Science-based books: task or pleasure?

● **Patrick Egan**

Abstract

This article examines data gathered in a study of using non-fiction and fiction science-based books as a basis to stimulate interest in learning about science to primary school children in Ireland. The data gathered were part of a project with four schools that were involved in a doctoral study thesis. As a result of this, the researcher established a school-based reading challenge for children aged between 6 and 10 years to read science-based books, centred in their school and home environments. Prior to undertaking the project, a survey was conducted where teachers helped identify children's reading habits as well as their knowledge of the science process. After the time allotted to the challenge had ended, participating teachers completed questionnaires and a sample group from each school were interviewed. Evidence relating to reading for pleasure was identified, extracted from the data set and analysed, and more positive attitudes resulted from taking part in the project. Contemporary science-themed books were found to be, in themselves, a source of pleasure. The study concluded that it is possible to differentiate between the pleasures of fiction and non-fiction science books: the types of pleasure that can be differentiated, and that different types of pleasure derived from reading science-based books can also be differentiated, ranging from extrinsic to intrinsic and including sensory to aesthetic.

Keywords: Reading, fiction, non-fiction, science information story books, aesthetic

Introduction

'Somerset Maugham once said that all intelligent people over twenty read nothing at all. Nowadays, all intelligent people over twenty read nothing that's not assigned' (Gore Vidal, 1993).

Many will concur with Vidal's assertion that most people, particularly in the school environment, only read to further their studies. Doris Lessing furthered this with:

'Books, literature…should be seen as pleasure, full of surprises and paths leading to whole worlds of delight and never a sort of agenda or requirement of the adult world' (Lessing, 1998, p.49).

While reflecting on these views, we can be certain that both these writers felt that children's pleasure in reading may be harmed by adults who deem reading as 'assigned' or as 'a requirement'. Can the same be assumed of science-based books? Until recently, reading in the USA has focused on fiction to help to learn science. However, the Common Core State Standards and the Next Generation Science Standards both emphasise the reading of non-fiction texts to gain specific skill sets for analysing information (Job & Coleman, 2016).

Science is viewed as a cross-curricular approach whereby children are encouraged to explore, observe, and find out about different things pertaining to the world around them (DfE, 2014). Finding things out for scientific purposes is usually achieved through enquiry-based activities, which develop children's enquiry skills such as observing, asking questions, and looking for patterns (Sackes *et al*, 2009b). These skills lend themselves well to early years settings as they lay down the foundations for developing scientific skills and attitudes needed for later school life (Sackes *et al*, 2009b). Cremin *et al* (2015) indicate that there is a synergy between science education and creativity in the early years, which allows teachers to contextualise children's investigative and exploratory engagement in meaningful ways.

Therefore, children's literature, whether it is fiction or non-fiction, is deemed an effective pedagogical tool that gives children a context for exploring concepts in the science classroom (McLean *et al,* 2015). The availability of such tools offers a solution to the lack of resources that teachers have for implementing practical enquiry-based instruction to develop children's enquiry skills (Sackes *et al,* 2009b). Sackes *et al* (2009a) recognise the difficulty in teaching science to young children and advocate that literature offers a solution for teachers, as books are an instrument that they feel confident in using. It is important to utilise teachers' familiarity with stories to *'foster inquiry-based pedagogical approaches to science'* (McLean *et al,* 2015:49).

Researchers recommend lists of books, criteria against which to choose from available books, and pedagogical approaches to using books to teach several science concepts (Sackes *et al,* 2009a: 415), suggesting that they enhance early years science education. However, several limitations, which could lead to misconceptions, have been identified within fiction books, including inaccurate illustrations (Trundle & Troland, 2005), fantasy (Ganea *et al,* 2014) and anthropomorphism (Waxman *et al,* 2014).

Sackes *et al* (2009a,b) contend that children's literature is becoming more popular for teaching science as it fosters positive attitudes and interests towards learning. Books can stimulate students on both the emotional and intellectual level, and children can readily identify with their *'imaginative illustrations, engaging storylines and the warm emotions that surround their reading experience'* (Ansberry & Morgan, 2007:1). Children are more likely to engage with ideas, because literature also supports children's ability to learn difficult science concepts as the content knowledge is laid out in the form of a narrative that aids their growing understanding (Sackes *et al,* 2009a). Bannister and Ryan (2001:75) found that conceptual connections are *'carried by the narrative links',* which indicates that there is a strong correlation between using stories to teach and children's increased learning. Horton (2013:38) argues that children are able to retain more information when it is presented in the format of a story. She found that this is partly due to *'the structure of stories which are familiar and accessible'.* Children, especially in the early years, have a familiarity with stories, as they permeate their day-to-day life and thus it seems reasonable to introduce science concepts this way (Sackes *et al,* 2009a).

However, researchers warn that teachers should be aware of the possible scientific misconceptions contained in children's fiction books (Ansberry & Morgan, 2007), as they *'present the most serious obstacles to learning scientific concepts'* (Sackes *et al,* 2009a: 416). For example, in *The Very Hungry Caterpillar* by Eric Carle, children might be led to believe that caterpillars eat a variety of food including cherry cake, lollipops and ice cream. If we are using books to teach children specific science concepts, we must ensure that these are represented accurately. Trundle and Troland (2005) analysed popular storybooks about the Moon; the books were chosen because of their easy accessibility for teachers. The most prominent inaccuracies found were the depictions of the Moon; they were often pictorially inaccurate and there were inconsistencies about the Moon's phases, amongst other things. By using literature that contains inaccurate facts, educators may unintentionally introduce misunderstandings that render that book redundant by the fact that it has provided children with false ideas about science. Although, Cavendish *et al* (2006) emphasise the fact that stories can be used as starting points, because children enjoy them and this will enhance their inclination to listen.

Methodology

This article draws on data gathered at various times over two years as an extension of a doctoral study. The aim of the research methodology was to understand not the enquiry but the product itself, and further look at the lived experience of primary schools (Gall *et al,* 1999). Within this study, qualitative research was used to look at the lived experience regarding the use of fiction and non-fiction books to facilitate the teaching of science (example books are listed in Table 1). Semi-structured interviews were conducted with 10 staff members from 4 rural primary schools. This comprised 7 teachers who were mainstream teachers, and 3 teachers who actively taught in the primary school but also held posts of responsibility for science within the school. As part of the recruitment process, teachers from 4 rural primary schools in the mid-west of Ireland were invited to

take part. In order to concretise results, a triangulation system, in line with Stenhouse's pioneering (1975) introduction to curricular research and development, is utilised. This will incorporate many aspects of education including motivation, desire and imagination.

Study ethics

The research adhered to the British Educational Research Association's (BERA) code (2011) addressing informed consent, confidentiality and secure data storage. Ethical sensitivities included a possible sense of obligation to participate and abuse of trust, ownership, issues of privacy, long term anonymity and special insights possible only to those deeply on the inside of the institution (Costly, Elliott & Gibbs, 2010). As such, BERA (2011) is the governing system for this work and, following approval from the school's Board of Management, written informed consent was acquired from teachers who partook in this research.

Data collection

Pre- and post-study questionnaires were completed, as well as semi-structured interviews that were conducted to determine the perceptions of teachers regarding aspects of the reading intervention programme. Participants were interviewed by the study researcher via Zoom while adhering to Marton's phenomenographic approach to identifying the perceptions of participants' lived experiences (Marton, 1988). The interviews were recorded to support analysis.

Data analysis

Following Marton's method of phenomenographic analysis, all questionnaires were uploaded to Google Drive and an Excel spreadsheet was formed to document and compare the results. Once all the interviews were conducted and recorded, they were each transcribed into a Google docs file. This involved a series of steps in which the data were categorised and sub-categorised into codes and themes, which included familiarising with the data, honing and refining the lower-level codes, and organising these into thematic clusters. After this was completed, a qualitative thematic data analysis was undertaken for the purpose of *'identifying patterns or themes, within qualitative data'* (Delahunt, 2017, p.3352). In 2018, the General Data Protection Regulation (GDPR) came into force in the European Union (EU). At all times, GDPR guidelines were followed and respected and the information gathered was kept securely.

Results

The post-project interviews and questionnaire showed that 98% of teachers considered the project to be very enjoyable, with many pedagogic benefits that impacted on the success of the

Book	Author
The Inventor's Secret	Suzanne Slade
Welcome to our Neighbourhood	Shaun Sheehy
Papa's Mechanical Fish	Candace Fleming
I Love this Tree	Anna Claybourne
Bacteria Book	Steve Mould
The Lighthouse Keeper's Lunch	David Armitage
What Makes You YOU?	Gill Arbuthnott
The Boy Who Harnessed the Wind	William Kamkwamba
Eye Benders	Clive Gifford

Table 1. A selection of books related to the project.

intervention. One teacher interviewed stated that: *'The books chosen really orientated the children to science activities and encouraged them to explore and discuss their books further. The books seemed to serve as a basis to various lessons and not just science, for example the book about women in STEM led the children to discover further women in history and modern history'.*

The project also yielded a good response to the teachers' and children's sense of wonder about the various books that they read. A second teacher stated that: *'As I teach in a multi-class setting, I was fortunate to give 7 of my older children all the same book. I was fortunate to also be able to elicit the children's conceptions and build my science class around the books, which led to a more collaborative and informed approach'.*

A different teacher in the project had also observed the children discussing the books with their peers and he integrated the books actively into an oral language paired activity, in which he asked the children to tell one another about the science book that they were reading and what science experiments could be undertaken based on the book. He commented that: *'This method was extremely useful for two children in my class for whom English is their second language. By encouraging them to discuss their books, they also built on their spoken language as well as their scientific language'.*

Prior to discussing the above findings in further detail, it is prudent at this stage to discuss the limitations of the current research that has yielded these results. One concern was that the saturation of science-based books would overload the children and somehow 'turn them off', but the various fiction and non-fiction books and the introduction of these over a year did not seem to deter either the teachers or the children. One teacher commented that: *'The drip-feeding of the books was very cleverly organised and, even though there was a scientific element attached to them, the children never seemed to get bored; for example, such books as 'The Pebble in my Pocket' and 'Cloudy in the Sky with Meatballs' were a stark contrast to 'My Book of Quantum Physics' and 'How Things Work'.*

On a personal note, one limitation that the researcher experienced was how time-consuming the research was, particularly when trying to complete another study in tandem. Also, as this study is small-scale, it must be remembered that this only offers a small-scale view of what teachers think but, in order to overcome this issue, *'triangulation in regards to imagination, desire and motivation, was considered to be crucial because, in essence, it is difficult to create rogue summaries when different components yield the same results'* (Stenhouse, 1975).

Discussion

Many pedagogic findings arose during the study, which impacted on the success of the programme. The project not only introduced children to the collaborative learning approach for science, but also to the joy of reading fiction as well as non-fiction science books. It seemed to help that the chosen books, such as *Eye Benders: the science of seeing and believing* by Clive Gifford, were beautifully illustrated. The findings in the project corroborate with those of other studies on how to promote reading for pleasure. Cremin *et al* (2014) recommend encouraging informal book-talk and creating a social reading environment as pedagogical strategies that foster enjoyment.

Many science information books lend themselves to being looked at by a couple of children together, which very naturally facilitates discussion and book-talk. Often, fact-intriguing snippets of information are presented that are easily read and remembered; information is usually in chunks and does not need to be read in linear fashion; and readers of varying reading ability can find a page that interests them and negotiate their way around it, chatting to a fellow reader as they do so (Alexander & Jarman, 2015). Children said that they liked to talk about the books that they had read with their friends and family. There was evidence that boys especially liked to pass on facts that they had learned to their peers.

Throughout the duration of the project, children usually undertook book-related activities. These included designing a cartoon strip of a scene from their book; shared reading activities with their guardian; designing and displaying science information posters or writing; and directing and producing a short film. Some contributed to group oral presentations, themed as 'big up your book'.

Such activities were optional and self-selected. The reading was not to facilitate the task, but rather to foster pleasurable associations with literacy. During the interviews, children spontaneously reported benefits from these ancillary activities, which they positively associated with the actual experience of book reading.

Even though there were many benefits from the project, it is clear that teachers should be aware of the possible scientific misconceptions contained in some factual books, as these can present the most serious obstacles to learning scientific concepts. Evidence reviewed from Sackes *et al* (2009a) concluded that anthropomorphism was not a *'specific or substantial problem with science learning'*; however, they suggest that language and illustrations in children's literature may present a source of misconceptions. Ganea *et al* (2014:4) investigated the effects of both anthropomorphic imagery and language and found that anthropomorphised language increases children's tendency to *'attribute anthropomorphic traits to animals'.* Therefore, information books may be the best choice to foster the development of children's scientific concepts, as they are a written format of scientific discourse. When presenting the argument in relation to information books to the group of teachers, six of them disagreed, as they believed that many non-fiction texts fail to address content in a meaningful way, indicating that fictional texts are also believed to be significant for the teaching of children. Furthermore, it has been noted that children acquire more scientific language when it has been taught through fictional stories, as this helps to master unfamiliar and abstract terminology. Books also support vocabulary as well as reinforce it through a combination of practical tasks and language games, which can be a useful strategy for noticing children who misuse language, and consequently address misunderstandings.

Books are an important way to bridge the gap between children and the content of science. Books give us a sense of who we are and put meaning into context. It was clear that, during the project, children engaged and were enabled to develop both reflective and communicative skills that could allow them to develop essential life skills of collaboration, problem-solving and critical thinking. From the project, it is clear that the books also helped to teach tricky concepts such as the shape and structure of the body's organs. Children need to investigate their stories to see how things all fit together, so teachers should allow time for children to think and encourage the expression of all ideas.

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Dr. Patrick Egan is a primary school teacher in Ireland and a doctor of science education.
E-mail: PatrickMacaogain@hotmail.com