

Improving science content and inquiry standards mastery of fourth-grade students:

# **A study of the effectiveness of *National Geographic Science***

**Kansas City, Kansas Public Schools  
2010–2011**

This study was conducted by National Geographic School Publishing in partnership with Kansas City, Kansas Public Schools.

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# Improving science content and inquiry standards mastery of fourth-grade students: A study of the effectiveness of *National Geographic Science*

## Background and Purpose

National Geographic School Publishing (NGSP) recognizes the importance of gathering scientific research evidence to support educators in making informed decisions about instructional programs. As such, NGSP, in partnership with Kansas City, Kansas Public Schools (KCKPS), conducted a study during the 2010–2011 school year to evaluate the impact of *National Geographic Science* (*NG Science*), a comprehensive core science program for elementary students.

*NG Science* is a research-based program that immerses students in the nature of science and science inquiry, unlocks the Big Ideas in science for all learners, and builds scientific and content literacy. *NG Science* makes real-life connections to scientists and explorers that encourage students to “think like scientists” as they master rigorous standards-based content for life, earth, and physical science. Students experience the ways scientists think, learn, and work as they deepen their scientific understanding through use of a science notebook and leveled inquiry investigations.

The purpose of this study was to evaluate the impact of *NG Science* on fourth-grade students’ mastery of science inquiry and content standards. This study also gathered information related to teachers’ *NG Science* implementation as well as their perceptions about science instruction and student learning with this program.

In the summer of 2010, KCKPS, a large urban school district, adopted *NG Science* as its core science instructional program for students in kindergarten through grade five. In the fall of 2010, ten schools began using *NG Science* while the other twenty elementary schools in the district continued using existing curricular materials for science instruction. A data-driven implementation plan was devised by the district to ensure that teachers implemented *NG Science* with fidelity so more students could succeed in science.

Overall, the results of this study strongly suggest that *NG Science* enhances students’ mastery of science inquiry and content standards. Findings from this study will inform continued implementation of *NG Science* in KCKPS and can provide educators nationwide an effective model for using *NG Science* to increase student science achievement in their own school districts.

## Study Design

This study employed a treatment/control quasi-experimental design to evaluate the effectiveness of *NG Science* in helping students master science content and build inquiry skills. Throughout the 2010–2011 school year, fourth-grade classes at ten KCKPS sites implemented *NG Science* as the core science instructional program while fourth-grade classes in the district’s twenty other elementary schools continued to use the existing kit-based science instructional program, and did not use *NG Science*.

This study focused on the science achievement of fourth-grade students since that grade level is tested by the state of Kansas in compliance with federal No Child Left Behind (NCLB) guidelines. Student performance on the Kansas Computerized Assessments (KCA) / Science Test was compared across the district’s thirty elementary schools to evaluate *NG Science*’s impact on mastery of tested fourth-grade science content and inquiry standards. Additional data, including checkpoint rubrics for guided inquiry activities and science notebook use, as well as student artifacts, was also collected from *NG Science* schools to gauge fidelity of implementation and to identify instructional practices that best support students’ understanding of science.

## Student Performance Results

For this study, student achievement data was collected in accordance with the Kansas State Assessment System. The KCA / Science was administered in April, 2011 to all fourth-grade students to measure achievement in the state science standards: Science as Inquiry, Physical Science, Life Science, and Earth Science.

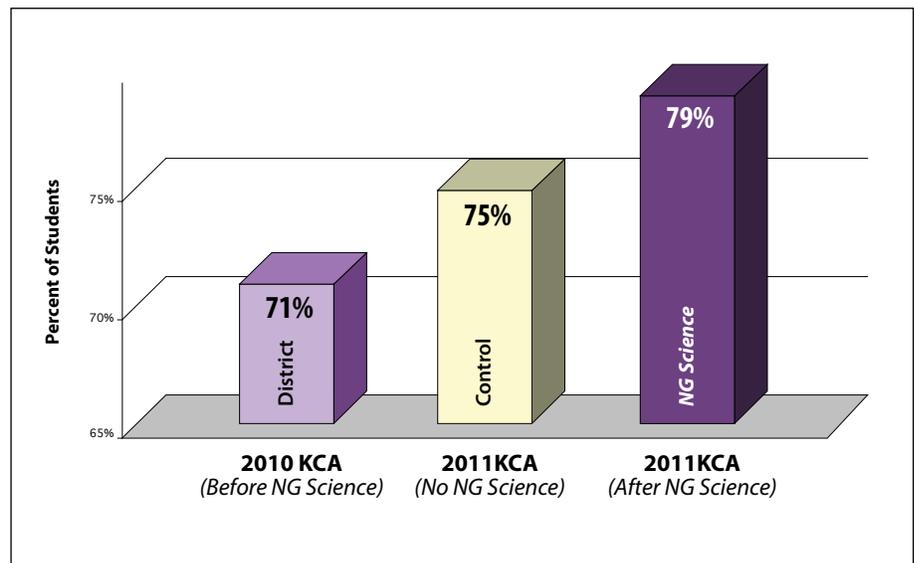
### Kansas Computerized Assessment / Science

KCA/Science scores are reported as percent correct scores and also by performance level: Exemplary, Exceeds Standards, Meets Standard, Approaching Standard, or Academic Warning. Results from the KCA/Science were compared across KCKPS's thirty elementary schools to determine *NG Science*'s impact on mastery of tested science inquiry and content standards.

KCKPS fourth-grade students historically meet standards in science, however, a comparison of KCA/Science results across school years shows that fourth-grade performance in science increased substantially for students using *NG Science* compared to the previous year's district-wide results and when compared to schools not using *NG Science* during the 2010–2011 school year. On average, *NG Science* students also scored higher than control school students on the total test and on each standard tested. When considering the percentage of students exceeding standards or higher, it becomes clearly evident that after just one school year using the program, *NG Science* students demonstrated heightened mastery of fourth-grade science inquiry and content standards.

### Overall Science Performance

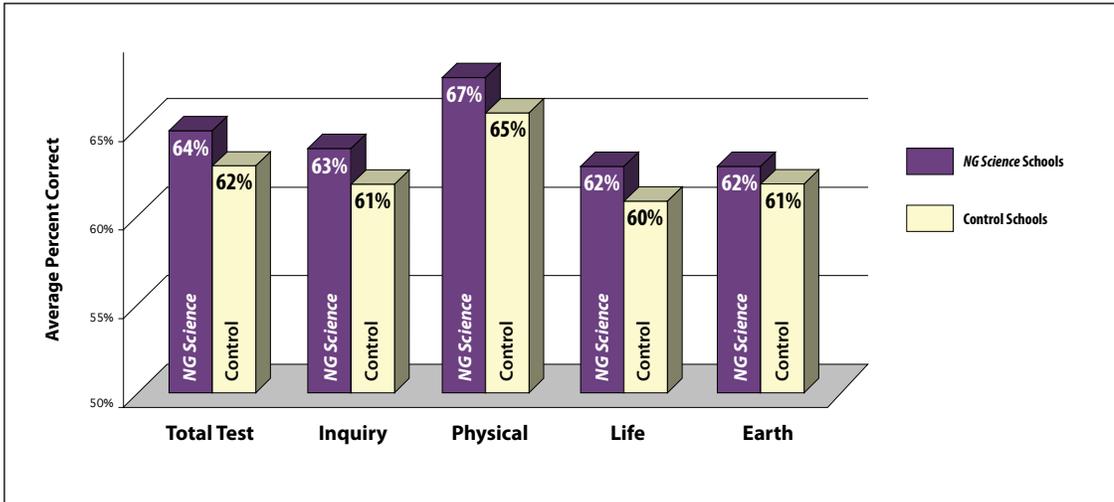
On the 2010 KCA/Science, prior to the adoption of *NG Science*, 71% of KCKPS fourth-grade students met or exceeded science standards, falling short of the 73% Kansas annual target. On the 2011 KCA/Science, 79% of students in *NG Science* classrooms met or exceeded standards, compared to 75% of students in control group classrooms. Though all schools met the 73% target in 2011, it is noteworthy that after only one school year's instruction, the *NG Science* schools showed a more substantial increase, 8% higher, in the number of students reaching proficiency on tested science standards compared to the previous school year (Figure 1).



**FIGURE 1. Percentage of fourth-grade students meeting or exceeding standards on the 2011 KCA/Science compared to the district total for fourth-grade students on the 2010 KCA/Science**

### Performance by Science Standard

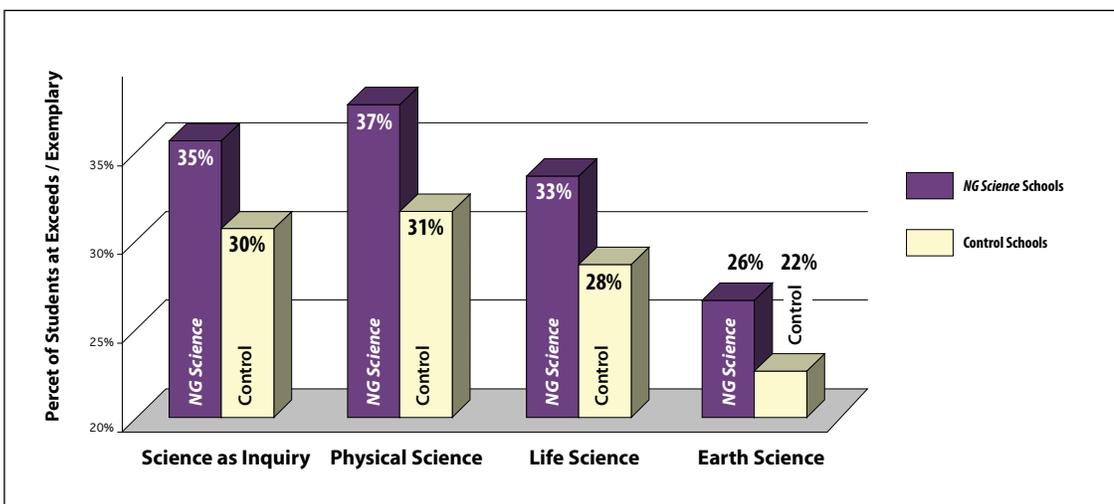
One way of comparing students' performance on the KCA/Science is to consider the average percent correct scores for each standard tested. The average percent correct scores for all district schools fall within the Meets Standards performance band (51–73 percent correct). However, when comparing the average percent correct scores across schools, *NG Science* schools performed higher on the total test and in all tested science areas (Figure 2).



**FIGURE 2.** Average percent correct scores on the 2011 KCA/Science, by study group for each standard area

### Exceeds/Exemplary Science Performance

A powerful way to examine the KCA/Science results is to consider the percentage of students who exceeded standards (Exceeds or Exemplary performance levels), since this is an indicator of being on-track for college-readiness. *NG Science* students outperformed control group students by a sizable percentage in all science areas: 5% greater for Inquiry, 6% greater for Physical Science, 5% greater for Life Science, and 4% greater for Earth Science (Figure 3).



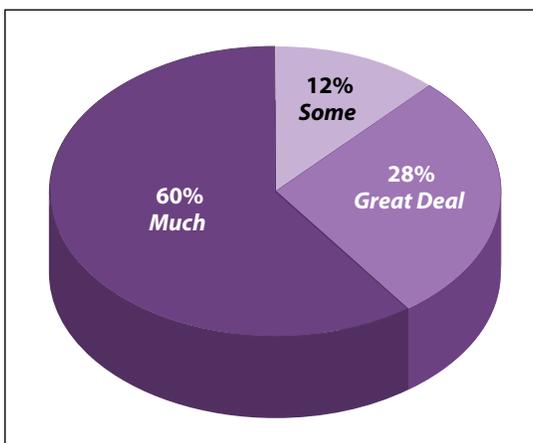
**FIGURE 3.** Percent of students in the Exceeds or Exemplary performance levels by standard as measured on the spring 2011 KCA / Science

## NG Science Implementation

Student learning is often directly affected by a teacher's fidelity of implementation with an instructional program. Implementation information was collected as part of the KCKPS Data Checkpoint process; *NG Science* teachers submitted rubrics from a Guided Inquiry investigation for each science unit and collected artifacts from students' science notebook entries for each unit of study. Teachers also responded to questions on the unit implementation logs related to their *NG Science* instruction. KCKPS teachers using *NG Science* during the 2010–2011 school year were found to have implemented the program with a high level of fidelity.

On the implementation logs, teachers consistently indicated that *NG Science* was effective in helping prepare students for the state science assessment, the program was very well aligned with the state's science standards and also with standards for reading informational text. The teachers also reported the hands-on inquiry investigations and the use of science notebooks deepened students' understanding of and interest in science. For example, one teacher stated, "*The leveled inquiries were very effective because they were hands-on and so high-interest. Once my students' curiosity was sparked, they asked the kinds of questions that lead to deeper understanding.*" Another teacher noted, "*It was great to have such a rich textbook to help students learn science. My students stayed engaged with the content and graphics during content instruction, and then the hands-on inquiry activities built a deeper understanding of science concepts.*"

Teachers reported that *NG Science* lessons and materials had a significant impact on their students' interest and engagement with science. Based on their classroom observations and experience during science instruction, 88% of teachers indicated that *NG Science* had 'much/great deal' of positive impact on indicators including how frequently students stayed on task, showed interest in materials and lessons, made positive comments about the materials, took ownership of their science notebooks, asked questions about science, or talked about science with their classmates (Figure 4).



**FIGURE 4. Positive impact of *NG Science* materials and lessons on increased student interest and engagement with science**

## Summary

Overall, the results of this study clearly demonstrate that *NG Science* enhances students' mastery of science inquiry and content standards. After just one school year, KCKPS fourth-grade students using *NG Science* outperformed their peers who did not use *NG Science* on the high-stakes state standards test by both average percent correct score and by an increased percentage of students exceeding standards for all areas tested including scientific inquiry, and earth, life, and physical science.

A notably higher percentage of fourth-grade students using *NG Science* met or exceeded science standards on the 2011 KCA/Science compared to fourth-grade students' performance district wide on the 2010 KCA/Science, prior to the *NG Science* adoption. On average, *NG Science* students also obtained a higher percent correct score than control school students on the 2011 KCA/Science for each standard tested. When considering the percentage of students exceeding standards or higher, an indicator of on-track for college preparedness, it becomes evident that after just one school year, *NG Science* students demonstrated heightened mastery of fourth-grade science inquiry and content standards. A substantially higher percentage of *NG Science* students exceeded standards in all areas tested: science as inquiry, earth science, life science, and physical science.

KCKPS teachers using *NG Science* during the 2010–2011 school year were found to have implemented the program with fidelity. Teachers indicated that *NG Science* was effective in helping prepare students for the state science assessment and the program was highly engaging for students and very well aligned with the state's science standards.

The results of this study provide substantial evidence of the effectiveness of *NG Science* as a comprehensive core science program that builds students' mastery of grade-level science content and inquiry standards.

Using *NG Science* with fourth-grade students was found to enhance science learning and support science instruction. Findings from this study will inform continued implementation of *NG Science* in KCKPS in the remaining twenty schools and also provide educators nationwide an effective model for using *NG Science* to increase student science achievement in their own school districts.

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