

Investigating the impact of using natural history videos on the teaching and learning of primary mathematics

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The Natural Curriculum is an online teaching and learning resource using BBC natural history videos to inspire and enthuse young learners. The project, which adopts a cross-curricular approach, began as a collaboration between primary school teacher David Millington and the Educational Recording Agency (ERA). Initially its resources focused on using natural world video clips as a stimulus for teaching primary literacy. The project later expanded to include primary mathematics. In the academic year 2021/22 NRICH and The Natural Curriculum collaborated to design four online problem-solving mathematics lessons for primary-aged learners. The lessons were trialed in nine primary settings where feedback was collected using pupil questionnaires and teacher interviews. The findings indicated positive impacts on both pupil engagement and learning, but also highlighted possible challenges facing practitioners regarding the perception of the primary mathematics curriculum among some learners.

Keywords: natural history; primary mathematics; video; engage

Background

This paper explores the impact of using natural history videos to support the teaching and learning of primary mathematics. In England over the last hundred years the teaching and learning of primary mathematics has reflected changing views regarding direct instruction versus exploratory learning. Many students studying mathematics in the early twentieth century experienced direct instruction through a curriculum teaching traditional calculation procedures. The Hadow Report (1931, p.102) championed a more engaging and explorative approach whereby learners would be 'keen to solve a problem' such as crossing a river. Thirty years later, this approach was echoed by The Plowden Report which stated that 'At every stage of learning, children need rich and varied materials' (1967, p.196). Further calls to adopt an exploratory approach towards the teaching and learning of mathematics followed, notably Ruthven (1989). Following the growth of the Realistic Mathematics Education approach in The Netherlands, the English government launched The National Strategies (1998-2011) and its curriculum handbook described mathematics as a creative subject offering 'moments of wonder and pleasure' (DfEE, 1999, p.60). In some ways, the National Strategies moved away from traditional teaching methods by encouraging differentiated teaching alongside an encouragement to teach less traditional calculation strategies, but it also attempted to formalise direct teaching through the introduction of its 'three-part' mathematics lesson. As the new millennium approached, an exploratory approach combined with the 'Low Threshold High Ceiling' (LTHC) design principles described by Papert (1980) was adopted by the NRICH mathematics outreach project, a collaboration between the Faculties of

Mathematics and Education at the University of Cambridge,. NRICH describes its LTHC exploratory materials as enabling ‘everyone to get started and everyone to get stuck’ (NRICH, 2019). It is an approach which enables its resources, which are intended to engage and enthuse young mathematicians, to be deployed with whole classes. Meanwhile, national policy changed again following the introduction of international league tables, resulting in the introduction of a new national curriculum (DfE, 2013). Since then, many primary learners have experienced direct teaching as whole classes, and an increase in lessons focusing on number recall and traditional calculation procedures, accompanied by a corresponding decrease in the study of other areas of the mathematics curriculum.

The Pilot Project

The Natural Curriculum <https://www.naturalcurriculum.co.uk/> is an online teaching and learning project intending to use BBC natural history video clips to inspire and enthuse young learners. The project began as a collaboration between primary school teacher David Millington and the Educational Recording Agency (ERA). Its initial resources employed selected video clips as a stimulus for teaching the primary literacy curriculum (DfE, 2013). For example, Figure A.

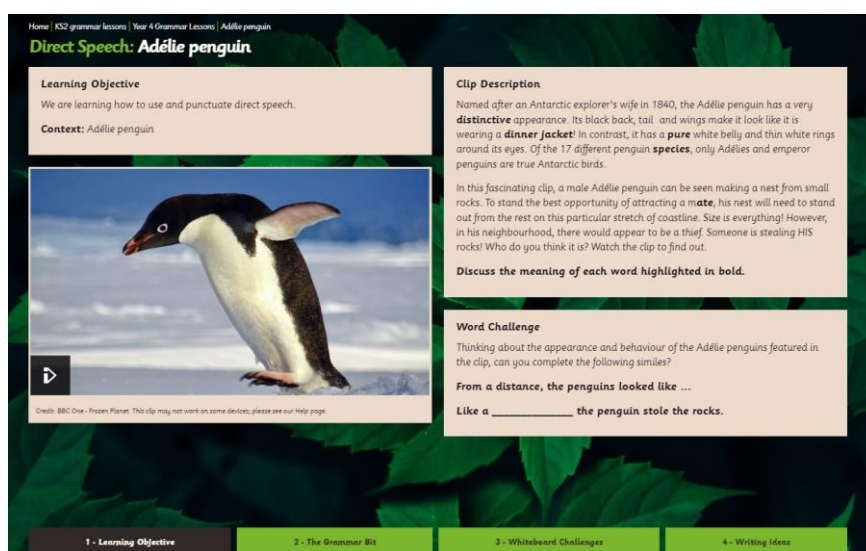


Figure A: Screenshot of a Year 4 Literacy Lesson (The Natural Curriculum, 2023)

When The Natural Curriculum expanded to offer mathematics resources, it invited NRICH to help design and pilot a set of problem-solving activities. NRICH is an outreach mathematics project specialising in designing challenging, engaging non-routine problem-solving resources for school-aged learners. The resulting pilot resources developed by NRICH and The Natural Curriculum consisted of four lessons (two for Year Three and two for Year Four) addressing mathematical curriculum topics beyond basic numeracy. This design decision was influenced by existing research highlighting the importance of nurturing visualisation skills among primary learners (Nunes et al, 2009) and the potential benefits of valuing estimating skills in the primary mathematics classroom (Lord, 2017).

The Year Three lessons explored non-routine problems developing estimating and measuring skills ([Voracious Vole](#) and [Robin and Mole](#)), and the Year Four lessons focused on estimating and symmetry ([Starling Murmuration](#) and [Megan's Snowflake](#)). A key design decision was ensuring that the selected video clips were

essential viewing for completing the problem-solving activity, rather than solely acting as a stimulus for further work. For example, in [Starling Murmuration](#) learners needed to observe a video clip of starlings to enable them to check that the presenter’s estimate for the total number of starlings in the murmuration for themselves. Each lesson followed The Natural Curriculum planning template which consisted of a selected natural history video clip and associated warm-up Number Challenge, followed by The Problem and Further Challenges (see Figures B1 and B2 featuring screenshots from the [Starling Murmuration](#) lesson).

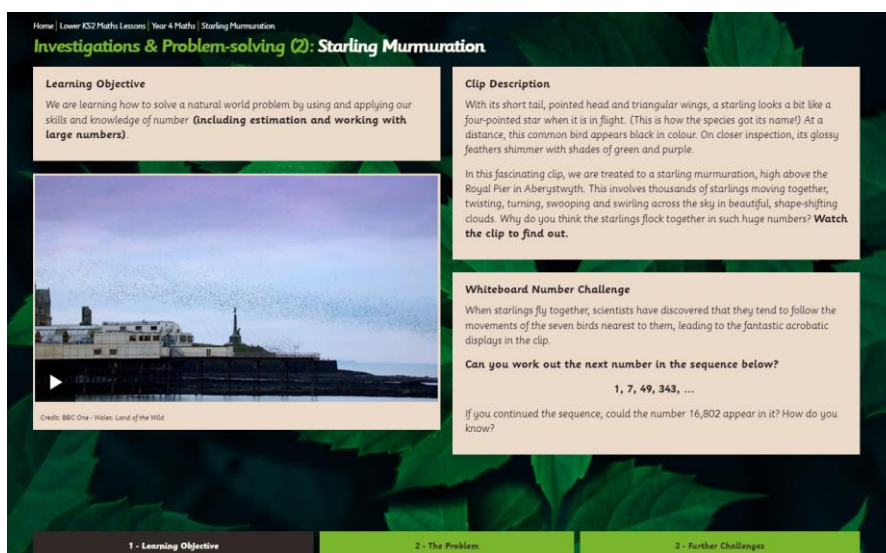


Figure B1: Screenshot of opening page of resources for [Starling Murmuration](#) showing video clip link and Number Challenge (The Natural Curriculum, 2023)

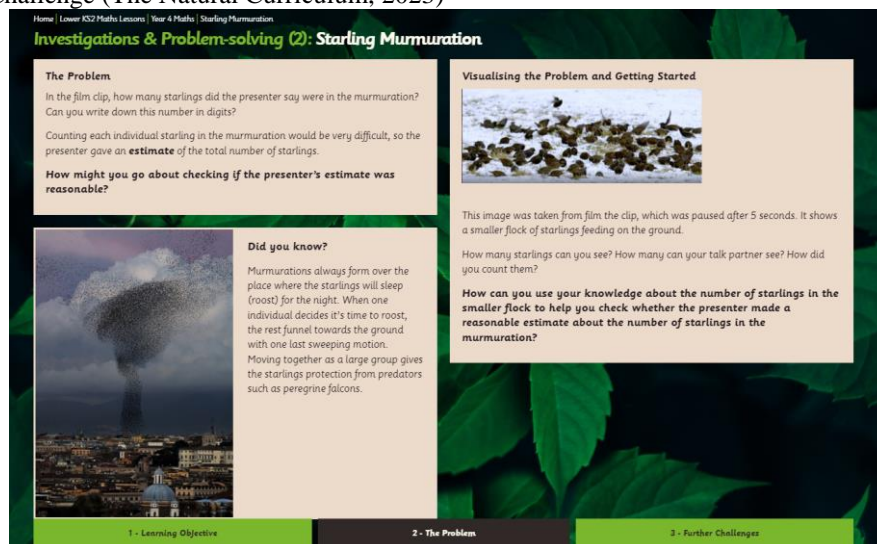


Figure B2: Screenshot of second webpage of [Starling Murmuration](#) showing The Problem (The Natural Curriculum, 2023)

Sample

NRICH launched an online recruitment call for schools willing to pilot the new resources. Over 70 schools registered their interest in the project by completing an online questionnaire confirming their cohort sizes, their willingness to share anonymous data with the research team and confirming whether the teacher completing the online form had received Senior Leadership Team approval to

participate in the trial. The final selection of nine pilot schools was drawn randomly from those meeting the criteria. Each school was sent details outlining the approaches taken by the research team to ensure confidentiality and security of their research data. Parental permission forms were also shared with the schools.

Data Collection

NRICH set up an online project page so that the schools taking part in the pilot study could easily access the pilot project guidance and teaching resources which were accessed via a link to The Natural Curriculum website. Each of the participating schools was asked to trial two lessons with their Year 3 or Year 4 classes during their spring term. Afterwards, they were asked to hand out a pre-printed learner questionnaire to each member of their class to collect their feedback. The learner questionnaires contained six closed Likert-style questions using learner-friendly wording, and two open questions to elicit further responses. Where parental permission had been granted, the anonymous completed questionnaires were returned to the NRICH team for analysis.

Findings

NRICH received $N=303$ completed learner questionnaires with parental permission granted ($n=127$ Year 3 questionnaires from four schools, and $n=176$ Year 4 questionnaires from four schools). The questionnaire responses consisted of both quantitative and qualitative data which were uploaded to an Excel spreadsheet. The following paragraphs explore the key findings from the analysis.

‘What was the best thing about the lessons?’

When the learners responded to this open question, almost two-thirds (64.0%) wrote about how much they had enjoyed learning about nature, especially learning new facts about the natural world. Typical comments included:

My favourite part of [the] lesson was when we learnt about the robin
I could see a video of a real mole
The best thing was we learned about wildlife
I loved watching the video about the moles
They were really fun to watch and do, I loved watching how snowflakes are made

More than three-quarters of the learners (75.6%) reported that they had ‘learned something new about nature’, and just over half (54.8%) reported that they had ‘learned some new maths in these lessons’. Several learners commented on the cross-curricular approach to the lessons which combined mathematics and nature:

The clips about nature helped me learn and concentrate more
I liked how it puts forest class and maths together
It helped you see things from a different perspective
I did not learn just about maths, but also about nature
I liked that they included animals in the maths, and we got to do some folding

‘What could we do better?’

The learners were also asked to suggest possible ways to further develop the lessons. Most of their comments related to the perceived level of difficulty of the activities.

Some learners commented on the enjoyability of the activities and there were some suggestions about possible animals to feature in future activities.

A third of the learners (66.7%) commented on the perceived level of challenge of the activities. Opinion was almost equally divided between making no changes to the activities (14.9%) and making the activities easier (16.5%). Few learners (2.3%) suggested making the activities harder. Here are some comments from learners who suggested that no changes should be made:

These lessons were great, and I am excited to do more
We don't need to do anything better because this is great
Nothing because it is perfect and I love it!

These comments came from learners who felt the activities should be changed:

We could make things a little easier for a starter
Word them in a different way
You could make the questions easier

Several learners (3.0%) suggested featuring different animals; their ideas included familiar animals such as rabbits as well as larger animals, including those found in jungles.

Is it maths?

A small but significant number of learners (4.0%) indicated that they struggled to associate learning about estimating, working with symmetry and measures with mathematics. It appeared that they felt their class lessons should focus on number and calculations. Typical comments included:

It needs to be more about numbers
Do more times tables and more sums
Do division
A little more maths

Their comments may have reflected the impact of national testing on the primary curriculum, and the corresponding effect on the mathematical experiences of young learners following a curriculum dominated by numeracy skills. Working mathematically requires various skills beyond the recall of number facts and procedures, especially a willingness to persevere to tackle unfamiliar problems, apply learning and work with others to find one or more solutions.

Teacher feedback

Although the extended school February half-term break and courier delays meant that there was insufficient time to conduct teacher interviews before the data collection window closed, a Y3 and a Y4 teacher from different schools emailed their comments to the NRICH team.

The Y3 teacher wrote:

Just a quick email to say we had a buzzing lesson today with the water vole work. The children loved it. We ended up on the playground with some string estimating how long 9m 60cm was. They then walked along the line to get a sense of the length pretending to be a very hungry water vole! Thank you for all the work that has gone into this. Looking forward to the moles tomorrow!

The Y4 teacher wrote:

Thank-you for inviting us to be part of your pilot - we all really enjoyed it. The Y4 team fed back to staff during one of our maths staff meetings and the Y6 team

took a sneaky peak at the resources as they study birds next, and specifically starlings and starling murmuration as part of their next writing unit!

Discussion

The findings indicated that bringing the natural world into the classroom was a popular teaching and learning approach among many Year 3 and Year 4 learners. The students reported enjoying watching the videos, estimating numbers and making snowflakes. Learning new facts about the natural world was valued by many learners. Moving forwards, ensuring that the reading ability of the learners does not hinder access to the resources requires further consideration. Future resources may also benefit from communicating more clearly how the activities are developing the mathematical skills of the young learners.

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