A Pilot Study of Pearson’s
Interactive Science Program in Fifth-Grade Classrooms

August 31, 2011
EXECUTIVE SUMMARY

Educators agree that today’s elementary students need a solid foundation in the sciences to succeed at higher grades and to lay the foundation for scientific literacy later in life. As such, there is a need for high-quality science materials that support the teaching and learning of essential science content. Pearson’s Interactive Science elementary program is a standards-aligned K–5 program designed to promote student interest and engagement while providing key science content to increase students’ understanding of the natural world. Interactive Science features a write-in student edition that allows students to interact with the text while connecting to essential science standards. The program provides multiple opportunities within each chapter for inquiry-based learning through labs and activities that support the key concepts for each chapter. The fully developed program will offer a digital component to support text-based learning.

Pearson, Inc. understands the importance of providing high-quality materials for elementary science instruction. To examine how the Interactive Science program is implemented in classrooms and to measure changes in student achievement and attitudes toward science over the course of the school year, Pearson, Inc. contracted with Magnolia Consulting, LLC, an external, independent consulting firm specializing in educational research and evaluation, to conduct a pilot study of the Interactive Science program in fifth-grade classrooms. Magnolia Consulting conducted this study during the 2010–2011 school year.

STUDY DESIGN & METHODS

Magnolia Consulting evaluators used a quasi-experimental design with repeated measures for a group of treatment students only to examine implementation of the Interactive Science program in fifth-grade classrooms. The final study sample included nine teachers and 264 students across six schools in three geographically diverse school districts. The purposes of this study were to evaluate teachers’ implementation of the fifth-grade Interactive Science program and to measure science achievement and attitudes among students who participated in the program.

Evaluators used a mixed-methods design to collect qualitative and quantitative data throughout the study period. Student measures included a pretest and posttest measure of students’ science content knowledge (Stanford 10 Science Test), a pre and posttest student science attitude survey, and student focus group interviews. Teacher measures included weekly implementation logs, classroom observations, and interviews.

INTERACTIVE SCIENCE PROGRAM IMPLEMENTATION

Key Question:
What was the nature of teachers’ implementation of Interactive Science?

Six teachers in the study implemented the program with high fidelity, and three implemented it with moderate fidelity as compared to study guidelines. Instructional time for science varied among districts and among schools within the same district. Because of the
A Pilot Study of Pearson’s Interactive Science Program in Fifth-Grade Classrooms
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varied amount of time for science instruction, teachers at some schools were able to cover more chapters than those at other schools. Teachers implemented 6–11 of the twelve fifth-grade chapters. Teachers reported high use of the Teacher’s Guides and Student Write-in Text and implemented many of the inquiry activities associated with the chapters.

Teachers found the program to be easy to implement and felt that the pacing of lessons was reasonable. Overall, teacher views of the program were positive. Teachers found two aspects of the Interactive Science program to be particularly valuable to their science instruction. They noted that the many inquiry activities engaged students in the learning while giving them a means to scaffold learning, support learning, and apply learning throughout the chapters. The Student Write-in Text supported instruction by helping students to organize and take ownership of their learning while supporting critical skills such as highlighting, note taking, diagramming, determining main ideas, and cause and effect. The Write-in Text also helped students to take ownership of their learning.

Teachers felt that the Interactive Science program best met the needs of on-level and above-level students. They noted that the reading level and the level of difficulty of some of the activities in the chapters were above the level of below-level and special education students. Teachers with below-level students had difficulty with the program pace, as they needed to move more slowly through the text-based activities. These teachers found the Leveled Readers to be useful in differentiating instruction for below-level readers. Teachers felt that the program assessments were not adequate for gauging student learning and felt that chapter tests should contain more open-ended and short answer responses to allow students to show what they had learned.

Teachers reported an average to high level of student engagement on the majority of weekly logs. Feedback from teachers and observation data revealed that students were highly engaged in the inquiry activities in the program and were also engaged by writing in the text. Teachers indicated that for struggling readers, student engagement was lower for the text-based activities in the program than for the hands-on activities.

Students in focus group interviews were extremely positive about the Interactive Science program. They particularly enjoyed the inquiry activities, although they were not always sure of the connections between the activities and the content presented in the text. Students also liked the visual aspects of the program such as the pictures in the Envision It! and on the Vocabulary Smart Cards. Students valued writing

Teacher Quote:
With this program, kids would take their knowledge and put it into play. It allowed them to show a greater understanding of what they had learned. I saw it lead to higher self-esteem because of the opportunities to practice what they were learning.

Student Quote:
I never knew that you could write in a science book. I was surprised. It was just different, and then we get to keep them at the end of the year!
in their texts and found it valuable for learning and studying new material. Students also appreciated that they could keep their texts at the end of the school year, indicating a sense of ownership of their learning.

**STUDENT LEARNING AND ATTITUDE RESULTS**

Study findings indicated that students demonstrated significant gains in science content knowledge over the course of the year while participating in the *Interactive Science* program; \( t(263) = 7.78, p < .0005 \). Gains corresponded to a medium effect size \( (d = 0.43) \) with average percentile gains of 17 points from pre to posttesting.

Subgroup analyses for gender and ethnicity indicated no difference in gains for males and females or for white and non-white students, suggesting that gains were relatively equal for students in these subgroups.

**Key Question:**
Did students demonstrate significant learning gains during the study period?

Student attitudes toward science showed a statistically significant decrease over the course of the year while using *Interactive Science*. The effect size \( (d = 0.33) \) indicated a moderate effect.

While student attitude scores decreased over the course of the year, it should be noted that students began the year with positive attitudes toward science and remained positive toward science at the end of the school year.

Overall, the pilot study of *Interactive Science* revealed that teachers found the program to be valuable to their science instruction. Students made significant gains in understanding of key science content, and they enjoyed and learned from the materials.
ACKNOWLEDGEMENTS

I would like to thank the many individuals who collaborated to make this study possible. I am especially grateful to the study participants including classroom teachers, students, and administrators for their contributions to data collection efforts and for the insights and feedback they provided on the Interactive Science program. I would like to thank the staff at Pearson, Inc. for their support across the study, with special thanks to Mary Ehmann. I would also like to thank Candace Rowland, Dr. deKoven Pelton, and Beverly Bunch of Magnolia Consulting for their invaluable support throughout the study and Dr. Mary Styers and Monica Savory for assistance in data analysis.

Carol Haden, EdD
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INTRODUCTION

Our world changes daily as new information and discoveries in the sciences are made public. With increased global competitiveness in science and technology, it is essential that U.S. schools provide quality science instruction that will serve to enlarge the student pipeline in science, technology, engineering, and mathematics (STEM) (Committee on Science, Engineering, and Public Policy, 2007). For those students who do not pursue STEM subjects in higher education, it is equally important that they have a solid foundation in the sciences to become better-informed decision makers and scientifically literate citizens. Science education at the elementary level should serve to lay the groundwork for learning at higher grades. As such, science education leaders emphasize the need for quality materials that support effective instruction in elementary school classrooms.

The National Science Education Standards (National Research Council, 1995) articulate goals for school science that include educating students who can (a) “experience the richness and excitement” of learning about the natural world, (b) understand the scientific process for personal decision making, (c) engage in discourse about scientific matters, and (d) benefit personally from the skills of scientific literacy. The National Science Teachers Association’s position statement on elementary science education states that elementary students learn science best when exploration and inquiry skills are nurtured, instruction builds on the student’s conceptual framework, content is organized around conceptual themes, and mathematics and communications skills are an integral part of instruction (National Science Teachers Association, 2002). Additionally, high-quality science lessons allow students of varying backgrounds and learning styles to engage effectively with content that supports important and developmentally appropriate science-learning goals (Weiss, Pasley, Smith, Banilower, & Heck, 2003).

Pearson, Inc. understands the importance of providing high-quality materials for elementary science instruction. To examine how the Interactive Science program is implemented in classrooms and to measure changes in student achievement and attitudes toward science over the course of the school year while using the program, Pearson, Inc. contracted with Magnolia Consulting, LLC, an external, independent consulting firm specializing in educational research and evaluation, to conduct a pilot study of the Interactive Science program in fifth-grade classrooms. Magnolia Consulting conducted this study during the 2010–2011 school year. This report presents the research design, methods, and findings of the Interactive Science pilot study.

PROGRAM DESCRIPTION

Pearson’s Interactive Science elementary program is a standards-aligned K–5 program designed to promote student interest and engagement while covering key science content to increase students’ understanding of the natural world. The national version of the fifth-grade Interactive Science program used in this study consists of 12 chapters covering topics in life science, earth science, physical science, and the nature of science. Lessons in each chapter are structured around a Big Question, which incorporates the overarching theme for the
chapter and provides an engaging point of reference to tie together lessons within the chapter.

*Interactive Science* lesson content is organized around the 5E learning cycle model: engage, explore, explain, elaborate, and evaluate. Each lesson begins with *Envision It!* consisting of an image with a question designed to activate prior knowledge and set a context for the learning in the lesson. The program contains multiple opportunities for inquiry-based learning within each chapter through labs and activities that support the key concepts for the chapter. Students begin the chapter with an investigation (*Try It!* designed to activate prior knowledge and set the stage for learning the content in the lessons. Additional inquiry activities within the lessons (*Explore It!*) are designed to provide students with meaningful ways to apply and support concepts within the lessons. Shorter inquiry activities within the lessons (*Lightning Labs, Go Green Labs, and At Home Labs*) provide additional support for understanding the content. An inquiry activity at the end of the chapter (*Investigate It!* offers a way to pull together learning from all of the lessons within the chapter and apply it to an investigation.

*Interactive Science* features a consumable, *Student Write-in Text* that allows students to connect with the text while exploring the Big Ideas of science. Throughout each lesson students have multiple opportunities to interact with the text by drawing and diagraming, graphing, answering questions, highlighting main ideas and taking notes right on their texts. Students assess their own learning through answering the *Got It!* questions featured at the end of each lesson. Text within each chapter is designed to support reading goals while addressing standards-based science content. *Vocabulary Smart Cards* are included in each chapter of the student edition to support vocabulary acquisition. *Do the Math!* activities within the chapters provide activities to make mathematics connections within the science content.

Teaching resources within each chapter include guides for lesson planning and tips for differentiating instruction, supporting English Language Learners, and addressing common student misconceptions. Additionally, each chapter contains a section providing background knowledge for teachers who may not have deep experience with the content. *Content Refreshers* within each lesson provide teachers with just-in-time support as they are teaching.

For this pilot study, teachers received the following materials for implementing the program:

- Individual *Student Write-in Texts*
- *Teacher's Guide* for each chapter
- Materials kits for the inquiry activities
- *Activity Cards*
- *STEM Activity Handbook*
- *Social Studies and Language Arts Connections* book
- *Leveled Readers*

The *STEM Activity Handbook* offers additional activities designed to focus on real-world problems in science. The *Social Studies and Language Arts Connections* book offers supplemental activities to draw connections across disciplines. *Leveled Readers* present science content related to the chapters for below-, on-, and above-level readers making content accessible to
students of varying abilities. *Interactive Science* includes a digital path that was under development at the time of the pilot study and not yet available to teachers. Therefore, evaluation of the digital components is not included in this report.

**RESEARCH DESIGN AND METHODOLOGY**

This section of the report describes the research design for the study. The section includes the study purposes, measures, settings, participants, and the data collection time frame.

**STUDY PURPOSES**

The purposes of this study were to evaluate teachers’ implementation of the fifth-grade *Interactive Science* program and to measure science achievement and attitudes among students who participated in the program. Given that the new version of the fifth-grade *Interactive Science* program had not been previously implemented in classrooms, much of this study was exploratory with emphasis on describing teachers’ program use and experiences implementing the program. As such, the pilot study addressed the following evaluation questions:

**Formative Questions**

1. What were the characteristics of teacher and student participants?
2. What was the nature of teachers’ implementation of the *Interactive Science* program?
3. What were teachers’ perceptions of the quality and utility of the *Interactive Science* materials they implemented?
4. What were teachers’ perceptions of the impacts of *Interactive Science* on students?
5. What were students’ perceptions of the *Interactive Science* materials?

**Summative Questions**

6. Did students demonstrate significant learning gains during the study period? If so, what is the magnitude of the gains?
7. Did gains in student learning differ by student characteristics (i.e., English proficiency, ethnicity, gender, and socioeconomic status)?
8. Did students demonstrate an increased interest in science during the study?

**METHODOLOGICAL APPROACH**

This study used a quasi-experimental design with repeated measures for a group of treatment students only. Without a counterfactual, this study yields weak information about causal inference of program effects on student learning and attitudes (Shadish, Cook & Campbell, 2002). Even with the repeated measures design, differences in scores for pre to postobservations could be influenced by maturation or history. To strengthen the design, evaluators conducted pre and postobservations of student impacts on two outcome measures. The first outcome measure assessed the changes in students’ content and science process knowledge, and the second measure assessed changes in student interest and self-
efficacy while using the program. To examine causal relationships between the program and targeted outcomes, Magnolia Consulting will conduct an efficacy study of Interactive Science using a randomized controlled trial study design in the 2011–2012 school year.

In order to appropriately address the evaluation questions for the study, evaluators conducted various analyses including analytic induction of qualitative data, non-parametric and parametric tests, descriptive analyses, inferential analyses, and calculation of effect sizes (Cohen’s $d$).

**Measures**

This study used a combination of quantitative and qualitative methods to allow for a full understanding of how the Interactive Science materials were implemented in study classrooms and to examine achievement and attitudes among participants. Data collection methods included classroom observations, online implementation logs, teacher and student interviews, a student attitude survey, and a student science content assessment. The measures are described in the following section.

**Student Measures**

Evaluators used multiple measures to examine attitudes and science achievement among students who participated in the Interactive Science program. Evaluators also collected data to examine student perceptions of the program. These measures included a content knowledge test, science interest survey, and student focus-group interviews.

**Stanford Achievement Test 10th Edition (Stanford 10)**

The Stanford 10 comprises a battery of tests across grade levels from Kindergarten through Grade 12. The Stanford 10 complete battery includes tests of reading, mathematics, language, spelling, listening, science and social science. For the purposes of this study, participating students completed only the science subtest portion of the Stanford 10. The science subtest includes four content strands: life science, physical science, earth science and the nature of science. The science subtest includes 40 multiple-choice items. To examine science achievement over the school year, students took the Intermediate 1 test in the fall of 2010 and the Intermediate 2 test in the spring of 2011. Reliability information for the Stanford 10 is presented in Appendix A.

**Student Attitude Survey**

Evaluators developed a survey to measure changes in student attitudes toward science over the study period. Students responded to 18 statements related to their interest in science, ability to understand science, and perceptions of their ability to do science using a 5-point Likert scale ranging from 1, strongly disagree to 5, strongly agree. Teachers administered the interest survey before starting the program in the fall of 2010 and again in the spring of 2011.
Student Focus Group Interviews

To gain an understanding of how students experienced the Interactive Science program, evaluators conducted focus group interviews with a sample of students from each participating classroom. Teachers selected four to five students of varying ability per class for interviews, and parental consent was obtained for participation. Researchers developed an interview protocol with questions designed to understand materials and methods that are best in helping students to gain proficiency in science and to gather student perceptions of the Interactive Science materials and activities. Interviews were conducted during the spring 2011 site visit and lasted approximately 20 minutes. Evaluators interviewed a total of 68 students across 13 focus groups.

Teacher Measures

Evaluators used multiple measures to assess teachers’ implementation of Interactive Science and to examine their perceptions of the program, materials, and impacts on student interest and understanding of key science concepts. Included in these measures were weekly implementation logs, classroom observations, and teacher interviews and reflections.

Online Weekly Implementation Log

Evaluators created an online implementation log to capture the breadth and depth of teachers’ use of the Interactive Science materials. The logs served as a mechanism for measuring implementation fidelity and variation in use. Teachers responded weekly to items indicating their use of required and optional program components. Teachers also responded to items related to their perceptions of the quality and utility of the materials including pacing, amount of materials, adequacy of the materials in meeting students’ needs, and perceptions of student engagement. Participating teachers accessed the log through an e-mail link sent to them once a week during the study period. Teachers spent 10 to 15 minutes completing the log each week. Evaluators supplemented the final weekly log with reflective questions about the program as a whole. Data from the logs were aggregated at the end of the study to arrive at ratings of teachers’ level of implementation of the program relative to other participating teachers and to implementation guidelines provided by Pearson, Inc.

Observation Protocols

Evaluators developed an observation protocol based on best practice research for science instruction. Evaluators created items specific to the program and adapted items from the Reformed Teaching Observation Protocol (Piburn et al., 2000), a research-based classroom observation protocol. Items were designed to align to the instructional goals of the program. Evaluators observed and documented evidence related to teacher–student interactions, instructional practices, lesson implementation, and student engagement. Evaluators also documented Interactive Science materials used in the lesson. Evaluators used the observation protocol during site visits to each school in the fall of 2010 and spring of 2011.
Interview Protocols

Researchers developed interview protocols for teachers. Teachers participated in interviews after evaluators observed their classrooms. Interview protocols focused on the classroom context, Interactive Science materials and component use, perceptions of program strengths and challenges with using the materials, and teachers’ perceptions of the impacts of the program on their students. Teachers were interviewed for 30–40 minutes during the fall 2010 and spring 2011 site visits.

DATA COLLECTION TIME FRAME

The initial product training (led by Pearson) and study orientation (led by Magnolia Consulting) occurred in August of 2010 for each site. Following the training, student measures were administered and teachers began implementation of the Interactive Science materials. The first site visit was scheduled for six to eight weeks after implementation in October or November. During this time, evaluators conducted classroom observations and interviews with participating teachers. In January 2011, Pearson conducted a follow-up webinar with teachers at one school in Site A. These teachers had instructional time for science cut in half after the study began and needed support in implementing the program in a shorter weekly time frame and with students of lower reading ability. Spring site visits were conducted in April of 2011, and teachers administered spring assessments in May or June. Table 1 below presents the time frame in which evaluators conducted data collection activities.

Table 1. 
Timeline of Data Collection Activities

<table>
<thead>
<tr>
<th>TASK AND ACTIVITY</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training, study orientation, study begins</td>
<td>Sites A, B, C</td>
<td></td>
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<tr>
<td>Administration of student measures</td>
<td>Sites A, B, C</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Sites B, C</td>
<td>Site A</td>
<td></td>
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<tr>
<td>Administration of implementation log</td>
<td></td>
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<tr>
<td>Follow-up training</td>
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<td></td>
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<tr>
<td>Fall observations/interviews</td>
<td></td>
<td></td>
<td>Sites B, C</td>
<td>Site A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring observations/interviews</td>
<td></td>
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<td></td>
<td></td>
<td>Sites A, B, C</td>
<td></td>
</tr>
<tr>
<td>End study</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sites B, C</td>
<td>Site A</td>
</tr>
</tbody>
</table>
STUDY SETTINGS

The study was conducted in fifth-grade classrooms across six elementary schools in three school districts in diverse geographical areas. All districts are comprised of primarily white students with relatively small percentages of low-income students and low percentages of English Language Learners. Table 2 presents the characteristics of each district including geographic location and student demographic information for all students in the district.

Table 2
Site Characteristics by District

<table>
<thead>
<tr>
<th></th>
<th>Site A</th>
<th>Site B</th>
<th>Site C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic location and city description</td>
<td>Mid-Atlantic; Rural, Fringe</td>
<td>South Central Suburb, Large</td>
<td>Midwest Suburb, Large</td>
</tr>
<tr>
<td>Total student enrollment</td>
<td>16,205 (pk-12)</td>
<td>21,675 (pk-12)</td>
<td>5,466 (pk-8)</td>
</tr>
<tr>
<td>Low income</td>
<td>7.2%</td>
<td>6%</td>
<td>12.6%</td>
</tr>
<tr>
<td>ELL population</td>
<td>&lt;5.0%</td>
<td>3.8%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Student ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>11.0%</td>
<td>8.0%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Asian</td>
<td>1.3%</td>
<td>5.0%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>3.7%</td>
<td>10.0%</td>
<td>7.2%</td>
</tr>
<tr>
<td>Native American</td>
<td>0.4%</td>
<td>11.0%</td>
<td>0.2%</td>
</tr>
<tr>
<td>White</td>
<td>83.6%</td>
<td>66.0%</td>
<td>82.0%</td>
</tr>
<tr>
<td>Multi-race</td>
<td></td>
<td></td>
<td>1.0%</td>
</tr>
<tr>
<td>Past performance on state assessments</td>
<td>Above Average</td>
<td>Above Average</td>
<td>Above Average</td>
</tr>
</tbody>
</table>

Site A

Site A is located in a school district in a rural suburb in the Mid-Atlantic with a population of approximately 101,108. Median household income is $60,543. White residents make up 89.2% of the population, followed by a small population of African-American residents (6.2%). The school district has thirty schools, of which seventeen are elementary schools. English Language Learners make up approximately 5% of students in the district. Two PK–5 schools from this district participated in this study and for the purposes of this report will be referred to as Schools 1 and 2. Three teachers from School 1 and one teacher from School 2 participated in the study.
Site B

Site B is located in a large suburb in the South Central area with a population of approximately 49,277. Median household income is $43,409. White residents make up 84.6% of the population, followed by a small population of Hispanic residents (5.1%). The school district has 29 schools, of which eight are elementary schools. English Language Learners make up approximately 3.8% of students in the district. Two K–5 schools from this district participated in this study and for the purposes of this report will be referred to as Schools 3 and 4. One teacher from each school participated in the study.

Site C

Site C is located in a large suburb in the Midwest with a population of approximately 55,520. Median household income is $67,574. White residents make up 93.5% of the population, followed by small populations of Hispanic and Asian residents (3.7% and 3.5% respectively). The school district has eleven schools, of which seven are elementary schools. English Language Learners make up approximately 3.4% of students in the district. Two PK–5 schools from this district participated in this study and for the purposes of this report will be referred to as Schools 5 and 6. Two teachers from School 5 and one teacher from School 6 participated in the study.

Participants

The participants in the Interactive Science pilot study included nine fifth-grade classroom teachers across six schools in three districts. Of the nine teachers, four taught multiple classes of science while five taught a single class. Teachers who taught more than one class of science taught their own students and then rotated with other teachers at their grade level to split science and social studies instruction across classes. The student sample size for Sites A through C consisted of 65–122 students.

Teacher Participants

The nine teachers provided weekly implementation data, observation data, and interview data. As an incentive for participation, classroom teachers received all components of the Interactive Science program free of charge. Classroom teachers in Sites B and C received stipends for their contributions to data collection requests. Teachers in Site A did not receive stipends due to a district policy prohibiting them. In lieu of stipends, classroom materials and a contribution to a field-trip fund served as an appreciation for participation. Pearson provided schools with funding to cover substitute teachers for participant training. All teachers completed an informed consent form for the study.

Of the nine teachers, five held a bachelor’s degree, and four held a master’s degree. The teachers had been teaching for a range of three to thirty-three years ($M = 12.44$). They had taught at their current grade level for a range of two to thirteen years ($M = 6.22$) and taught at their current schools for a range of zero to twelve years ($M = 5.44$).
Student Participants

The final analytical sample for the study included 264 fifth-grade students. Numbers of students varied across schools because some teachers taught multiple classes of science. Across all schools, 55.7% of participating students were male, and 44.3% were female. The majority of students were white (83%). Of the remaining ethnic categories, 6.1% of students were Hispanic, 5.3% were African American, and 5.6% were “other” which included Asian, American Indian, or multiracial. Of the participants, 2.3% were English Language Learners, and 4.9% were special education students. Free or reduced lunch information was provided by three of the six participating schools. Of those three schools, 12.7% of students had free or reduced lunch status. The remaining six schools were prohibited from providing student-level free/reduced lunch status. Appendix B presents demographic information for participating students disaggregated by schools.

Attrition

Evaluators conducted analyses to examine the overall sample attrition (i.e., number of participants who did not complete the study for any reason), measurement attrition (i.e., number of participants who did not complete all assessments because they were absent on the day of testing), and dropout attrition (i.e., how many participants left the study) that took place throughout the study.

The initial student sample included 302 participants. The final sample for analysis consisted of 264 final study participants, for an overall attrition rate of 12.6%. There were two reasons for overall attrition. Evaluators dropped student participants from the sample if they moved (n = 13) or had incomplete data (e.g., completed only fall assessments and not spring) (n = 25).

FINDINGS

The Interactive Science pilot research study sought to provide an understanding of teachers’ use of the Interactive Science materials and their perceptions of the effectiveness of the materials in meeting instructional needs. The study also sought to examine changes in student achievement and attitudes toward science over the course of the study. This section of the report presents findings related to the overarching evaluation questions.

IMPLEMENTATION OF THE Interactive Science Program

Key Question:
What was the nature of teachers’ implementation of the Interactive Science program?
Understanding how teachers used the *Interactive Science* materials was a key objective of the study. Teacher implementation is described by material use, instructional practices, and perceptions of and experiences with the program. Weekly teacher implementation logs and site visits that included observations and interviews served to illuminate these aspects of implementation.

The weekly implementation logs provided a comprehensive assessment of the teachers’ depth and breadth of use of the *Interactive Science* materials. Implementation log response rates varied across teachers in the study from 53% to 100% completion rates. The overall response rate across all logs was 81%. Implementation log data includes analysis of 221 log entries by the 9 teachers across the study period.

Pearson provided implementation guidelines for teachers (Appendix C). Implementation guidelines for the study required that teachers implement *Interactive Science* for two hours each week. The amount of time spent on science instruction varied across districts and sometimes across schools within the same district. Teachers in District A averaged more than 30 minutes of science instruction two to three times a week. However, when examined by school, there was a significant difference in the amount of science instruction between School 1 and School 2. One month into the study and the school year, School 1 reduced their instructional time for science to 30 minutes, twice per week for a total of one hour of science instruction weekly. This decision was beyond the control of the participating teachers and was due to increased instructional time for mathematics and language arts. As a result, teachers at School 1 progressed very slowly through the program. The teacher in District A, School 2 had more time for science instruction and typically taught science 2 ½ to 3 hours per week. District B teachers typically taught science 4 days per week for more than 30 minutes, and teachers in District C typically taught science 3 to 4 days per week for 30 minutes. Figure 1 presents the average daily implementation across weekly logs. Data from logs indicate that teachers implemented *Interactive Science* from 1 to 5 days per week during the study period, with an average of 3 days per week. Inclement weather and school cancellation accounted for the weeks when the program was taught for only 1 day.

![Figure 1. Average daily implementation of Interactive Science (n = 221).](image)

Participating teachers reported the amount of time spent each week planning and preparing for the use of the *Interactive Science* materials. Planning time ranged from 0 minutes to 120 minutes weekly, and the average planning time was 29 minutes per week.
Use of Program Components

Of the Interactive Science chapters available, individual teachers reported on 6–11 chapters. The number of chapters implemented varied due to instructional time for science. As previously noted, implementation at School 1 was slow due to greatly reduced instructional time for science. Table 3 shows the total number of chapters each school covered during the study period. Teachers spent the most time on chapters 1: The Nature of Science (25% of weekly logs) and 2: Design and Function (15% of weekly logs) and the least time on chapters 3: Classifying Organisms (4% of weekly logs) and 12: Changing Forms of Energy (3% of weekly logs).

Table 3
Number of Chapters Completed by School

<table>
<thead>
<tr>
<th>School</th>
<th>Chapters Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>School A</td>
<td>6</td>
</tr>
<tr>
<td>School B</td>
<td>11</td>
</tr>
<tr>
<td>School C</td>
<td>10</td>
</tr>
<tr>
<td>School D</td>
<td>11</td>
</tr>
<tr>
<td>School E</td>
<td>8</td>
</tr>
<tr>
<td>School F</td>
<td>8</td>
</tr>
</tbody>
</table>

The Interactive Science program components include a Teacher’s Edition, Student Write-in Text, Vocabulary Smart Cards (with vocabulary words and pictures on one side and activities on the other), kit materials for inquiry activities, Leveled Readers and Activity Cards for the inquiry activities in the chapters. Teachers reported on their frequency of use of Interactive Science components on each weekly log. Because District A teachers taught science 2–3 days per week, District B teachers taught science 4 days per week, and District C taught science 3–4 days per week, evaluators disaggregated data on use by district. The number of days per week teacher used individual program components is presented in Table 4.

Table 4
Average Days per Week Use of Program Components

<table>
<thead>
<tr>
<th>Component</th>
<th>District A Days of Use per Week*</th>
<th>District B Days of Use per Week</th>
<th>District C Days of Use per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher’s Edition</td>
<td>1.93</td>
<td>3.00</td>
<td>2.60</td>
</tr>
<tr>
<td>Student Write-in Text</td>
<td>1.80</td>
<td>3.10</td>
<td>2.72</td>
</tr>
<tr>
<td>Vocabulary Smart Cards</td>
<td>0.71</td>
<td>0.94</td>
<td>0.77</td>
</tr>
<tr>
<td>Kit materials</td>
<td>0.78</td>
<td>1.10</td>
<td>0.74</td>
</tr>
<tr>
<td>Leveled Readers</td>
<td>0.34</td>
<td>0.01</td>
<td>0.65</td>
</tr>
<tr>
<td>Activity Cards</td>
<td>0.10</td>
<td>0.13</td>
<td>0.11</td>
</tr>
</tbody>
</table>

* Averages of less than one day per week reflect averages across all weekly logs and account for weeks when these components were not used at all.

As shown in Table 4, Teachers in District A used the Teacher’s Edition and Student Write-in Text daily, while teachers in District B used the Teacher’s Edition and Student Write-in Text daily, while teachers in District C used the Teacher’s Edition and Student Write-in Text daily, while teachers in District C used the Teacher’s Edition and Student Write-in Text daily, while teachers in District C.
Write-in Text 3 days per week and teachers in District C used the Teacher’s Edition and Student Write-in Text 2 to 3 days per week. Teachers in District A averaged materials kit use 0.78 days per week Leveled Readers 0.34 and Activity Cards 0.1 days per week. Teachers in District B reported use of the materials kits, on average 1 day per week, the Leveled Readers in 1 weekly log, averaging .01 days per week and the Activity Cards 0.13 days per week. Teachers in District C averaged kit use 0.74 days per week, Leveled Readers 0.65 days per week and Activity Cards 0.1 days per week.

Activity Cards offer three versions of the Investigate It inquiry activity at the chapter’s end. The directed inquiry version provides the question for investigation and the methods for investigation. The guided inquiry version allows students to modify the question, while open inquiry allows students to choose a question and a means of investigating it. Across all the logs teachers reported using the Activity Cards 12% of the time. When teachers used the Activity Cards, they used them for guided inquiry most frequently (32%), followed by directed inquiry (39%), and open inquiry (29%).

On average, teachers in all three districts used the Vocabulary Smart Cards approximately once per week. Teachers used the Vocabulary Smart Cards in various ways. Students would cut the cards out and in some cases do the activities on the backs of the cards. Teachers reported that at times the activities on the backs of the cards were difficult for students, and so they created their own activities. Examples of these activities included doing a “card sort” for like concepts, having students apply the word in writing exercises, and having students use the cards with peers as flashcards or in matching games. Most teachers reported using the Vocabulary Cards for review at the end of a lesson or chapter. One teacher noted that she used the cards at the start of the chapter to preview the vocabulary and then had students come back to them at the end.

Each week teachers were asked what supplemental materials they used with Interactive Science. Teachers indicated use of supplemental materials in 39% of the weekly logs. Specifically, teachers reported using science videos or video clips (n = 25), science reading materials (n = 9), teacher created projects or activities (n = 9), “student interactives” (n = 5), and newspapers or magazines (n = 4).

Use of Teacher’s Edition Features

The Interactive Science Teacher’s Edition features include the Chapter Resource Guide that provides an overview of the lessons in the chapter, a lesson plan for each lesson providing a timeline for all the activities in the lesson, and a Teacher Background feature that provides background information on the topic for the teacher. The Lesson Plan also includes a feature called Short on Time that guides teachers toward parts of the lesson to select if they have limited instructional time. Of these features, teachers used the Lesson Plan and Chapter Resource Guide most frequently (Table 5). Teacher’s reported using the Short on Time feature on 10% of the weekly logs.
Table 5
Average Days per Week Use of *Teacher’s Edition* Features

<table>
<thead>
<tr>
<th>Component</th>
<th>District A Days of Use*</th>
<th>District B Days of Use</th>
<th>District C Days of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter Resource Guide</td>
<td>0.74</td>
<td>0.94</td>
<td>1.52</td>
</tr>
<tr>
<td>Lesson Plan</td>
<td>1.25</td>
<td>1.14</td>
<td>1.93</td>
</tr>
<tr>
<td>Teacher Background</td>
<td>0.92</td>
<td>0.72</td>
<td>1.51</td>
</tr>
<tr>
<td>Content Refresher</td>
<td>0.67</td>
<td>0.53</td>
<td>0.78</td>
</tr>
<tr>
<td>ELL Lesson Plan</td>
<td>0.04</td>
<td>0.14</td>
<td>0.19</td>
</tr>
<tr>
<td>Lab Support</td>
<td>0.41</td>
<td>0.56</td>
<td>0.62</td>
</tr>
<tr>
<td>Ell Support</td>
<td>0.03</td>
<td>0.24</td>
<td>0.22</td>
</tr>
<tr>
<td>Differentiated Instruction</td>
<td>0.44</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>Response to Intervention</td>
<td>0.16</td>
<td>0.57</td>
<td>0.46</td>
</tr>
</tbody>
</table>

* Averages reflecting less than one day per week reflect averages across all weekly logs and account for weeks when these components were not used at all.

Teachers received the *STEM Activity Handbook* and *Social Studies and Language Arts Connection* book as supplemental resources for use with the program. Teachers reported using the *STEM Activity Handbook* on 6% of weekly logs and the *Social Studies Language Arts Connection* book on 9% of logs. Although the *STEM Activity Handbook* was listed as a required program component, teachers noted lack of time for implementing additional activities as the primary reason for low use of these ancillaries. One teacher commented on the lack of classroom funds for purchasing extra materials as a reason for not using the *STEM Activity Handbook*. Another found the *STEM Activity Handbook* especially useful for challenging higher-level students.

**Chapter-Level Features**

Chapter-level features of the *Interactive Science* program include the *Try It!* exploratory activity at the start of the chapter and the *Investigate It!* activity at the end of the chapter. Teachers reported using the *Try It!* inquiry activity on an average of 76% of chapters on which they reported and the *Investigate It!* activity on an average 62% of chapters on which they reported. Teachers noted that they or their students often referred back to the *Try It!* activity when learning new concepts in the chapter lessons. Teachers noted that *Try It!* was a means of scaffolding the learning and activating prior knowledge in the lessons.

Also included at the chapter level is the *Let’s Read Science* reading strategy activity at the start of each chapter. Teachers indicated use of the *Let’s Read Science* reading strategies on an average of 64% of chapters they implemented. They used these and the interactivities in the student text as a means of supporting language arts instruction.

Each chapter has a *Big Question* that is the overarching theme of the chapter. For example, the question for the *Forces and Motion* chapter is “What affects the motion of objects?” Teachers used the *Big Question* at the start of each chapter to stimulate discussion and “brainstorm” prior to learning. One teacher posted the *Big Question* on the wall in the classroom so students could view it and return to it while covering the chapter. Teachers
also used the Big Question as a means of review and checking for understanding while working through the chapter. One commented, “I always like to start off with it so they have a pathway of where we are going. I like to come back and revisit the Big Question so they always know what the focus is and how things can relate to one another.” Another teacher stated that the engaging pictures with the Big Question stimulated discussion and allowed students to “go all over the place with their ideas about a topic.”

**Lesson Features**

Each Interactive Science lesson begins with a feature called Envision It!, which consists of a picture with an engaging question designed to stimulate discussion and interaction around the lesson objectives. Teachers reported use of the Envision It! feature in 57% of the logs. Teachers reported using the Envision It! feature as a way to engage students at the start of the lesson and to scaffold learning in the lesson. One teacher commented, “It was a good introduction to the chapter, and sometimes the kids took it somewhere else, and we would go with wherever it took us.” Another stated that Envision It! allowed students to relate what they were about to discuss to real-world objects or situations, thereby activating prior knowledge. Teachers also reported that they would refer back to the Envision It! while working through the lesson as a means of supporting student understanding.

Explore It! activities are inquiry activities at the beginning of lessons within the chapters. These activities are designed for students to explore concepts before formal introduction of subject matter. Teachers reported use of the Explore It! activities in 47% of the logs. Additional inquiry features include Lightning Labs, quick activities to reinforce chapter concepts. Teachers indicated using the Lightning Lab activities with their students in 18% of the logs.

Teachers reported using the My Planet Diary activities in 22% of the logs and the Do the Math! activities in 16% of the logs. The Teacher’s Edition offered other lesson features including Science Notebook Activities, which teachers used 26% of the time and Elaborate, which teachers used 22% of the time.

**Assessments**

Teachers reported using the Student Write-In Text as a means of assessing learning on 95% of all log entries, indicating that this feature of the text is a useful means of gauging student understanding. Got It! (Stop, Wait, and Go) has students indicate something they need help with (Stop), something they have a question about (Wait), and something they have mastered (Go). Teachers indicated use of the Got It! student self-assessment 59% of the time on weekly logs.

Teachers reported a high level of use of the student interactivities in the text for assessment purposes (82% of the weekly logs). Other assessment features include study assistance components such as the Lesson Check worksheets and chapter-level study and assessment features including the Chapter Study Guide, Chapter Concept Map, and Chapter Review. Teachers indicated use of the Lesson Check worksheets on 47% of the logs. Teachers reported using Chapter Concept map on 29% of the chapters reported on in the weekly logs. Of the chapters covered, teachers indicated use of the Chapter Review 33% of the time, the Chapter Concept Map
29% the time, and use of the Test Prep 17% of the time. Of chapters reported on, teachers indicated use of the Chapter Test 41% of the time.

Several teachers commented that the chapter test contained primarily multiple-choice items and that to truly understand whether students understood the concepts, they felt a need to supplement the tests to include more open-ended responses. Teachers reported that they used some of the questions from the Chapter Test but often added their own questions. Two teachers noted that they added questions to better mirror the types of questions students would encounter on district or state assessments. In some cases, teachers supplemented the tests to make them more challenging. For example, one teacher talked of how she supplemented the test for Chapter 2:

*I used some of the questions from the chapter test as well as the chapter review. I also included the scenario from the book in order for the students to follow the design process [Chapter 2]. It was definitely more challenging for them to fill in the blanks and apply what they know!*

Teachers at two sites commented that multiple-choice questions are often difficult for lower level students and do not adequately assess student understanding. Several teachers noted the need for more assignments that could be used for recording student grades in their grade books. These teachers were required by their districts to have a certain number of grades on record for each student in science.

**Implementation Fidelity**

To examine the degree to which teachers implemented Interactive Science in accordance with the study guidelines, evaluators calculated implantation fidelity scores for each teacher. The Interactive Science pilot implementation fidelity score is based upon 17 variables from the weekly logs, which address adherence to program components and exposure to the materials. Sixteen of the seventeen variables were weighted 5% in the calculation of implementation fidelity and one variable (total days of exposure to the materials) was weighted 20%. In-person fall and spring classroom observations provided an assessment of teacher quality across 20 indicators. In order to calculate overall implementation fidelity, evaluators averaged the fidelity weekly log score (assessing adherence and exposure) with the in-person observation fidelity score (assessing quality). Table 6 shows that of the nine teachers, six implemented the program with high fidelity and three implemented with moderate fidelity.

**Table 6**

**Number of Teachers at Three Levels of Implementation**

<table>
<thead>
<tr>
<th>Implementation Level</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (80% or higher)</td>
<td>6</td>
</tr>
<tr>
<td>Moderate (60%–79%)</td>
<td>3</td>
</tr>
<tr>
<td>Low (59% or lower)</td>
<td>0</td>
</tr>
</tbody>
</table>
TEACHER PERCEPTIONS OF *INTERACTIVE SCIENCE*

**Key Question:**
What were teachers’ perceptions of the quality and utility of the Interactive Science materials they implemented?

Evaluators collected teacher perceptions of the *Interactive Science* chapters through the weekly implementation log and through teacher interviews. This section of the report presents findings related to teacher perceptions of the implementation of the chapters as well as their perceptions of students’ engagement and learning resulting from program use.

**Implementation Perceptions**

Teachers reported each week on the ease of implementation of the *Interactive Science* chapters and on their comfort with using the materials. Teachers indicated ease of use on a 4-point scale with 1 representing *very difficult* to 4 representing *very easy*. Teachers indicated that it was easy to very easy to implement science materials in their classrooms (93% of weekly entries). In one weekly log (less than 1% of weekly entries) a single teacher indicated that it was very difficult to implement the science materials (Figure 2).

On weekly logs, teachers indicated their comfort level with implementing *Interactive Science* on a 5-point scale with 1 representing *very uncomfortable* to 5 representing *very comfortable*. Teachers indicated that that they felt comfortable to very comfortable implementing the materials on 97% of logs (Figure 3).

![Figure 2. Teachers’ perceptions of ease of implementation (n = 218).](image)

![Figure 3. Teachers’ comfort with program use (n = 216).](image)

During interviews and on open-ended log responses, teachers commented on the layout of the *Teacher’s Guides* as being particularly helpful for implementing the program. A typical quote from one teacher was,

*I like the way the Teacher’s Guide is laid out. It’s very easy to use. I’ve used some programs that were really not teacher-friendly; you had to jump from book to book to book. With this, the fact that each chapter has almost everything you need right there in one book, is really helpful.*
Another said, “The directions and everything are clear. Even a brand new teacher could open up the book and use it. It has all of the content and the background you need to teach the lesson.” One teacher commented that she really appreciated that the Teacher’s Guides were separate for each chapter rather than in one big book. Separate Teacher’s Guides for each chapter made it easy to take materials home for lesson planning and to walk around the room with the guide while instructing the lesson. Several teachers also commented that the background knowledge provided for teachers in each chapter was helpful in planning and implementing the lessons. One stated, “The Content Refresher is good for me—and it’s right there where it should be in the book.” Another noted, “I’m definitely learning something new with every chapter.” Teachers also commented that the organization of the materials in the activity kits made it easy to facilitate the inquiry activities in the program.

Teachers rated the pacing of instruction relative to the recommended lessons and materials provided each week (Figure 4). On a 3-point scale in which 1 represented fast-paced, 2 represented reasonably paced, and 3 represented slow-paced, the mean rating for pacing was 2.12, indicating that teachers felt the pacing of the program was appropriate. As shown in Figure 4, teachers indicated the pacing to be reasonable 76% of the time on weekly logs. Teachers at School 1, where science instruction was reduced to twice weekly for 30 minutes, had difficulty with the pacing due to their instructional situation and the low reading level of their students. Follow-up training provided by Pearson focused on tips for implementing the program given reduced time for instruction and use of the Leveled Readers to cover content more easily with lower readers thus allowing them to move through the program at a more reasonable pace in the second half of the study.

On 68% of logs, teachers indicated that the pace of their weekly science instruction allowed them adequate time to address the needs of all students in the classroom. On 24% of logs teachers indicated that the pace “somewhat” allowed for meeting all students’ needs, and on 8% of logs, teachers indicated that the pace did not allow adequate time for addressing all students’ needs. Teachers indicated the following reasons for feeling that the pace somewhat or did not meet all students’ needs:

- Lack of instructional time (n=32),
- Difficulty with reading level (n=17),
- Lack of student background knowledge (n=12)
- Need for extra support for English Language Learners (n=4).

Lack of instructional time was a factor primarily for teachers at the school where science instruction was reduced to one hour per week.
Teachers described their level of lesson preparation and planning each week on a 4-point scale, with 1 representing very easy and 4 representing very difficult. Teachers indicated that planning was easy to very easy on 75% of all logs and somewhat easy on 22% of logs (Figure 5).

![Figure 5. Teachers’ perceptions of preparation and planning (n = 220).](image)

On 58% of logs, teachers felt that the amount of time suggested on the Chapter Resource Guide and Lesson Plans presented in the Teacher’s Edition was accurate for the lessons they completed. Of the time when teachers did not think the suggested lesson timing was accurate, they indicated that they needed more time to complete the lessons. Teachers noted in interviews that this was more of an issue with their time for instruction rather than the program structure itself.

**Perceptions of Program Structure**

During interviews and on the final weekly log, teachers shared their perceptions of the program structure and components. All teachers identified the Student Write-in Text and the inquiry activities as being particularly motivating to students and valuable to their instruction.

All teachers agreed that the inquiry activities in the program were what students most enjoyed. One commented, “Learning has to be experienced, and I think that the book sets that up.” Inquiry activities allowed students of varying ability levels to engage with the learning. Teachers noted that the inquiry activities allowed students to explore lesson concepts in a meaningful way through application of their learning to a hands-on situation. Teachers commented that students “learn better by doing.” One stated,

> With this program, kids would take their knowledge and put it into play. It allowed them to show a greater understanding of what they had learned. I saw it lead to higher self-esteem because of the opportunities to practice what they were learning.

Teachers at a single school felt that lower-level students sometimes could not make the connection between the inquiry activities and what they were reading in the text. These teachers noted that they needed to make the connection and the “why we are doing this” explicit for their students. They felt the program could do more to make the connections overt. Teachers at other sites felt that the inquiry integrated well with the text. One teacher commented that she would like to see at least one “involved” experiment for each chapter. She noted that the while she and her students valued the inquiry activities, they were “fast” and she would like to see more in-depth experiments to challenge her higher learners.
Teachers noted that the write-in aspect of the student text was helpful for students to take ownership of their learning and of their materials. Teachers liked that all student work was in one place. One commented,

In fifth grade, they’re going through a transition time. They know their science book is important, and they don’t lose that like they would a science journal. I know they’ve really enjoyed it, and I’ve really enjoyed having that book right there. What they need to do is right in front of them. They don’t need to get lots of worksheets, which is good for the environment, and I don’t have to run off copies.

Teachers also commented that the Student Write-in Text allowed students to develop important note-taking skills. The ability to highlight important passages in the text was helpful to students while learning and studying and helped them to “put the knowledge into their heads.” One teacher stated,

I know we do highlighting a lot. I say, ‘Read to find this, and when you find it, highlight it.’ So they’re able to see it right there and write in it. They don’t have to transfer anything. They don’t have to read and then write it elsewhere. That’s been really helpful.

Across sites, teachers commented that the write-in aspect of the text helped students to pay attention and stay on track with the lesson. One commented, “I don’t have to worry if they are on the right page. I find they stay on track more when they write in the book.” Teachers also noted that the chance to write in a text was a novelty for students especially at the beginning of the year. One stated, “They were thrilled they could write in their book. They liked that they could write in it, highlight, underline and draw right in their book—it was huge.” Teachers commented that students were excited to have books that they could keep after the end of the school year. Two teachers commented that it would be helpful to have larger spaces for writing in the text, particularly for special education students whom had difficulty writing in the spaces provided in the text. Another commented that it would be helpful to have extra pages for taking notes at the end of each chapter.

Teachers across all sites felt that the Student Write-in Text supported language arts connections for students. Teachers noted that the interactivities supported skills that students needed across content areas including understanding cause and effect, main idea, comparing and contrasting, and overall reading skills. Teachers were mixed in their perceptions of how well the program supported mathematics connections. While some felt that activities such as Do the Math! supported mathematics skills students were learning during mathematics instruction, others felt that for lower students, the math connections were sometimes too difficult. One teacher commented that she would like to see more emphasis on interpreting graphs and charts.

Perceptions of Program Components

On the final weekly log, teachers were asked to provide their perceptions of various Interactive Science program components using a 4-point scale with 1 representing not valuable and 4 representing very valuable. Six of the nine teachers responded to this question and therefore responses do not represent all teachers in the study. Figure 6 shows the results of the teacher perceptions of the value of program components to their instruction.
The findings in Figure 6 corroborate the findings related in previous report sections as to use and value of various Interactive Science components. All respondents rated the inquiry activities, inquiry kit materials, and interactivities in the Student Write-in Text as valuable or very valuable. The majority of teachers found the Envision It! activities, the Vocabulary Smart Cards, Science Notebook activities, and My Planet Diary to be valuable or very valuable. The majority of teachers found the STEM Activity Handbook, and Do the Math! activities to be somewhat valuable or valuable. Eighty percent of teachers found the Activity Cards to be somewhat valuable.

**Perceptions of Effects on Student Learning and Interest**

**Key Question:**
What were teachers’ perceptions of the impacts of Interactive Science on students?

Evaluators gathered teachers’ perceptions of the effects of Interactive Science on their students through weekly implementation logs and interviews. On the weekly log, teachers provided feedback on how well the Interactive Science materials met the needs of various student groups within their classrooms on a 5-point scale ranging from 1 representing very inadequate to 5 representing very adequate. These results are presented in Figure 7.
As shown in the figure, teachers rated the materials as adequate to very adequate most frequently for on-level and advanced students. Teachers perceived that the Interactive Science program adequately or very adequately met the needs of on-level students on 77% of weekly log entries and advanced students on 80% of log entries. On the majority of logs, teachers indicated that the program was somewhat to very adequate in meeting below-level student needs on 64% of logs. Teachers indicated that the program was somewhat adequate or adequate in meeting the needs of significantly below-level students on 46% of logs. Teachers indicated that the program was somewhat adequate to adequate at meeting the needs of English Language Learners on 66% of log entries and special education students on 59% of log entries.

Interviews with teachers and open-ended final log responses served to illuminate these findings. Teachers across sites commented that the reading level and level of difficulty of activities worked best for on-level and above-level students. One teacher commented, “It’s great for above-level students. It gives them enough challenge. There are a lot of things that lead to higher-level thinking.” For below-level students, teachers noted that they had to provide more support and scaffolding so that students could understand the text. Teachers noted that readability was an issue especially when chapters covered particularly complex topics with unfamiliar vocabulary. In these lessons, teachers needed to move slower through the material to ensure understanding.

Teachers commented that at times the difficulty of the reading reduced engagement for lower-level students when lessons were focused on the text rather than on hands-on activities. Teachers stated that text-heavy lesson components led to “more of a reading lesson than a science lesson.” One commented, “Students are often hindered by the reading and some tend to not enjoy science class as they should. The reading in this text and the vocabulary used at a much higher and advanced level then where most of the students are currently reading.”

Teachers found that for lower readers, English Language Learners, and special education students, the visuals in the Envision It! activities, on the Vocabulary Smart Cards, and in the
interactivities were particularly helpful in increasing understanding. For teachers at one school with many struggling readers, the Leveled Readers were useful in bringing the vocabulary and reading to the appropriate level for their learners. A single teacher felt that the program could include more independent learning activities for her students who were at a higher level to challenge them more.

Each week teachers indicated their perceptions of student learning of academic vocabulary, essential questions for each chapter, lesson objectives, and scientific inquiry (Figure 8). Teachers indicated that students learned some to a great deal related to academic vocabulary (92% of log entries), essential questions (94% of log entries), lesson objectives (96% of log entries), and science inquiry (89% of log entries).

Figure 8. Teachers’ perceptions of student learning (n = 214 to 219).

Teachers at the school with reduced science instructional time noted that the pacing of their instruction made it difficult at times to perceive how well students were learning. Students were exposed to a wider range of science topics, but with one hour per week it was difficult to go into the depth they would have liked with the material. Teachers at the other sites felt that the program gave students the skills and understanding they needed for state testing in science and that they had seen an increase in understanding over the year.

In weekly logs, teachers provided student engagement scores. Teachers classified students as showing high engagement, average engagement, or low engagement with the Interactive Science materials and program over the course of the week. Table 7 presents teachers’ perceptions of student engagement with the program. Descriptions of engagement levels are included in Appendix D.
Table 7
Teachers’ Ratings of Student Engagement Across Weekly Logs

<table>
<thead>
<tr>
<th>Engagement Across Logs*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>High Engagement</td>
<td>70.6%</td>
</tr>
<tr>
<td>Average Engagement</td>
<td>30.6%</td>
</tr>
<tr>
<td>Low Engagement</td>
<td>10.5%</td>
</tr>
</tbody>
</table>

* For each weekly log, the percentages added up to 100%; however, the above percentages represent data across multiple teachers and logs, and as a result, do not add to 100%.

Across all logs, teachers felt that most students displayed high or average engagement. During observations evaluators noted that students were highly engaged during lab activities and that during text-based activities, they showed interest in answering teachers’ questions and writing in their texts. As previously noted, teachers felt that the inquiry activities were highly engaging for students. Teachers felt that the emphasis on inquiry in the program worked well for kinesthetic learners and that all students benefited from hands-on, active science.

**STUDENT PERCEPTIONS OF INTERACTIVE SCIENCE**

**Key Question:**
What were students’ perceptions of the Interactive Science materials?

Evaluators gathered student feedback on the Interactive Science program through interviews with a sample of four to five students in each participating classroom. Students responded to questions about what they liked about science, what helped them learn, and their feelings about the Interactive Science materials and activities. Across the six schools, evaluators conducted interviews with 68 students across 13 focus groups.

Across all focus groups, students enjoyed sharing their thoughts about the program. They enjoyed flipping through the Student Write-in Text while talking with evaluators and showing what they were learning. Several themes emerged across interviews including value of the write-in aspect of the text, pictures and illustrations, and emphasis on inquiry.

**Inquiry Activities**

Evaluators began focus groups by asking students what they like most about science and what most helps them learn. Across all focus groups, students most frequently cited “doing experiments” as most enjoyable and most helpful for their learning. Students felt that doing the inquiry labs in the Interactive Science program let them “interact with it and see how it works” and to help them “visualize” the concepts. Students commented on the Try It! labs at the beginning of the chapter that helped them preview what they would be studying. One
student commented, “You can put your hands on it to get used to it before you actually read
the book.” Several students stated that the Try It! and other labs were helpful for
constructing meaning as they were reading the text. One student said, “If you don’t know
what a word is, and then you do an experiment on it, it gives you a better understanding of
it.” Another commented that the inquiry activities “give them more information” when they
are learning new things. Students in two focus groups commented that they weren’t always
sure how the labs tied to what they were learning. One student commented that some
experiments help them to learn and some are “just for fun.”

Visual Aspects

Students also appreciated the visual aspects of the Interactive Science program. Students felt
that the Envision It! activities were helpful in providing a picture along with a question that
helps them to understand concepts. One student commented, “We have to look at the
picture and visualize what is happening. It helps us learn the material, especially after we read
the section.” Another commented that the pictures “show that science is in real life.”

Students also also commented that pictures on the Vocabulary Smart Cards helped them to
understand the vocabulary although they found the questions or activities on the back to be
difficult or confusing at times. With respect to the pictures throughout the text, one student
stated, “I need pictures. I need to see it” while another said, “If they didn’t have pictures,
how could you understand it?” Students in one focus group commented that the Interactive
Science text had more pictures than science texts they had used in the past, and this helped to
“give you an idea of what you’re learning about.” Students especially liked the pictures in the
interactivities where they could draw and diagram directly on the picture in the book. These
comments illustrated the importance of visuals like pictures, diagrams, and charts in helping
students to construct meaning.

Write-in Text

Across all focus groups, students valued the write-in aspect of their text. Students especially
appreciated that all of their science learning and work was contained in one book. They
commented that it was easy to keep track of all of their science materials because there was
no need for a notebook. Students commented that having everything in one place facilitated
learning and review of concepts. Students noted that the text became the study guide for
tests because they could underline and take notes directly on their books. One commented,
“You can move your eye right from your text to the question. You can highlight words or
phrases that help you in answering your questions and help you visualize it for the test.”

Students also appreciated being given important words and highlighted words in the text and
believed the captions provided more explanation. Students appreciated being able to circle
and underline in their text, which helped them to note areas of difficulty. One group of
students felt writing in their textbook held them accountable. As one student said, “You
know you need to answer the questions, so you read more carefully.” This same group of
students also believed that writing the information in their own words made more sense to
them than just reading it again in the text.

Across groups, students expressed a sense of ownership in their texts because they could
write in them and keep them after the end of the school year. One commented, “I can read
it and not really get it the first time, but I go back and since it’s my own book and I have it to myself, I can go back and underline the important stuff.” The ability to write in their science texts was new for all students. A typical student comment was, “I never knew that you could write in a science book. I was surprised. It was just different, and then we get to keep them at the end of the year.”

Across all focus groups, the majority of students indicated that the Interactive Science program made science more interesting for them than in the past. For most students, the program offered more opportunities for hands-on learning and exploration rather than “just reading and answering questions.” Students noted that the program “gets them more involved in science.” Students in one focus group who had previous experience with completely kit-based programs indicated that they were not as interested in the reading aspects of the program and preferred doing experiments. Students in several groups commented that they thought they were doing better in science with the Interactive Science program.

**STUDENT ACHIEVEMENT**

**Key Question:**
Did students demonstrate significant learning gains during the study period?

To examine whether students made significant learning gains in science over the course of the school year, evaluators examined pretest and posttest scores on the Stanford 10 standardized assessment. Scoring of the science test of the Stanford 10 yields a science scaled score that can be compared from pre to posttesting. Cut scores are provided for strands within the science test including life science, earth science, physical science, and the nature of science.

Science scaled scores on the pretest ranged from 576 to 736. The mean pretest score was 647.34 (SD = 26.71). Science scaled scores on the posttest ranged from 561 to 763. The mean posttest score was 659.55 (SD = 30.23). Figure 9 presents these findings descriptively.

![Figure 9. Mean pretest and posttest Stanford 10 science scores (n = 264).](chart.png)
Mean scores on the Intermediate 1 pretest and Intermediate 2 posttest were higher for the students in the Interactive Science study than for the students included in the normative sample for the test forms ($M = 633.06, SD = 38.12$ and $M = 636.4, SD = 32.8$ respectively).

To examine whether students experienced significant gains in science learning over the course of the year, evaluators conducted a paired-sample t-test on science scores on the Stanford 10. Results show that there was a statistically significant increase in science scores from fall to spring $t(263) = 7.784, p < .0005$. The Cohen’s d statistic (0.43) indicated a moderate effect size. The effect size translates to an average gain of 17 percentile points on the science test over the course of the study.

Evaluators examined the distribution of students within performance categories for life science, earth science, physical science, and the nature of science clusters from pretesting to posttesting. Figures 10–13 present these findings descriptively.

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1 Guidelines proposed by Lipsey (1990) indicate that an effect size of 0.00 to 0.32 = small effect, 0.33 to 0.55 = medium effect, and 0.56 to 1.20 = a large effect.
The majority of students began and ended the year as average to above average in each of the content clusters. As shown in Figures 10–13, the percentage of students in the above average category increased for life science, stayed relatively the same for physical science and earth science, and decreased for the nature of science.

To examine the relationship between teacher's implementation fidelity (as measured by the calculated implementation fidelity score) and student gains in science content knowledge (as measured by gains on the *Stanford 10* science test), evaluators used a Pearson product–moment correlation coefficient. There was a weak correlation between the two variables, \( r = .10 \) indicating that students made learning gains regardless of whether teacher's implemented the program with moderate or high fidelity to implementation guidelines.

**Key Question:**
Did significant learning gains differ by student characteristics?

To examine whether subgroups of students experienced different gains over the course of the study, evaluators conducted independent samples t-tests with gain scores as the dependent variable and gender and ethnicity as independent variables. Sample sizes for special education and English Language Learners were too small to run analyses on those subgroups.

Results indicate that there was no significant difference in gain scores for males and females, \( t (262) = .259, p = .796 \). White students and non-white students showed no difference in gains, \( t (262) = .264, p = .708 \). Table 8 presents means and standard deviations for each subgroup.

**Table 8**
*Student Subgroup Analyses for Gender and Ethnicity*

<table>
<thead>
<tr>
<th>Student Subgroup</th>
<th>n</th>
<th>Pretest Mean</th>
<th>SD</th>
<th>Posttest Mean</th>
<th>SD</th>
<th>Pre/Post Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>147</td>
<td>651.79</td>
<td>27.42</td>
<td>664.26</td>
<td>29.89</td>
<td>+12.47</td>
</tr>
<tr>
<td>Female</td>
<td>117</td>
<td>641.74</td>
<td>24.79</td>
<td>653.40</td>
<td>29.68</td>
<td>+11.66</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>219</td>
<td>649.28</td>
<td>25.93</td>
<td>661.13</td>
<td>30.82</td>
<td>+11.85</td>
</tr>
<tr>
<td>Non-White</td>
<td>45</td>
<td>637.87</td>
<td>28.68</td>
<td>651.27</td>
<td>25.96</td>
<td>+13.4</td>
</tr>
</tbody>
</table>
Results of these analyses indicate that students made comparable gains over the course of the study regardless of gender or ethnicity.

**STUDENT ATTITUDES TOWARD SCIENCE**

**Key Question:**
Did students demonstrate an increased interest in science during the study?

To examine whether students demonstrated an increased positive attitude toward science during the study, evaluators examined mean pre and posttest scores on the student science attitude survey. The survey consisted of 18 statements related to science interest and efficacy. Students indicated their agreement with each statement on a 5-point scale ranging from 1 representing really disagree to 5 representing really agree. Evaluators averaged student scores on all items to calculate a mean science attitude score for each student. A mean score of 3 would indicate a neutral view of science. Mean scores below 3 would indicate a negative view of science, while mean scores above 3 would indicate a positive attitude toward science. Mean scores for each item on pre and postsurveys are presented in Appendix E. Figure 14 presents Interactive Science participants’ mean presurvey and postsurvey scores for overall science attitude.

![Figure 14. Mean pretest and posttest science attitude scores (n = 264).](image)

As presented in Figure 14, student interest scores declined from pretesting (M = 3.92, SD = .55) to posttesting (M = 3.71, SD = .73). Evaluators conducted a paired samples t-test to compare attitude scores from pretesting to posttesting. The decrease in scores was statistically significant $t(263) = 5.46$, $p < .0005$. The Cohen’s d statistic (0.33) indicated a moderate effect.

Evaluators calculated scores for science interest (10 of 18 items) and science self-efficacy (8 of 18 items). Figure 15 presents mean scores for these subscales.
As shown in Figure 15, scores for self-efficacy and science interest declined from pre to posttesting. However, scores remained positive on both scales throughout the study period. When interpreting findings related to science attitude, it is important to note that while mean scores decreased over the course of the study, student attitudes toward science were positive at the start of the year and remained positive at the end of the year as indicated by pre and posttest mean attitude scores above 3. These findings indicate that students remained positive toward science while participating in the Interactive Science program. Several factors could influence lower scores on the posttest attitude survey. For example, the postsurvey was administered close to the end of the school year when students were likely anticipating summer break.

**SUMMARY & DISCUSSION**

*Interactive Science* is a standards-aligned comprehensive science curriculum that features text-based learning in an interactive *Student Write-in Text* supplemented with numerous and varied opportunities for hands-on learning through inquiry-based activities. The purposes of this study were to evaluate teachers’ implementation of the fifth-grade *Interactive Science* program and to measure science achievement and attitudes among students who participated in the program. The treatment-only quasi-experimental design was intended to provide exploratory findings about the *Interactive Science* program. Without a counterfactual, the study cannot make strong causal claims about program impacts.

Evaluators factored coverage of material and use of required program components into the calculation of an implementation fidelity score. Overall, teachers implemented the *Interactive Science* program with fidelity to program guidelines. Teachers at one school were unable to implement the program for the required two hours per week because their science instructional time was reduced to one hour per week after the study began. Because of the varied amount of time for science instruction across schools, teachers at some schools were able to cover more chapters than those at other schools. Students made learning gains over the course of the school year while participating in *Interactive Science* regardless of whether teacher’s implemented the program with moderate or high fidelity, indicating that significant learning took place across all study classrooms.
Evaluators gathered teachers’ feedback on the Interactive Science program through interviews and weekly implementation logs. Teachers found the program easy to use and particularly valued the organization of the Teacher’s Guides and the materials in the activities kits for supporting their implementation. Teachers found two aspects of the Interactive Science program to be particularly valuable to their science instruction. They noted that the many inquiry activities engaged students in the learning while giving them a means to scaffold learning, support learning. Inquiry activities also provided a means for students to apply learning throughout the chapters. The Student Write-in Text supported instruction by helping students to organize and take ownership of their learning while supporting critical skills such as highlighting, note taking, diagramming, determining main ideas, and cause and effect.

Teachers felt that the Interactive Science program best met the needs of on-level and above-level students. Teachers noted that the reading level and the level of difficulty of some of the activities in the chapters were above the level of below-level and special education students. Teachers with below-level students had difficulty with the program pace, as they needed to move more slowly through the text-based activities.

Teachers reported an average to high level of student engagement on the majority of weekly logs. Teachers indicated that for struggling readers, student engagement was lower for the text-based activities in the program than for the hands-on activities. Leveled Readers helped to make the material more understandable to struggling readers.

Students provided feedback on the Interactive Science program in focus group interviews with evaluators. Student responses to the program were uniformly positive across focus groups. They particularly enjoyed the inquiry activities, although they were not always sure of the connections between the activities and the content presented in the text. Students also liked the visual aspects of the program such as the pictures in the Envision It! and on the Vocabulary Smart Cards. Pictures helped students to see the connections between science and the real world and everyday life. Students valued the fact that they could write in their texts. This was a new experience for most students, and they found it useful for learning and studying new material.

Study findings indicated that students demonstrated significant gains in science content knowledge over the course of the year while participating in the Interactive Science program. Gains corresponded to a medium effect size with average percentile gains of 17 points from pre to posttesting. Subgroup analyses for gender and ethnicity indicated comparable gains for males and females or for white and non-white students suggesting that gains were relatively equal for students in these subgroups.

Student attitudes toward science showed a statistically significant decrease over the course of the year while using Interactive Science. The effect size indicated a moderate effect. While student attitude scores decreased over the course of the year, it should be noted that students began the year with positive attitudes toward science and remained positive toward science at the end of the school year.

In conclusion, teachers valued the Interactive Science program for providing a hands-on, experiential approach to science instruction. The program helped students to understand the
connections between science and the world around them. Teacher and student attitudes toward the program were generally positive, and students made significant gains in understanding standards-based science concepts over the course of the year of using the program.
REFERENCES


APPENDIX A
Assessment Reliability Information

*Stanford 10 Reliability*

The *Stanford Achievement Test, Tenth Edition* was the standardized norm-referenced diagnostic assessment used in this study. Teachers administered Intermediate 1, Form A in the fall and Intermediate 2, Form A in the spring. Each level contains 40 items.

The Kuder-Richardson Formula 20 (K-R 20) reliability coefficients for the *Stanford 10* Intermediate 1 and Intermediate 2 raw scores are presented in Table A1. The K-R 20s for the *Stanford 10* indicate high reliability.

**Table A1**
**Reliability Information for the Stanford 10**

<table>
<thead>
<tr>
<th>Level</th>
<th>Form</th>
<th>Test</th>
<th># of items</th>
<th>K-R 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate 1</td>
<td>A</td>
<td>Science</td>
<td>40</td>
<td>0.86</td>
</tr>
<tr>
<td>Intermediate 2</td>
<td>A</td>
<td>Science</td>
<td>40</td>
<td>0.84</td>
</tr>
</tbody>
</table>
## APPENDIX B

### Participant Characteristics

**Table B1.**

**Participant-level Characteristics**

<table>
<thead>
<tr>
<th>Gender Among Participants</th>
<th>Site A</th>
<th>Site B</th>
<th>Site C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>School 1</td>
<td>School 2</td>
<td>School 3</td>
</tr>
<tr>
<td>Male</td>
<td>n = 43</td>
<td>n = 22</td>
<td>n = 59</td>
</tr>
<tr>
<td>Male</td>
<td>58.1%</td>
<td>72.7%</td>
<td>63.6%</td>
</tr>
<tr>
<td>Female</td>
<td>41.9%</td>
<td>27.3%</td>
<td>36.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethnicity Among Participants</th>
<th>Site A</th>
<th>Site B</th>
<th>Site C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>School 1</td>
<td>School 2</td>
<td>School 3</td>
</tr>
<tr>
<td>African American</td>
<td>20.9%</td>
<td>4.5%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2.3%</td>
<td>0.0%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Caucasian</td>
<td>69.8%</td>
<td>95.5%</td>
<td>77.3%</td>
</tr>
<tr>
<td>Other</td>
<td>7.0%</td>
<td>0.0%</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>English Language Learners Among Participants</th>
<th>Site A</th>
<th>Site B</th>
<th>Site C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>School 1</td>
<td>School 2</td>
<td>School 3</td>
</tr>
<tr>
<td>ELL</td>
<td>2.3%</td>
<td>0.0%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Non-ELL</td>
<td>97.7%</td>
<td>100.0%</td>
<td>98.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special Education Among Participants</th>
<th>Site A</th>
<th>Site B</th>
<th>Site C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>School 1</td>
<td>School 2</td>
<td>School 3</td>
</tr>
<tr>
<td>Special Education</td>
<td>2.3%</td>
<td>13.6%</td>
<td>6.1%</td>
</tr>
<tr>
<td>Non-Special Education</td>
<td>97.7%</td>
<td>86.4%</td>
<td>93.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Free/Reduced Price Lunch Among Students</th>
<th>Site A</th>
<th>Site B</th>
<th>Site C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free/Reduced Lunch</td>
<td>School 1</td>
<td>School 2</td>
<td>School 3</td>
</tr>
<tr>
<td></td>
<td>n = 43</td>
<td>n = 22</td>
<td>n = 59</td>
</tr>
<tr>
<td>Free/Reduced Lunch</td>
<td>25.6%</td>
<td>27.3%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Non-Free/Reduced Lunch</td>
<td>74.4%</td>
<td>72.7%</td>
<td>75.0%</td>
</tr>
</tbody>
</table>

*Schools were unable to provide free/reduced priced lunch information for individual students because of school privacy policies.

**Percentages based on data collected.
APPENDIX C
Implementation Guidelines

1. *Interactive Science* must be implemented for a minimum of 2 hours per week.
2. The following chart outlines required versus optional features at the chapter and lesson levels. Please note the following:
   - There are more required features in Chapter 3. After becoming familiar with the instructional resources in the program you will be able to choose which features best support the instructional needs for your classroom.
   - In Chapter 3 you are required to implement both chapter-level inquiry *Try It!* and *Investigate It!*. You must minimally complete 2-3 *Explore It!* found within the lessons.
   - In Chapter 5, you are required to minimally complete 3 inquiries for the entire chapter. You can choose from *Try It!*, *Explore It!*, and *Investigate It!* inquiries.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Grade 5 Student Edition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter Opener</td>
<td>Required</td>
</tr>
<tr>
<td><em>Try It!</em> Inquiry (per chapter)</td>
<td>Required</td>
</tr>
<tr>
<td><em>Let's Read Science</em></td>
<td>Optional</td>
</tr>
<tr>
<td><em>Envision It!</em></td>
<td>Required</td>
</tr>
<tr>
<td><em>Explore It!</em> Inquiry</td>
<td>Recommended (Must teach 3 inquiries within Ch. 5)</td>
</tr>
<tr>
<td><em>My Planet Diary</em></td>
<td>Optional</td>
</tr>
<tr>
<td>Content/Interactivities (questions throughout the lesson)</td>
<td>Required</td>
</tr>
<tr>
<td><em>Elaborate</em> (TE Notes)</td>
<td>Optional</td>
</tr>
<tr>
<td><em>Do the Math!</em></td>
<td>Optional</td>
</tr>
<tr>
<td><em>Lightning/Go Green/At Home Labs</em></td>
<td>Optional</td>
</tr>
<tr>
<td><em>Got It!</em></td>
<td>Required</td>
</tr>
<tr>
<td><em>Lesson Check</em> (TE)</td>
<td>Optional</td>
</tr>
<tr>
<td><em>Investigate It!</em> Inquiry (per chapter)</td>
<td>Required</td>
</tr>
<tr>
<td><em>Vocabulary Smart Cards</em></td>
<td>Required</td>
</tr>
<tr>
<td><em>Study Guide</em></td>
<td>Optional</td>
</tr>
<tr>
<td><em>Chapter Review</em></td>
<td>Optional</td>
</tr>
<tr>
<td><em>Benchmark Practice</em></td>
<td>Required</td>
</tr>
<tr>
<td>Feature (Career, NASA, Biography, Big World, Go Green)</td>
<td>Optional</td>
</tr>
</tbody>
</table>

**Required Ancillary Items**
*STEM Activity Handbook: Design It! Activity*

**Optional Ancillary Items**
*Social Studies and Language Arts Connection Book*
## APPENDIX D

### Student Engagement Descriptors

<table>
<thead>
<tr>
<th>Description of Student Engagement Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Engagement</strong></td>
</tr>
<tr>
<td>Students stayed on task during science instruction and enjoyed participating in the science and inquiry activities in the program. Students showed interest in the <em>Interactive Science</em> materials and seemed to love science. Students made positive comments about the materials. Students often talked to each other about the materials and regularly asked questions about the science content or inquiry process. Students showed great interest and ownership in their Write-in Texts.</td>
</tr>
<tr>
<td><strong>Average Engagement</strong></td>
</tr>
<tr>
<td>Students stayed on task and participated in the required science and inquiry activities. They showed some interest in the materials and seemed to enjoy science. Students made some positive comments about the <em>Interactive Science</em> materials. They sometimes discussed the content with each other. They used their Write-in Texts as expected.</td>
</tr>
<tr>
<td><strong>Low Engagement</strong></td>
</tr>
<tr>
<td>Students had difficulty staying on task and participating in the required science activities. They showed very little interest in the materials and did not seem to enjoy science. They sometimes seemed frustrated by the activities. Students made few or no positive comments about the <em>Interactive Science</em> materials.</td>
</tr>
</tbody>
</table>
## APPENDIX E

### Mean Responses to Attitude Statements

**Table E1**

*Mean Responses to Individual Attitude Survey Items*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Presurvey Mean</th>
<th>SD</th>
<th>Postsurvey Mean</th>
<th>SD</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science is interesting to me.</td>
<td>4.27</td>
<td>0.77</td>
<td>3.88</td>
<td>1.05</td>
<td>-0.39</td>
</tr>
<tr>
<td>I like to talk to my friends and family about science.</td>
<td>3.22</td>
<td>0.99</td>
<td>2.94</td>
<td>1.09</td>
<td>-0.28</td>
</tr>
<tr>
<td>I am good at understanding science.</td>
<td>3.96</td>
<td>0.80</td>
<td>3.83</td>
<td>.95</td>
<td>-0.13</td>
</tr>
<tr>
<td>Solving science problems is fun.</td>
<td>3.69</td>
<td>1.03</td>
<td>3.34</td>
<td>1.25</td>
<td>-0.35</td>
</tr>
<tr>
<td>I am good at doing science experiments and activities.</td>
<td>4.55</td>
<td>0.69</td>
<td>4.44</td>
<td>0.79</td>
<td>-0.11</td>
</tr>
<tr>
<td>I understand how science is used in real life.</td>
<td>3.86</td>
<td>0.96</td>
<td>4.00</td>
<td>.86</td>
<td>+0.14</td>
</tr>
<tr>
<td>I understand how scientists study the world.</td>
<td>3.52</td>
<td>1.02</td>
<td>3.70</td>
<td>0.97</td>
<td>+0.18</td>
</tr>
<tr>
<td>Doing science experiments and activities is fun.</td>
<td>4.80</td>
<td>0.54</td>
<td>4.61</td>
<td>0.80</td>
<td>-0.19</td>
</tr>
<tr>
<td>Being a scientist would be an exciting job.</td>
<td>3.37</td>
<td>1.22</td>
<td>3.16</td>
<td>1.26</td>
<td>-0.21</td>
</tr>
<tr>
<td>It is important for me to learn science.</td>
<td>4.30</td>
<td>0.74</td>
<td>4.06</td>
<td>.97</td>
<td>-0.24</td>
</tr>
<tr>
<td>I like to read about science.</td>
<td>3.37</td>
<td>1.14</td>
<td>3.03</td>
<td>1.25</td>
<td>-0.34</td>
</tr>
<tr>
<td>I enjoy learning new things in science.</td>
<td>4.31</td>
<td>0.78</td>
<td>4.00</td>
<td>1.05</td>
<td>-0.31</td>
</tr>
<tr>
<td>I like to know the answers to science questions.</td>
<td>4.30</td>
<td>0.84</td>
<td>4.09</td>
<td>1.08</td>
<td>-0.21</td>
</tr>
<tr>
<td>I want to be a scientist when I grow up.</td>
<td>2.35</td>
<td>1.20</td>
<td>2.30</td>
<td>1.20</td>
<td>-0.05</td>
</tr>
<tr>
<td>Science helps us to understand the world.</td>
<td>4.41</td>
<td>0.66</td>
<td>4.20</td>
<td>0.87</td>
<td>-0.21</td>
</tr>
<tr>
<td>I have a good feeling about science.</td>
<td>4.16</td>
<td>.86</td>
<td>3.71</td>
<td>1.15</td>
<td>-0.45</td>
</tr>
<tr>
<td>Science is one of my favorite subjects in school.</td>
<td>4.02</td>
<td>1.16</td>
<td>3.40</td>
<td>1.36</td>
<td>-0.62</td>
</tr>
<tr>
<td>I usually understand what we are doing in science class.</td>
<td>4.05</td>
<td>0.84</td>
<td>4.03</td>
<td>0.83</td>
<td>-0.02</td>
</tr>
</tbody>
</table>