Although assessment data shows a positive trend in mathematics for the majority of children, I feel that it is too early to attribute any specific percentage to the research project. However, I feel that this simple, cost effective change, which gives mathematics a favourable image, enhances the children's enjoyment. This should ultimately lead to enthusiastic participation and should, therefore, result in a rise of attainment over time.

Moving forwards, I would like to keep the consistency of a 'growth mindset' across other areas of the curriculum and empower new staff to embrace the culture. Also, during parent consultations, to introduce the language of 'growth mindset' and encourage them to use the ideas at home.

Contact	Deborah Higginson, Mathematics Coordinator at Nascot Wood Junior School
Reading and website references	<p>'Week of Inspirational Maths' Jo Boaler Youcubed</p> <p>'Elephant in the Classroom' by Jo Boaler</p> <p>'TED Talks: The Official TED Guide to Public Speaking' by Chris Anderson, curator of TED</p> <p>'Beautiful Oops' by Barney Saltzberg .</p> <p>'Rosie Revere, Engineer' by Andrea Beaty</p> <p>'The Girl Who Never Made Mistakes' by Mark Pett and Gary Rubinstein</p> <p>'Raising Achievement' by Robert Powell</p> <p>'Mindsets in the Classroom' by Mary Cay Ricci</p> <p>'Mindset' by Carol S. Dweck</p> <p>'Teaching Resilience to Children' by Lynne Namka</p> <p>'The Perfect Teacher' by Jackie Beere</p> <p>'The Iceberg Theory of Success' by Steve Mueller</p> <p>www.classdojo.com/BigIdeas</p> <p>https://www.youtube.com/watch?v=ManC7UO0HeY</p> <p>http://www.growthmindsetmaths.com/ Helen Hindle</p> <p>'Growth Mindset Maths Questionnaire' devised by Helen Hindle.</p> <p>http://nigelholmes.com/graphic/two-mindsets-standford-magazine/</p> <p>https://www.perts.net/</p> <p>https://www.mindsetkit.org/</p> <p>https://www.youtube.com/watch?v=86LIN8vRsTg&nohtml5=False</p> <p>https://www.teachingpacks.co.uk The Growth Mindset Pack</p> <p>School website: www.nascotwoodjm.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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