Learning from the Mary Anning Project

● Stuart Naylor (writing on behalf of the Mary Anning project team: Marianne Cutler, Derek Bell and Wynne Harlen)

Abstract

The Mary Anning Project provides a set of resources for primary school children and their teachers. Evaluation in trial schools during 2020-21 shows that the project had a positive impact on children's learning and teachers' willingness to adopt new teaching strategies. Feedback from teachers suggests that the teaching approaches that they use can be influenced purely through the provision of suitable teaching resources.

Below are some of many quotes from children's interviews after they had experienced the Mary Anning Project (Cutler, Bell, Harlen & Naylor, 2022):

'You have to think harder. It opens your mind to think of things that are out of the box, which might eventually lead to an answer.'

'I learned that scientists are not always correct, and we have to listen to other people's ideas.'

'What I loved about this project is that I never felt like I was getting things wrong. My ideas always counted – they were as important as someone else's ideas.'

These were fairly typical of the responses from children, when we sampled groups of six children in 14 of the trial schools. An interesting question for teacher educators is what led to children making comments like these? We could speculate that learning about Mary Anning's life and her fossil discoveries is fascinating for children; that the pedagogy employed by the teachers was highly suitable; or maybe that other factors were involved. That speculation is the focus of this article.

A brief outline of the project

The project aimed to develop teaching resources to enhance 9-11 year-old children's understanding of some aspects of evolution, the nature of science enquiry and the strengths and limitations of scientific knowledge, using Mary Anning and her fossil discoveries as a backdrop. It also aimed to develop suitable guidance for teachers, including relevant content background, suitable teaching strategies, the nature of enquiry-based learning and the relationship between science and other subjects.

An award-winning, cinema-quality 15-minute film sets the scene by dramatising the sale of the first ichthyosaur fossil skull. Through this, children quickly identify with Mary and the problems that she faced at that time, and generate questions that they wish to answer through the project. The classroom activities that follow fall into four main areas, dealing broadly with Mary Anning's life and background, her most important fossil discoveries, extinction of animal species, and how scientific ideas are based on evidence. Nine core activities present questions that can be tackled by all the children in a typical primary classroom, while six enrichment activities might be tackled by some children, offered to the whole class with suitable support, or chosen by some children for additional research and enquiry. Most of the activities use visual ways of representing information (Petty, 2018) in order to support and enhance children's understanding of conceptually challenging ideas.

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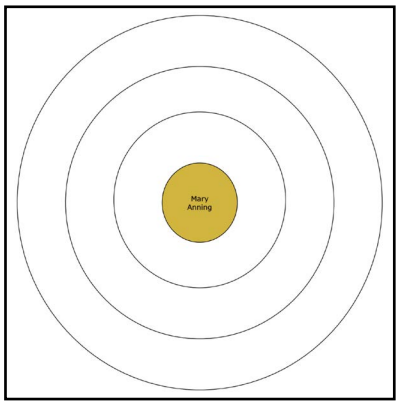
Extensive teacher support material was developed, with two main purposes: to provide activity-specific guidance to enable teachers to manage the activities successfully; and to provide information and ideas about the content and pedagogy so that they could use the project resources effectively. This includes the rationale and guidance for a pedagogy that develops children's thinking through enquiry-based, dialogic teaching approaches. In other words, the teacher support material focuses on professional development as well as relevant background information.

After an initial pilot with 10 schools, 38 schools agreed to trial the project resources during 2019-20. Because of the COVID-19 pandemic, this was postponed until 2020-21.

Feedback was collected in a variety of ways from selected groups of children and from the teachers involved in the trial.

Examples of classroom activities

1. What helped Mary to make her discoveries and develop her ideas?



The main feature of this activity is a bullseye card sort, with Mary Anning at the centre. Groups of children discuss a set of statements, decide how significant each statement is to Mary making her discoveries, then move it to the most suitable place on their bullseye. (Close to the centre = they think that it made a big difference; further away = they think that it didn't make much difference.)

The statement cards include interesting but irrelevant points, such as 'Mary was struck by lightning when she was very young'. Other points are much more significant, such as 'Mary's father was a cabinet maker, so she could borrow tools like hammers and chisels' and 'The rocks at Lyme Regis are very crumbly, and often fall onto the beach after storms'. High-achieving or highly interested children are encouraged to select additional cards for extra challenge, or use some blank cards to create their own statement cards to go on the bullseye.

After each group completes their bullseye, they share ideas across the class. They identify areas of agreement and disagreement and, after discussion, they agree on what were the most important factors that made a difference to Mary making her discoveries.

2. Why are there no ichthyosaurs alive today?

Groups of children are presented with a list of five animals that have become extinct (sabre-tooth tiger, woolly mammoth, tyrannosaurus rex, dodo and passenger pigeon), challenged to find out through research why these might have become extinct, and then reach consensus about the reasons across the class through discussion and argument.

This leads in to being presented with a list of possible reasons why ichthyosaurs might have become extinct (e.g. predators that ate ichthyosaurs became more common and ate all the ichthyosaurs, or

catastrophic events such as meteor collisions had a big effect on the climate). Each group selects one reason, does some research, then creates an ichthyosaur extinction storyboard with drawings and captions to illustrate how they think ichthyosaurs might have become extinct. They present their storyboard to the rest of the class.

Finally each group chooses an animal that is currently endangered, finds out why the population is under threat, then creates an 'endangered' poster for that animal, summarising the reasons why it is endangered.

Activities and pedagogy

The examples above deal with ideas that seem interesting. Certainly, many of the children involved in the project were absolutely fascinated. There seems to be no reason why children wouldn't be engaged – apart from the fact that, in schools all over the country, teachers constantly offer interesting ideas to children, but some of the children choose not to engage. There doesn't seem to be a lot of evidence to show that ideas, in themselves, consistently engage children's interest and attention.

What about pedagogy? There was an explicit intention in this project to build pedagogy firmly and inescapably into the classroom activities. What the classroom activities have in common is that they are easily accessible to the majority of children; they don't require extensive instructions or teacher introduction; they generally begin with questions, not information; there are no obvious right answers; children's ideas make a difference to how the activity develops; and they have a clear sense of purpose. In other words, each activity in the project uses a dialogic approach (Alexander, 2008), in which children's ideas are important, discussion and argumentation are expected, and alternative viewpoints are analysed using evidence, reasoning and justification. As a consequence, each activity also provides opportunities for formative assessment, as was evident in feedback from teachers at the end of the project.

What is notable about the quotes from children at the beginning of this article is that they refer to pedagogy, not content. This positive reference to the teaching approach came through consistently in the interviews with children, written evaluation feedback from teachers, and interviews with teachers. The evidence that we have is that children engaged with the ideas in the project, not just because they were interesting, but because their own ideas were sought, shared, valued, explored and developed further.

Our most important priority in developing the project was to create classroom activities that use a dialogic approach, with ongoing formative assessment from children sharing their ideas. There were also other priorities.

We built in opportunities for differentiation by creating activities that are procedurally simple, with easy starting points, but conceptually varied. Most of the activities can be tackled at a fairly simple level or at a more conceptually challenging level. The strong emphasis throughout on children's ideas means that they can tackle most of the activities at a conceptual level that suits them. The children involved in the project helped to set their own suitable challenges, rather than this being left for the teacher to manage. We also created enrichment opportunities for children who are higher-achieving, more knowledgeable and/or more interested, where the level of conceptual challenge is greater.

We built in opportunities for interdisciplinary teaching by ensuring that children can't engage in most of the activities from a single subject perspective. For example, the first activity above raises questions for children about aspects of science, history, religious beliefs, social class, women's rights, economics and education. Although the question arises in a science context, children are inevitably drawn into other subject areas as they attempt to answer it, and this is similar for each of the project activities.

We built in opportunities for children to experience the use and importance of evidence by ensuring that every project activity requires children to use evidence in one form or another. None of the activities simply present a view from authority; instead, children are expected to research, discuss, understand and interpret evidence, and reach consensus about its significance. For example, an activity about the shape of the Earth requires children to understand and interpret evidence on statement cards, share their thinking, engage in justification and argumentation in relation to their ideas, and reach a common view on the significance of the evidence. Another activity focuses more on the limits of evidence, where children investigate what features of a fossil can or can't be identified by observation, and recognise the need for further evidence to draw firm conclusions.

What is the relevance for teacher educators?

The project's aims were rather ambitious. As well as developing the children's understanding, they included developing teachers' understanding of various aspects of pedagogy and influencing the way in which they teach. However, there was no opportunity to offer any training to the teachers involved (apart from those in the small pilot project), and all the project resources are freely available on the ASE website for any teacher to use. So our challenge was to influence how teachers teach, purely through the nature and quality of the resource materials provided.

Here's how some teachers responded:

'I feel that I have gained so much as a teacher through my reflection on my own learning alongside the children.'

'Learning myself to allow students to think for themselves was a great learning practice for myself.'

'I loved the fact that this project inspired and engaged not only children but also the staff. As a science leader, this was excellent CPD for my team.'

'This has been a brilliant project and will change the way I teach science in the future.'

Of course, these are selected quotes – they weren't all that good! But many of them were, and it was clear that the great majority of the teachers responded very positively to the project, with many of them indicating that their practice **had** been influenced and they intend to make changes to the way that they teach science in future.

We can suggest why the project appears to have had a positive impact on many of the teachers. As indicated above, what many children readily responded to is the pedagogy embedded in the project activities. Even though children found the topic interesting, what really captured their attention was the opportunity to have their voices heard and valued. Without visits to the trial schools because of the pandemic, we have little knowledge of what the project schools are like, but when children make

comments such as *'What I loved about this project is that I never felt like I was getting things wrong. My ideas always counted'*, there appears to be a clear implied comparison with their previous experience.

Research evidence suggests that changing teachers' professional practice is generally far from easy. But how will teachers respond if they see their children engaged, excited, motivated and enjoying their learning? If their children respond positively to the pedagogy that they are using, if they get undeniable evidence from their own classroom, maybe it isn't surprising that many of the teachers seemed very willing to make changes to their professional practice. Darwin's ideas on natural selection don't just apply to evolutionary change in living organisms; they can also apply to social and professional change. Teachers tend not to continue with teaching approaches that don't seem to work for them; conversely they are much more inclined to use strategies that give them minimum hassle and maximum learning.

The way in which the project activities were constructed made it easy for teachers to adopt a dialogic approach without requiring major shifts in their values or beliefs. The way that the project activities were constructed actually made it difficult to use a more didactic approach, even if a teacher would normally use that approach in their school. We believe that this made it much more likely that teachers would adopt a dialogic approach during the project. Our aim of influencing how teachers teach has definitely been achieved in practice with many of the teachers involved. We have been able to influence the teaching approaches that teachers use purely through the provision of suitable teaching resources.

In writing this, I came across an article previously written for *School Science Review* (Keogh & Naylor, 2007), which draws an obvious parallel with the main focus of this article. It seems worth repeating the final paragraph here:

'...helping to create circumstances in which there is more talk and dialogue in classrooms may not be too difficult. There are plenty of strategies that can be used without any radical shifts in how teaching and learning are organised. Our research tells us consistently that opportunities for talk, dialogue and learning conversations are likely to be well received by pupils. And if pupils respond positively, get more engaged and find lessons more productive, then teachers are likely to do more of it. So gradually both pupils and teachers take on new roles during lessons, and roles become transformed without any conscious decision to do this. And because there is no conscious decision to transform roles, there is no resistance to role transformation. In this way, small-scale evolutionary changes can result in major shifts in professional practice over a period of time, and talking and thinking in science can become embedded in science lessons.'

References

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Stuart Naylor is an independent writer, researcher and teacher.