Using Popular Fiction to Inspire Scientific Inquiry

By Kristin Cook and Winn Wheeler

Teachers often use literature both as a hook into and throughout inquiry-based instruction (Cervetti et al., 2006; Pearson, 2010). This tendency to embed literature into the science classroom indicates that many teachers use literacy as an access point to spread disciplinary instruction across content areas (Cook & Dinkins, 2015b; Yager, 2004). The use of literature in the science classroom can strengthen students’ scientific inquiry skills by presenting a context for exploration and providing a springboard into interdisciplinary, real-world problem solving (Bush et al., 2015; Cook & Dinkins, 2015a, 2015b; Grysko & Zygouris-Coe, 2020). Jaeger and Ratzer (2019, p. 2) describe the ways in which literature can provide a launching pad into inquiry:

How can we get ... students to think, consider, verify, or investigate more? ... How can we use the power of books to spark thinking, student voices, and collaboration? These activities will make the difference between a simple read-aloud and a springboard to inquiry.

Research has shown that when making connections across disciplines, teachers and students alike draw heavily on popular culture (specifically, movies, fictional texts, and novels); researchers therefore suggest that educators look to the area of popular culture as a means by which to engage students in science and literacy practices (Moje, 2008).

Many teacher educator preparation programs do not provide opportunities for preservice teachers (PSTs) to experience and examine the use of popular fiction as a connection point to science teaching; as a result, PSTs are unlikely to bring such practice into their future classrooms (Kurt & Pehlivan, 2013). Furthermore, the structure of many teacher preparation programs facilitates the isolated development of content-area methodologies. As PSTs experience their methods classes in these silos, they do not experience—and may fail to recognize—the “synergistic relation between literacy and science” (Grysko & Zygouris-Coe, 2020, p. 497). To address these challenges, we (a science educator and a literacy educator) created an experience for PSTs to consider the ways in which a popular text, Song for a Whale (Kelly, 2019), could lead to an exploration of a range of science content and practices underscored in the Next Generation Science Standards (NGSS; NGSS Lead States, 2013). Our aim was to support students in learning and applying core concepts and practices in our methods courses in a concerted effort to better prepare teachers to integrate literacy and science in their own future classrooms.

Project description

Twenty-one PSTs interested in becoming elementary school teachers were part of this project. The project took place in the spring semester of PSTs’ junior year, when PSTs learn content methods for different disciplines, including science and literacy methods. Given PSTs’ interest in teaching in prekindergarten through
Grade 5, in which all content areas are taught by a single person, the science and writing methods professors saw an opportunity to give PSTs the chance to use a carefully selected text as a springboard for instruction in each of their methods classes. Song for a Whale was a logical choice in the writing classroom because of the different modes and genres of writing that are present in the text. The text was an appropriate choice for the science methods class because the main character, Iris, is deeply interested in science, technology, engineering, arts, and mathematics (STEAM) topics and using engineering processes to solve problems she faces. Methods classes focus on pedagogy rather than science content, but this text offered the additional benefit of weaving in several different strands within science (e.g., Earth science, life science, physical science, and engineering).

In the literacy methods class, PSTs participated in collaborative discussions about the text, the author’s writing techniques, and potential curriculum connections (see Online Appendix A for guiding questions). PSTs also engaged in reflective writing as a means of solidifying their thinking about methods and processes that emerged through discussions and their own self-reflection. In the science methods course, PSTs extended their reading to explore potential science connections across the strands of science to reveal deeper science content in the text, and they considered how the text could be used as part of the 5E planning process.

Alongside reading and reflecting on the text within the literacy class, PSTs were required to develop an inquiry-based lesson in their science methods class. Using the 5E Instructional Model (Bybee 2015; Bybee et al., 2006), PSTs completed the template (see Online Appendix B for the template found in Bush & Cook, 2019) to design an inquiry-based science lesson to springboard from Song for a Whale. Each project design was required to (i) use Song for a Whale to connect to the NGSS (NGSS Lead States, 2013) in an inquiry-based lesson; (ii) incorporate strategies for teaching reading, writing, and viewing in tandem with content; and (iii) follow the 5E lesson planning structure.

The lessons described in this article are examples of what PSTs created through this cross-curricular collaboration. Lessons were selected based on their appropriate application of science content and pedagogy so that they could illustrate potential connection across strands of science and offer examples that would be appropriate for classroom use in the specified grades. Such pairings of content and pedagogy not only work well across methods courses but also could be incorporated in undergraduate general science courses (e.g., biology, chemistry, physics) as a springboard for discussing essential concepts and ideas.

### Song for a Whale connections to science

Lynne Kelly’s Schneider Family Book Award winner, Song for a Whale, chronicles the story of Iris, a 12-year-old aspiring engineer and scientist who is deaf and grappling with the recent loss of her beloved grandfather. As Iris makes her way through the typical challenges of adolescence, she must also navigate the difficulties of loss in a school where she is the only deaf student. In her science class, Iris learns about Blue 55, a baleen whale who struggles to communicate with other whales because of a difference in the pitch of his song. Iris becomes determined to devise a way to communicate whale songs to Blue 55. Adventure follows as Iris commits to creating a song Blue 55 can hear and uses her skills with fixing radios to create a special speaker that will allow Blue 55 to understand that he is not alone and that he is heard.

The multivoiced text offers the perspectives of both Iris and Blue 55 through first-person narratives told through prose and a bit of poetry. Given the novel structure, composition of the text, and subject matter, myriad opportunities for curriculum integration between science and writing methods courses were evident. In terms of writing instruction, the text offers models of different kinds of writing, as well as a portrayal of the development of Iris, a compelling main character, as she uses science in her daily life—including through her inventiveness as an engineer when fixing old radios and her obsession with understanding the nature of sound, even though she is deaf.

Within the context of the writing methods course, PSTs read and discussed the text and started thinking about points of integration for both writing and science. Suggestions that PSTs offered for topics that they could address to integrate science included exploration and research of the ocean ecosystem, animals and animal communication, animal sanctuaries and their role in supporting animal survival, acoustic biology, the nature of sound, states of matter, astronomy, opportunities to create or engineer something new, and recycling. After the initial reading and group conversations about the text, the PSTs were excited and surprised by the possibilities for content connections. One PST reflected in a manner congruent with her peers: “I am learning more about how we can make connections to other content areas with books and readings that we use in the classroom. So many books make connections that I never would have thought of before reading the book we read for this class.” PSTs’ use of literature as a springboard into teaching science was a promising sign of their development as teachers. Such promise is illustrated by another PST’s thinking:

**Song for a Whale is a unique book since there are multiple...**
areas of core content connection. Not only could this text be used for the purpose of writing or literature, but it could be connected to science, math, the arts, or even STEAM activities in the classroom. This book works as a springboard for students’ learning, meaning that they can take the information and knowledge in this book to go even further. While it is an excellent springboard for students, it is also a wonderful mirror, window, and door text for so many students.

Inquiry-based science lessons

To support PSTs in incorporating science literacy into their instructional thinking, the course culminated in each student designing an inquiry project that they could implement in their future classrooms. This section includes examples of PST-created 5E lessons that showcase the variety of ways they used the text as a springboard to inquiry. We selected exemplars that highlighted different content areas within science as well as ones that targeted Grades 3 through 5 (grades in elementary school where the text would best fit). Table 1 showcases the variety of ways in which PSTs connected the text to the NGSS (NGSS Lead States, 2013) in planning their inquiry projects.

Life science: Exploring structure, function, and information processing

Song for a Whale offers a clear entry point to exploring methods of communication because of the overarching concept of the text, which is that both Iris and Blue 55 have unique situations in which they are not able to communicate with members of their group in typical ways: Iris is not able to hear, and Blue 55’s whale song is at a frequency that other whales cannot hear. This invites students to consider the logistics of communication: How do structures create sound, and how is the sound processed by other members of their group?

Here are how teachers can engage students in the five phases of the 5E Instructional Model:

• Engage: Students will have the opportunity to view between three and five short video clips that show animals communicating in different ways. This activity will be a springboard for students to generate questions for a Know-Wonder-Learn (KWL) that they will use to note their thinking throughout the lesson. Teachers collect ideas from students on what they already know and what they wonder about, and students will come back to the chart later to fill in what they learned.

• Explore: Students will engage in station work to explore different ways that animals communicate by viewing video clips and reading articles; new findings will be recorded on the KWL chart. Discussion at each station and a whole-class discussion to end the station work will further support students’ developing understanding.

• Explain: Students will use a KWL chart in the beginning of the lesson to capture their prior knowledge and after interacting with the content to synthesize their new learning. Students’ questions and key vocabulary related to the lesson will provide the basis for teacher explanation. The teacher will lead the students in creating a concept map as they fill out the final column on the KWL.

• Elaborate: By answering an open-response question, students will transfer their new learning about how animals process information through their senses to communicate different messages by viewing video clips and reading articles; new findings will be recorded on the KWL chart. Discussion at each station and a whole-class discussion to end the station work will further support students’ developing understanding.

• Extend: Students will use a KWL chart in the beginning of the lesson to capture their prior knowledge and after interacting with the content to synthesize their new learning. Students’ questions and key vocabulary related to the lesson will provide the basis for teacher explanation. The teacher will lead the students in creating a concept map as they fill out the final column on the KWL.

<table>
<thead>
<tr>
<th>TABLE 1</th>
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<tbody>
<tr>
<td>PSTs brainstorm of how Song for a Whale connects to the NGSS.</td>
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<tr>
<td><strong>Topic of book connected to science</strong></td>
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<tr>
<td>How do animals use their senses to process information?</td>
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<tr>
<td>What is sound, and how does it travel in water and air?</td>
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<tr>
<td>How do Earth’s seasons affect the patterns of stars shown in the night sky?</td>
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</tbody>
</table>
to how they use their senses as humans to process information and communicate key ideas.

• **Evaluate:** Students’ notes from each station and their verbal answers to open-ended questions will serve as indicators of students’ deepening understanding. Students will be summatively assessed when they answer questions related to their experiences with station teaching.

**Physical science: Exploring sound waves**

Echolocation connects to *Song for a Whale*, and in this lesson, students will make connections about how animals use echolocation to communicate. Sonar will be relevant to the lesson to allow students to learn how one can navigate and detect objects under the surface of the sea. Wavelength will be relevant because this is how students will learn more about the start of one sound wave to the end. Transverse and longitudinal waves will be the types of waves the students learn about and make connections to through the lesson. Furthermore, students will consider how sound travels through different mediums.

Here is how teachers can engage students in the five phases of the 5E Instructional Model:

• **Engage:** Teachers will play underwater whale sounds as students enter the room. Students will be asked to consider the sounds as they generate questions and observations. Next, the teacher will display the video that the sounds are coming from, which has the benefit of providing visual input. Students will think about how they used their senses in different ways to process the information. This reflection will activate their prior knowledge about sound as they consider how sound travels in the ocean.

• **Explore:** Students will use stations to explore how sound travels through different mediums; they will make observations in their journal as they move through the stations. At one station, students will strike a tuning fork to see what happens when the tuning fork is held in the air and note what happens when the tuning fork is placed in water. Another station will allow students to experiment with a string telephone and to observe if the sound travels better when the string is pulled tight or held loosely. A third station will have students use a metal spoon attached to a string; students will hold the ends of the string to their ears and notice what happens when the spoon strikes a hard object. The different experiences will help students think about how sound travels through solids, liquids, and gases. After participating in the centers, students will share something that they learned through a circle share.

• **Explain:** An interactive Nearpod lesson will be used to support students’ content understanding. Example questions include the following: Why can we sometimes feel and see sound? Why is sound an important survival tool for some animals, such as whales? How does sound travel? What makes sound? The lesson will also incorporate important terms such as echolocation, sonar, wavelength, transverse wave, longitudinal wave, reflection, and frequency.

• **Elaborate:** Students will work in small groups with a Slinky to generate waves and will observe how waves travel. The main purpose of this activity is for students to relate the Slinky to sound as a model because students will be able to see each coil of the Slinky vibrate in place. Students will write their observations in their science journals.

• **Evaluate:** Students will demonstrate what they have learned from the lesson by returning to their graphic organizer. The goal is for students to write and incorporate new vocabulary terms such as echolocation, sonar, transverse waves, wavelength, and frequency into their reflections. Questions will include the following: How are sounds waves made? Why are they important to understand? How do sound waves produce different types of sounds? How do whales communicate? How does sound in air differ from sound in water?

**Earth science: Exploring Earth’s place in the universe**

In the text, Iris’s best friend, Wendell, is also passionate about science. However, his specific interest is focused on stars and space. Although Wendell’s passion is not as prominent as the themes introduced by Iris, his interest opens another potential avenue for connection. In the following example, students will explore the different star patterns in the sky during the different seasons on Earth. Students will do this through investigations of patterns in the sky and will end by creating a wheel-diagram art project that allows them to see the different constellations that are not visible during the different seasons.

Here is how teachers can engage students in the five phases of the 5E Instructional Model:

• **Engage:** To activate students’ prior knowledge, teachers will ask the following questions: Who can tell me something you know about space? What about stars? Using a think-pair-share strategy, students will turn and talk to the person sitting next to them, then share ideas with the whole group.

• **Explore:** Students will analyze photographs of constellations in different seasons. For instance,
As teacher educators, we are charged with preparing PSTs to support integrated literacy and science connections with their future K–12 students. By using a literacy and science partnership, this cross-disciplinary unit showcases one way in which teacher preparation programs can support PSTs’ understanding of building inquiry using popular text as a springboard and the ability to teach with such texts in their future classrooms. As we make concerted efforts to address national and state standards, teacher educators must model strategic cross-disciplinary planning and curriculum to make authentic connections across subject areas.

**References**


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Yager, R. E. (2004). Science is not written, but it can be written about. In W. E. Saul (Ed.), Crossing borders in literacy and science instruction (pp. 95–107). NSTA Press.

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