

SPORE\* SERIES WINNER

# Penguins and Polar Bears Integrates Science and Literacy

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Science is often not included in elementary school curriculum despite the recognized importance of early development of science concepts and skills (1–3). In addition, there are few science resources available online that are focused on elementary school students. This combined state of affairs inspired the creation of an online magazine for elementary school teachers and their students: *Beyond Penguins and Polar Bears*.

Launched in March of 2008, *Beyond Penguins and Polar Bears* (<http://beyondpenguins.ndsl.org>) consists of 20 thematic issues relating elementary science concepts to the real-world context of the polar regions (see the first figure). *Beyond Penguins and Polar Bears* presents science content for topics such as rocks and minerals, the water cycle, seasons, states and changes of matter, plants, the indigenous peoples of the Arctic, polar research and explorers, and climate change in the context of life in the Arctic and Antarctica.

The online magazine format provides professional development content and instructional resources with a focus on integrating science and literacy. The strategy was initially conceived as a “Trojan horse” approach, using the reading and writing that elementary teachers were comfortable with as a vehicle for increased science instruction.

As the project progressed, it became apparent that the overlap between science and literacy was much richer than originally anticipated. Inquiry-based instruction and hands-on experiences help students develop the background knowledge needed to comprehend science texts. These experiences also build vocabulary and provide an authentic purpose for reading and writing (4). Reading about science concepts complements and extends the knowledge that students gain from inquiry and hands-on experiences and can substitute for direct experience when that is not possible (5). Writing and discussion around scientific concepts



Beacon Valley field camp, Antarctica.

allow students to share their knowledge as members of a scientific community in the same way practicing scientists do (6). Evidence suggests that such a combined curricular approach can benefit the development of students’ reading engagement and comprehension, academic language, and written and oral discourse abilities (7–9). There is also growing recognition that students’ ability to engage in the authentic practice and process of science requires the development and use of the structures of logical argumentation and the ability to read and write in informational text genres (10, 11).

The content of each issue of *Beyond Penguins and Polar Bears* is organized into five departments:

- *Professional Learning* contains resources for teachers, including science and literacy content knowledge, student misconceptions in science, teaching and assessment strategies, and information about creating an equitable classroom environment.
- *Science and Literacy* includes lesson plans and a virtual bookshelf of children’s literature.
- *Across the Curriculum* includes ideas for integrating other disciplines—such as

Elementary teachers find resources about the Arctic and Antarctica along with practical ideas for enhancing children’s literacy skills in this online project.

math, social studies, and art—into a science lesson or unit.

- *In the Field: Scientists at Work* profiles polar researchers.
- *Polar News and Notes* provides updates on news, research, and opportunities for teachers and students.

*Beyond Penguins and Polar Bears* also includes original content. A monthly nonfiction article, called a feature story, is written for students and is available in three grade bands, kindergarten to grade 1 (K to 1) and grades 2 to 3 and 4 to 5. Teachers can print full-color books with illustrations, access electronic versions with recorded narration, or print a text-only version of each story. Unit plans help teachers assemble the resources available in a given issue into a cohesive instructional framework based on the 5E learning cycle (engage, explore, explain, elaborate, and evaluate), a model used to plan inquiry lessons. All resources are correlated to the National Science Education Standards and/or the National Council of Teachers of English Language Arts and International Reading Association’s Standards for the English Language Arts.

Pilot testing of project materials with 19 teachers and 173 K to 5 students in

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Columbus, Ohio, and Charlotte, North Carolina, was conducted over a 2-year period. Teachers and students were different in every year of testing. Teachers were asked to include resources from Beyond Penguins and Polar Bears as either a supplement to or a replacement for the existing curriculum, to keep a journal of the Web site and resource usage, and to participate in classroom observations, interviews, and pre- and post-teaching questionnaires.

Data that were collected assessed teacher usage of reform-based teaching practices, including the integration of science and literacy instruction, utilization of Beyond Penguins and Polar Bears, and changes in classroom practices following integration of the resources therein. Teachers reported changes, such as an increase in their likelihood to provide opportunities to read about science and to have their students write to communicate scientific results. Teachers also reported that an increased content knowledge about the polar regions and science in general also increased their confidence in teaching science (12).

Student questionnaires assessed attitudes regarding science. Statistically significant changes were seen in third grade students who were less likely to agree with the statements that “science was mostly memorizing facts” and that “science is more for boys than girls.” They were also more likely to agree that writing is important in science (13).

In subsequent pilot testing, another group



Northern lights, Greenland.

of third grade students was significantly more likely to agree with the statements “I like science,” “I am good at science,” and “I understand more of what goes on in science” (12). Over the entire pilot testing period, students were more likely to agree with the statements “I am good at science” and “writing is important in science.” Students in fourth and fifth grade did not show significant changes in their agreement with these statements after exposure to project materials. Continued evaluation efforts include a closer look at why third grade might be a critical point in developing students’ understanding and attitudes about science.

Beyond Penguins and Polar Bears capitalizes on social media, such as Facebook (Beyond Penguins) and Twitter (@beyondpenguins), to connect teachers to project content. Monthly Web seminars provide opportunities for virtual professional development in science and literacy instruction and exposure to project resources. Archives and descriptions of upcoming seminars are available on the home page and at <http://bit.ly/BPPBseminars>. Such seminars have received positive evaluations from participants, who have included classroom teachers, curriculum specialists, and other education professionals.

Although our goal was to provide an online resource that could be easily accessed across the country and around the world, we also realized that many teachers still prefer printed versions of resources. We therefore provide a “print-on-demand” option (see <http://bit.ly/printondemand>).

The Arctic and Antarctica are remote, beautiful, unique, and fragile (see the second figure). Through Beyond Penguins and Polar Bears, we hope that we have brought these far-off places a little closer to elementary teachers and students and have inspired excellent science instruction, too.

References and Notes

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14. Beyond Penguins contributes to the National Science Digital Library and is supported by the NSF’s Division of Research on Learning in Formal and Informal Settings under grant 0733024. Any opinions, findings, conclusions, or recommendations expressed on this Web site are those of the authors and do not necessarily reflect the views of NSF.

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