reading to learn about birds and their conservation

Reading about NZ birds is a useful activity in primary science programmes as *Junjun Chen, Bronwen Cowie* (both from University of Waikato), and *Kim Oliver* (Marian Catholic School) explain:

Introduction

Active reading is an important activity for making meaning during the process of science inquiry (Osborne, 2010). As Bulman (1985) explains, "if we wish to give our pupils a taste of being a real scientist then reading should play an important part in our science lessons" (p.19). This statement is even truer in today's information age with rich and varied science texts available through a wide range of resources, in particular the news media and Internet (Hipkins, 2010).

Research has shown that student subject-specific reading proficiency can become a gatekeeper to their further learning (Greenleaf et al., 2010; Pearson, Moje, & Greenleaf, 2010; Wallace & Hand, 2007). Students who will become future scientists need to be capable of reading actively, critically and evaluatively (Wellington & Osborne, 2001). If they are to participate in socio-scientific debates and decision-making processes as active and involved citizens (Ministry of Education (MOE), 2007), *all* students need to be able to gain information about science matters through reading.

Opportunities to talk science and interact with a range of texts, when complemented by hands-on activities, can stimulate children's interest in the world around them and in science itself (Bull, Gilbert, Barwick, Hipkins & Baker, 2010). The skills such as engaging with a range of science texts and using their growing science knowledge when considering issues of concern to them are endorsed in the *communication* aspect of the nature of science strand in the New Zealand Curriculum (NZC). Asking questions and finding evidence are part of *investigating in science*.

The integration of science and literacy can enhance student learning in both areas (Greenleaf et al., 2010; Wallace & Hand, 2007). However, research has shown that for students to learn to read critically, teachers need to make explicit the tacit reasoning processes and strategies needed to become successful readers (Lemke, 1990). Teachers also need to consider the quality of the science reading materials they use in order for students to gain the most benefit from reading activities (Pearson, Moje, & Greenleaf, 2010). In this paper we describe the range of interactive and collaborative instructional reading approaches a teacher (Kim) used to engage her Year 7 students in learning about native birds.

Reading approaches to learn about birds and their conservation

The science unit was aimed at helping students understand why certain birds in New Zealand have a threatened status or have become extinct, and to investigate various conservation methods to protect New Zealand native birds. Kim used a variety of reading approaches throughout the unit, including shared reading, reading to students, reading in small groups and guided reading. In the main, she sourced reading material from the Science Learning Hub (SLH): http://www.sciencelearn.org.nz/[1]. The Hub materials are based on current New Zealand research and aligned with the NZC.

The researchers observed ten lessons through the unit, interviewed students after the first and the final lessons, and interviewed the teacher after the final lesson. The students completed a pre- and a post-test. Here we provide detail on these reading approaches.

Shared reading

Shared reading is an approach in which the teacher, as a reader and facilitator, supports students as readers and listeners (Ross & Frey, 2002). It allows a high degree of teacher-student interaction to help students read and understand the text and come to see themselves as effective readers (MOE, 2006). During shared reading, both the teacher and the students can see the text even though students may not have an individual copy of it.

Kim employed shared reading using handouts and online materials, sometimes in combination, to introduce new science ideas. For example, in Lesson 7, Kim wanted students to understand the methods used to protect native birds, along with the pros and cons of each method. Kim handed out a copy of the article *Protecting Native Birds*. Before she began reading the article, she instructed, "I would like you to highlight the key pieces of information with your partner as I read. Just the key bits of information."

While she was reading the article, Kim asked the students to explain the meaning of some technical terms such as 'non-target species'. She did this to make sure students understood the science meaning of key terms within the context of the unit. Then she accessed the SLH website and projected the same article onto a screen and guided the students through the article, enlarging and explaining the images embedded in it. She said, "I'm just putting up the article that I read to you. Here is the image of a *Predator-proof Fence*, so if I click on it, [it will] come up a little bit bigger." She asked questions like, "Why do you think the vegetation has been cleared away from the edge of the fence? Why are there big strips either side?" (Video data, November).

In this example, Kim's actions indicated that although the students were to read silently she expected them to be active readers as well as listeners. She encouraged the students to identify the main ideas in the text. More than just reading for literal meaning, Kim's questions guided students towards inferential thinking as in the giving of reasons for clearing the vegetation from both sides of the fence. Kim thought that there were advantages to the handout and to the online article for shared reading. During the shared reading of the handout, she could stop reading and ask questions when she thought her students might need support or they looked confused. The students could highlight key ideas on the handouts and keep the handout for later review.

When using the online-shared reading, the visual information played a greater role. Kim could enlarge

[1] The Science Learning Hub is an online portal funded by New Zealand's Ministry of Science and Innovation, formally the Ministry of Research, Science, and Technology, and managed by Wilf Malcolm Institute of Educational Research, the University of Waikato since 2007.

the images so that the students could see more detail, and online the images came with pop-up explanatory notes. Because of this the students were more able to take advantage of the information the images depicted. This approach links well with the intention of the communicating in science strand in NZC because it supported students to consider more critically the images and the writer's purpose in using them. Many of the students appeared to find the online text very engaging and to find the images informative.

Reading in small groups

Student reading gains can be linked to their opportunities to talk with others about a text (Guthrie, Schafer, Wang, & Afflerbach, 1995). In small group reading, the teacher can scaffold a group to help them make sense of the text and become actively engaged with it. Students themselves can work together to arrive at a deeper understanding of the text through discussion. Kim made considerable use of reading in pairs or in small groups using both handout reading materials and online reading materials. For example, in Lesson 1 students, in small groups, read the article *Native Bird Adaptations* on the SLH website.

This lesson focused on biological adaptation and its effect on an organism. First, Kim used a deck of playing cards to randomly assign students to 'home' groups of four students (groups had to include each suit in the pack). She then regrouped the students into four 'expert' groups (one for each suit in the pack). Each 'expert' group read the article to answer the question that had been allocated to them. Once the group had agreed on the answer, the students went back to their 'home' groups and shared their answers with other group members.

Kim made it clear that she expected the students to read, synthesize, and interpret the reading and then answer their assigned questions using their own words: "It will be great if you aren't just copying what is on the website. If you could use your own words, I will be even more impressed." (Video data, October) In this way, Kim ensured that students were able to 'talk science' using their own words (Lemke, 1990).

Kim indicated she had two distinct purposes for using reading in small groups: to encourage students to work together, and to enhance their science learning. While the students were reading, Kim circulated around the groups and provided support to make sure students understood the article. She explained the technical vocabulary using straightforward language, and examples that linked to students' prior knowledge and life experience. Kim emphasised, "It's good to find an example from their own life." For example, when students read that adaptation occurs over many, many generations, they could not understand the word 'generation'. Kim explained: "What does it [generation] mean? Your grandparents to your parents, it is one generation, and then to you, it is another generation, when you grow up, and you have children, that's another generation…so it takes hundreds of years for adaptation to occur."

When students' prior knowledge is activated and they make connections between what they know and what they are reading this improves their reading comprehension and helps them to hypothesise, infer, and build their own interpretations (MOE, 2006), something that is also important in learning science.

Linking reading to hands-on activities

It is important that students understand the reasoning that underpins the activities their teacher asks them to do. Teachers can use reading materials to help with this (Weiss et al., 2003). Kim's students read and talked about the different types of predators and the impact of bird habitat loss prior to making tracking tunnels to check the presence of predators in the school gully. Understanding the kinds of threats birds face was important when they came to locate their tracking tunnels in the school gully. When the students checked the tunnels, not many of the tracking paper strips had footprints on them. The students realised that this was evidence that their area was probably safe for native birds. The students really valued this activity. It prompted some of them to think more widely about taking action to conserve native birds. Some students placed tracking tunnels in gullies near their homes and brought the evidence of predators to school. As Kim commented, "Obviously, they [students] were interested in it and enthusiastic about it." This action provides a science-based example of participating and contributing in science as outlined in NZC.

Reading stories to students

Reading to students is a time when the teacher is the reader, involving the students as active listeners as they jointly enter the world created by the story or other materials (Ross & Frey, 2002). For this, students do not need to have a copy of the text. Kim read a number of books and articles to her students. For example, in the final two lessons Kim read aloud the book *Old Blue* by Mary Taylor (1993). This is a story of how the Chatham Island Black Robins of New Zealand were brought back from the edge of extinction.

During the reading Kim posed a number of questions. For example, when reading that, "The black robin had become the rarest bird in the world. Only a miracle could save it from extinction," Kim asked, "Can anyone make a prediction about what they [the scientists] did?" Predicting is a strategy that can used to prompt students to anticipate what will come next. It involves using prior knowledge and information in the text and relates to inferring meaning rather than mere speculation (MOE, 2006, p.139).

Throughout the reading, Kim also used questions like this to prompt students to recall and make connections with what they had learned in the previous lessons, such as adaptation, the impact of predation, and the role of birds in the ecosystem. The children really enjoyed the *Old Blue* story, as one student commented in the interview, "I was very interested in the story – how we create more robins and how we grow more of the plants they like." It brought the ideas of the unit to life for the students and was used strategically by Kim to help her students to create a coherent, cohesive mental image of the focus of the unit. It also helped the students understand the nature of scientists' work.

Student outcomes

Student attitudes towards science were surveyed before and after the unit. Findings indicated that students' attitudes towards science were more positive after the unit. Student and teacher post-unit interviews confirmed that their enjoyment and interest in learning science had been increased. As might be expected, comparison of the pre- and post-test results showed that students' understanding about native birds had increased. However, both the teacher and students were of the view that students had learned much more than usual. One student said, "I learnt quite a lot more. When I heard that we were going to learn about kiwis, I thought I knew a lot about them, but then I realised that there was quite a lot that I didn't know." In their end-of-unit evaluations, 20 of the 23 students stated that they had learned facts relating to native birds, 5 stated that their understanding had increased, 6 stated that the unit had been interesting, and 12 stated that they felt more confident in their knowledge of native birds and the threats they face.

Concluding comments

The NZC promotes a view of students as confident connected lifelong learners. With Miles Barker (2010), we agree that ideally students also need to become confident connected lifelong *science* learners. Reading can play a role in this. Various forms of communication and reading are important aspects of scientists' work and in learning science. The birds' unit described here included a combination of reading, writing, discussing and doing activities, although overall it could be claimed that reading was a dominant activity. While reading is often contrasted unfavourably with opportunities for students to build science knowledge through hands-on scientific exploration, we hope that we have illustrated that reading can be an interactive activity that builds students' interest in and ability to engage with science ideas now and into the future. Teachers have a rich repertoire of reading approaches and strategies that can be used with multiple positive outcomes as part of science lessons. With careful teacher guidance, the reading of different texts can foster active student engagement with ideas that replicates the kinds of thinking needed to interrogate and make sense of data in science.

For further information contact: **j.chen@waikato.ac.nz**

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