

Levels of Inquiry and the 5 E's Learning Cycle Model

by Dr. Judith Sweeney Lederman

Engage

Explore

Explain

Elaborate

Evaluate

Curriculum designed around levels of inquiry provides a rich context for the implementation of the 5 E's model of instructional practices. Inquiry provides the overarching framework for curriculum design. The 5E's Learning Cycle gives specific guidelines for what teachers should be doing to implement inquiry-based lessons. Both inquiry and the 5 E's are constructivist based, student centered, and consistent with the vision of teaching and learning in the National Science Education Standards. Together, the curriculum and the specific practices support the teaching and learning of science concepts, as well as the methods and processes of scientific inquiry.

Levels of inquiry and the 5 E's are integrated in *National Geographic Science*. In *National Geographic Science* classrooms, children develop conceptual understanding through a series of experiences and questions, in contrast to more traditional deductive approaches in which concepts are defined at the beginnings of lessons. During each level of inquiry and each of the 5E's, students who use *National Geographic Science* are presented with new opportunities to build on and apply knowledge, construct meaning, and assess their understandings of concepts.

In *National Geographic Science*, the levels of inquiry move students through inquiry-based activities that help them learn concepts and skills. Eventually, students are able to carry out open-ended investigations during which they ask their own questions, plan and implement their investigations, and come to conclusions based on their data and previous knowledge.

The 5E's Learning Cycle embedded in *National Geographic Science* provides teachers with the strategies to initiate any level of inquiry and to guide their students successfully through an investigation. The ultimate objective of employing the 5E's model during all levels of inquiry is to develop a richer understanding of science concepts and a more sophisticated understanding of how scientists work.

Levels of Inquiry in *National Geographic Science*

In the late 1960s and early 1970s, researchers developed a tool for determining the level of inquiry promoted by a particular activity. Known as Herron's Scale, the assessment tool is based on a simple principle: How much is "given" to the student by the teacher or activity instructions? Using this question as a framework, Herron's Scale describes four levels of inquiry: exploration, directed, guided, and open-ended.

Level 1. Exploration

During these activities, students are given the question and instructions about how to go about answering the question. Students are already familiar

with the concepts being presented, and they already know the answer to the question being asked. This level of inquiry in *National Geographic Science* is employed at the beginning of each new unit. It serves as an advance organizer for the learning to come and allows teachers to tap students' prior knowledge about the concepts. Exploration activities often create experiences that cause students to become more curious and ask more questions.

“In *National Geographic Science* classrooms, children develop conceptual understanding through a series of experiences and questions.”

Level 2. Direct Inquiry

In direct inquiry, the problem and procedure are given directly, but the students are left to reach their own conclusions. Students investigate a problem presented by the teacher and use a procedure that is prescribed by the teacher. They have the opportunity to analyze data and arrive at their own evidence-based conclusions. Directed inquiry comes at the beginnings of chapters in *National Geographic Science*.

Level 3. Guided Inquiry

In guided inquiry, the research problem or question is provided, but students are left to devise their own methods and solutions. Students take more responsibility during this type of inquiry. They may choose their materials, data organization, and approach to analysis. They apply their analytical skills and support their evidence-based conclusions. Guided inquiry comes at the beginnings of chapters in *National Geographic Science*.

Level 4. Open-Ended Inquiry

At this level of inquiry, problems as well as methods and solutions are left open. The goal is for students to take full responsibility for all aspects of the investigation. These activities involve students in formulating their own research questions, developing procedures to answer these research questions, collecting and analyzing data, and using evidence to reach their own conclusions. Open-ended inquiry comes at the end of each unit in *National Geographic Science*.

The 5 E's Learning Cycle Model in *National Geographic Science*

Engagement: Students are presented with unfamiliar phenomena, objects, events and/or questions to pique their curiosity and have them make connections with what they already know. During the engagement phase, students become mentally and physically engaged. They raise questions, identify problems to solve, and consider plans to find answers to their questions. Teachers are able to ascertain prior knowledge and elicit misconceptions.

In *National Geographic Science*, engagement comes at the beginning of every level of inquiry through the *Tap Prior*

Knowledge and *Connect to the Big Idea* features in the Teacher's Edition.

Exploration: During this phase, students are provided with a common base of experiences. They actively examine and manipulate objects and phenomena through direct investigations organized by the teacher.

Exploration is part of every level of inquiry in *National Geographic Science*, with support for teachers provided in the *Guide the Investigation* section of the Teacher's Edition.

Explanation: During this phase, students explain their understanding of the concepts and processes they have been exploring. They have opportunities to verbally explain new concepts and /or demonstrate new skills and abilities.

In every level of inquiry in *National Geographic Science*, students are asked to explain and conclude during and after every investigation. Students are prompted to explain "how they know" their predictions make sense and to anticipate what they would do differently "next time."

“During the engagement phase, students become mentally and physically engaged.”

Elaboration: In this phase of the model, students are given opportunities to apply concepts in new contexts or situations in order to develop deeper understandings. Students take part in activities that extend conceptual understandings and that allow them to practice new skills. They become involved in more

open-ended inquiry, problem solving, and decision making. In this phase, students may design and carry out their own investigations.

In every level of inquiry in *National Geographic Science*, students are encouraged to "Find Out More" and to "Think of Another Question" as a means to extend and elaborate on their learning.

Evaluation: In this final phase, students assess their knowledge, skills, and abilities. Activities permit evaluation of student development, lesson effectiveness, and future instructional adjustments. Formal and informal evaluation should occur in every phase and level of inquiry.

Throughout *National Geographic Science*, teachers are given self-reflection rubrics from the Assessment Handbooks and thought-provoking questions provided by the Teacher's

Edition to help students think about their learning and assess their understandings of science concepts.

Conclusion

In *National Geographic Science*, the 5 E's Learning Cycle is fully integrated in all levels of inquiry. By being thoughtfully interwoven in each level, the 5 E's help students achieve the highest level of learning in each and every investigation, no matter which levels teachers choose to implement.

References

- American Association for the Advancement of Science. (1993). *Benchmarks for science literacy: A Project 2061 report*. New York: Oxford University Press.
- Herron, M.D. 1971. The nature of scientific inquiry. *School Review*, 79, 171–212.
- Lederman, J.S. (2009). *Levels of Inquiry*. Monterey, CA: National Geographic School Publishing.
- Lederman, N.G., Lederman, J.S., & Bell, R.L. (2003). *Constructing science in elementary classrooms*. New York: Allyn & Bacon.
- National Research Council (1996). *National science education standards*. Washington, DC: National Academic Press.
- Schwab, J.J. (1962). The teaching of science as inquiry. In J.J. Schwab and P. F. Brandwein (Eds.), *The teaching of science*, 3-103. Cambridge, MA: Harvard University Press.



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