RESULTS
with
GLENCOE SCIENCE
in Middle School

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With the development of the National Science Education Standards in 1996, educators throughout the United States have been inspired to raise the academic bar. It is more important than ever to ensure that our schools are reaching for the highest in science academic achievement so that all children will be prepared to explore current and future frontiers of science and technology.

It is imperative that our schools impart knowledge of and experience with physical, life, and Earth science to all students, as well as the skills necessary to critically evaluate evidence that is labeled "scientific." We need to look at schools that are engaging their diverse student populations and producing results, and use those as models for the rest of the country.

This report describes fourteen schools in nine districts that have been successful in teaching physical, life, and Earth science concepts, as evidenced by student performance on assessments, feedback from students and parents, and responses from teachers. These results demonstrate the benefits of effective middle school science programs, as well as successful teaching practices.

The schools that use these middle school science programs described here share several other critically important characteristics.

- All show improved student performance.
- All have created exciting climates within their schools to encourage learning.
- All monitor student progress during the school year to ensure effective instruction.
- All demonstrate the importance of maintaining high expectations for all students, not just the brightest or most privileged.

The leaders and teachers of the schools described herein are eager to share their results and to see their practices and experiences spread to many other schools. Please feel free to contact the people identified in each article. We've provided contact information whenever possible to make communication as easy as possible.

Let's learn from the example set by these schools. In doing this, we can help our children become the successful learners they need to be to face the challenges and promises of the 21st century.

Introduction

Results. More than at any other time in recent history, attention is focused on the results our schools produce. With the *No Child Left Behind Act* of 2001, expectations have been raised and student performance standards have been identified for virtually every school subject. In turn, states have set target goals that students must meet if they are to make "Adequate Yearly Progress."

Science education is guided by the National Research Council's National Science Education Standards. The Standards describe a vision of the scientifically literate person and present criteria that will allow that vision to become reality for all students. Science teachers and administrators are called to challenge students to become inquisitive and active science learners.

To achieve the high goals set by the Standards, educators and others involved in science education reform need an array of state-of-the-art strategies and tools. Their toolbox must include inquiry-based curricula—supporting the Science Standards and forming a flexible learning system that provides options to enable all students to reach high standards.

Glencoe's middle school science programs:

- **Fully support the National Science Education Standards' for Content**. Each *Teacher Wraparound Edition* includes linkage charts to clearly show which Content Standards are met in each lesson.
- **Provide a balance of explicit and implicit teaching strategies.** Each combines the best research on "reform" curricula with proven "traditional" curricula, incorporating the active involvement of students to make sense of important scientific ideas.
- **Include opportunities for inquiry, scientific discussion and debate, and problem solving.** Each *Student Edition* includes a wide array of lab experiences and problem-solving exercises to support students as they build science skills.
- **Offer a variety of instructional methods for all students**. Resources include Differentiated Instruction strategies in the *Teacher Wraparound Edition* to meet individual needs, supplements for intervention, and enrichment activities to challenge high-achieving students.
- **Offer a range of technology options to enhance skills, promote critical thinking, and connect the classroom to the world in which students live.** Multimedia resources include links to Glencoe's Web site, Virtual Labs, Vocabulary PuzzleMaker, StudentWorks™ Plus CD-ROM, Interactive Chalkboard CD-ROM, Video Labs, MindJogger Videoquizzes, and Online Study Tools available at www.mhln.com.

This report shares the stories of 14 schools in nine districts that have implemented one of Glencoe's middle school science programs. The common characteristic is results. All have implemented programs of instruction in science that have enabled them to raise the performance of their students to exemplary levels. It is undoubtedly true that there is no one way for all children to learn, but it is essential that all children learn to meet the challenges of our ever-changing world.

I encourage you to explore how Glencoe's middle school science programs can support excellence in standards-based scientific teaching and help our children be prepared for and productive in the 21st century.

Professor Frank E. Crawley
Department of Mathematics & Science Education
East Carolina University

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Matt Meadows

The Glencoe Science series discussed in this report include the following related middle school titles: ***Glencoe Life Science, Glencoe Earth Science, Glencoe Introduction to Physical Science, Glencoe Science: Level Red, Level Green, Level Blue (Integrated)***, and ***Glencoe Texas Science***. For information about results with other middle school titles, please contact Glencoe Science.

Austin Independent School District

Covington & Fulmore Middle Schools, Austin, Texas

Austin (pop. 656,562), the state capitol of Texas, is located on the Colorado River in the south central region of the state. Known as a strong cultural and technology-based center, Austin is the second fastest growing city in the United States.

The Austin Independent School District (AISD) serves approximately 76,000 students through 74 elementary schools, 18 middle/junior high schools, and 12 high schools. Sixteen of these AISD schools have recently earned National Blue Ribbons and four have earned Texas State Blue Ribbon Awards. The AISD also has five of *Newsweek* magazine's top 600 schools in the nation, and has more National Board Certified teachers than any other district in Texas. AISD's student body is 53% Hispanic/Latino, 30% Caucasian, 14% African American, 2% Asian, and 1% Native American.

At the start of the 2002–2003 school year, the ***Glencoe Texas Science*** series was adopted in all middle school science classrooms district-wide. Fulmore Middle School, founded in 1886, serves over 850 sixth- to eighth-grade students, demographically represented as 66% Hispanic/Latino, 19% Caucasian, 14% African American, and 1% Asian/Pacific Islander. Covington Middle School, a National Blue Ribbon Recipient, serves roughly 950 sixth- to eighth-grade students. Their student body is 48% Caucasian, 41% Hispanic/Latino, 9% African American, and 2% Asian/Pacific Islander.

Students Excited About Science

Providing a setting where students are engaged and excited about their science classes is important to teachers like Connolly Coyle, eighth-grade science teacher at Covington Middle School. "Here in Austin, I think our students' skills and excitement about science are increasing significantly. With the Glencoe program we have a curriculum that is inquiry based, where kids can go in and find what they need in order to go forward with completing their work activities. It allows us to do a lot of lab work in our classes. So much of ***Glencoe Texas Science*** is very well set up to be inquiry based." Crystal Rushing, a sixth-grade teacher at Fulmore Middle School, also finds that Glencoe's program engages students: "My students are always super excited about much of the work we do, especially the lab work. They stay focused on these activities because they don't want to miss them. I also know that many students do more than I assign them. For instance, the textbook provides great Web links to current information, and I've noticed that our classroom computers have gone to these sites even when I don't assign them. They are going there on their own, obviously because the textbook is engaging them to do so."

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Teacher Resources

Staci Pierce, science department chair and eighth-grade teacher at Covington Middle School, shares, "Glencoe provides really helpful CDs with ***Glencoe Texas Science*** for teachers to use. For example, the Exam*View*® Pro Testmaker software allows you to make your own tests and quizzes, choosing exactly what questions you want in order to customize assessment. I recommend teachers utilize all the CD resources, so they can assess students in a wide variety of ways." Ms. Rushing adds, "I use the color transparencies from the Glencoe program every day as a warm up in my classes. They are high quality and are a good introduction to the content we are going to cover each day. I use the Directed Reading for Content Mastery workbook as homework, and even do some standardized testing preparation with materials that Glencoe provides for the Texas Assessment of Knowledge and Skills (TAKS)."

The ***Glencoe Texas Science*** resources used most often by some AISD teachers are the materials in Spanish. Ms. Rushing comments: "I use the Spanish materials every day, and they are available for many of the resources that Glencoe provides. I have a lot of English as a Second Language (ESL) students, so having the booklets, glossary, and directed reading materials in Spanish is really helpful. Even the Exam*View*® Pro Testmaker software has the feature of just clicking a button, and instantly translating the test into Spanish. We just wrote our final exam with the software and it was extremely easy to create and translate." Ms. Coyle echoes these sentiments from experiences at her school. "I love the Spanish supplements that go along with the text. I use the Spanish version of the guided reading materials within the Fast Files. We can also give Spanish materials to students in an ESL class and they can do the lab activities with us. The Spanish materials help me a ton! It's really nice as a teacher to have all these things set up for you. You don't have to do it alone."

Doug Martin

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Conroe Independent School District

Reaves Intermediate & York Junior High Schools, Conroe, Texas

Conroe Independent School District (CISD) is located in Montgomery County (pop. 190,000), a densely populated metropolitan county in southeastern Texas, known as the birthplace of the Lone Star flag. Twenty-two percent of Montgomery County's population is foreign born. CISD is the largest employer in Montgomery County, and serves almost 40,000 students through 47 schools—23 elementary, 7 intermediate, 6 junior high, 6 high schools, and 2 academies—and is growing by approximately 1,300 students per year. CISD has received 16 exemplary and 12 recognized awards from the Texas Education Agency, and has scored above national and state averages on all standardized tests.

Reaves Intermediate School serves just over 800 fifth- and sixth-grade students. The student body is 69% Caucasian, 21% Hispanic/Latino, 9% African American, and 1% Native American. York Junior High School serves almost 800 sixth- through eighth-grade students. Their student body is 75% Caucasian, 13% Hispanic/Latino, 7% African American, and 2% other.

Evaluating New Science Programs

Holly Pitts, a seventh-grade science teacher at York Junior High School and textbook adoption committee member, shares, "In our district, science is up for adoption every seven years. For this adoption, we evaluated materials from several textbook companies, including the software that came with the textbooks. I was really impressed with the software that came with Glencoe's textbook. I loved the PuzzleMaker, and now I use it with every unit, and make every puzzle that I can. I also liked the Exam*View*® Pro Testmaker software, because with a push of a button, I could tailor the tests for everyone in my class—my special education students, regular students, and honors students. As far as the textbook, I found that it was divided into smaller chunks of information, so we could stop and review information often. It wasn't 3–4 pages of reading on the same thing. Also, the reading level wasn't technical or boring, so I thought my students could really get into it and understand it. I especially thought my students would like the National Geographic features with eye-catching pictures. They are really geared toward children."

For the 2002–2003 school year, CISD adopted ***Glencoe Texas Science*** for all of its sixth-, seventh-, and eighth-grade science classes.

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Positive Teaching Experiences

Since implementing ***Glencoe Texas Science***, teachers at CISD are reporting positive teaching experiences. Teresa Luikens, a sixth-grade science teacher at Reaves Intermediate School, remarks, "***Glencoe Texas Science*** is easy to use because it flows very well and it is written with kids in mind. Kids can identify with the pictures and examples used throughout the book because it deals with current events that are ongoing in the world today. It interests them. I particularly like the way that it always reinforces from section to section, so you pick up the same information, and there is continuity. It also does a good job of asking thought-provoking questions of the students, rather than just questions that solicit a 'yes' or 'no' response. Students have to think and process information in order to come up with a well-thought-out answer."

Ms. Pitts echoes many of her colleagues' remarks: "The *Teacher Wraparound Edition* of ***Glencoe Texas Science*** is so simple to use. It has more activities than you could possibly use, for all levels of students; easy activities for special education students and more challenging ones for those in honors. In the margins there are notes for teachers, such as 'these are for kids with language barriers,' 'these are extensions for honors students,' so it is simple to tailor your lessons. You don't have to do the same old thing day after day with Glencoe; you can mix it up because there are so many activities. They also have a lot of technology for teachers and students to use and you don't have to be technologically savvy to use them. Glencoe provides the teacher with many different ways to assess student learning too. They have Quick Checks in each chapter, a question to see if students are getting it. They also have labs, online games, puzzles, chapter tests, and quizzes. I just love ***Glencoe Texas Science***."

The New Science Student

CISD teachers are impressed with how their students have responded to ***Glencoe Texas Science***. Ms. Pitt shares, "I see my students get excited. They thumb through the book to see the pictures and read the captions. I also know that they do quizzes and games at home online. Though we have no standardized test scores to share, I can report that my grades in science were higher this year, and that I know my students leave my class more independent than when they arrived."

Ms. Luikens also shares her thoughts: "All my students—over 100 a day—love coming to my science class. I think they enjoy using this textbook because of the way it flows, and they are not intimidated by it. They don't close the book and say I don't want to do this. They are captivated by the pictures and graphics that help them understand and visualize the science. They really love the introductory visuals for each chapter, and they could spend all day talking about them. They never seem to become bored. I could see a progression from the first of the year to the end, an increase in interest, and it was awesome. ***Glencoe Texas Science*** encourages students to enjoy and learn about all the aspects of science."

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DeVeaux Junior High School

Toledo Public Schools, Toledo, Ohio

The City of Toledo (pop. 313,000), located in northwest Ohio, is the fourth largest city in the state. The Toledo Public School District serves roughly 36,000 students in 47 elementary schools, 7 junior high schools, 8 senior high schools, and 13 specialized learning centers, and employs over 5,000 staff members. The district is proud of its culturally and ethnically diverse student body, staff, and school cultures that promote an atmosphere of mutual respect and dignity. The district is a member of the Council of Great City Schools, which represents 50 of the largest urban school districts in the nation with a combined enrollment of 7 million students. DeVeaux Junior High School currently enrolls over 1,000 students each year: 56% Caucasian, 39% African American, 3% Hispanic/Latino, 1% Native American, and 1% Asian/Pacific Islander.

Adopting the Glencoe Science Program

Toledo Public Schools adopted the Glencoe Science series in all middle school science classrooms at the start of the 2002–2003 school year. Lera Doneghy, a seventh-grade science teacher at DeVeaux Junior High School, recalls the adoption process: "We had several publisher in-services that dealt with the mechanics of the program first, which were really helpful in taking on something like this. I recall learning how to utilize the Interactive Teacher Edition on CD-ROM so that we never had to take the physical textbook home. Learning how to use that, with all its wonderful features, was great. We also had another in-service, which was strictly technology based: navigating the Web site, helping students with low reading abilities through the Guided Reading Audio Program, and the Interactive Student Edition on CD-ROM that allows students to work individually on the computer through taking quizzes and other self-evaluations." Duane McGorty, another seventh-grade science teacher at DeVeaux Junior High, adds, "After an initial in-service that introduced the teacher materials, our second in-service focused on specific activities like the Interactive Lesson Planner with Teacher Resources CD-ROM and Foldables™. It was really helpful to learn about features that I can use in my classroom with my students."

Ms. Doneghy continues, "We also had follow-up teacher meetings by grade level where we talked about our experiences using the program, and sometimes someone from Glencoe came to those meetings as well. I am really glad that I was able to take the time to learn about all the possibilities with the program, including using all the supplemental books and materials."

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Meeting Student Needs

Ms. Doneghy talks about the features she and her colleagues believed would meet students' needs: "The textbook layout is very student friendly and is different from any other text I've seen in that it augments so many of the topics effectively. Also, the language is not so advanced that it turns students off, and there are great photographs and diagrams throughout. Glencoe also has a Guided Reading Audio Program, which is a great resource for some students. I remember it was key to several teachers that we have a text with Spanish student resources, and Glencoe provides that." Lucy Vernile, an eighth-grade science teacher at DeVeaux Junior High School also on the textbook adoption committee, remarks, "Much of our student body really struggles with interpreting graphs and charts, so we are pleased that the Glencoe program offers many high-quality diagrams which help them with that issue. I also appreciate that the text is very colorful, which is appealing to students. It is also advanced enough that we as teachers know our students are moving to higher-order thinking skills."

Ms. Vernile comments on specific resources that work really well in her classrooms: "The Foldables™ are something that my students hadn't had experience with before, but that they find really helpful. It's an extra learning tool for them. They don't feel like they are just doing vocabulary, but it serves as a study helper, especially for kids who just need a little something more." Ms. Doneghy adds, "I use the MindJogger Videoquizzes at the end of each chapter of the book, where each section of the chapter is reviewed like a game show. Kids divide into groups and have cards they hold up; it's just like they are on TV. They love it! It is excellent review before I give them their written test. I've had similar experiences where activities really caught their attention, especially in labs. I recall one activity on heredity and one with bacteria. These labs worked really well with the students."

Teacher Resources

Teachers at DeVeaux Junior High are finding that the Glencoe Science program is providing them with the tools they need. Mr. McGorty shares, "In comparison to the last textbook we were using, Glencoe has more materials, specifically teacher materials, and it is better organized. The resources I use most are the Interactive CD-ROM with Presentation Builder, the Exam*View*® Pro Testmaker software, the Virtual Labs, and a bunch of online resources." Ms. Doneghy adds, "The teacher resources that come along with this textbook are massive. I usually have at least six different types of material to try with this curriculum. The teacher outlines that they do for each chapter are excellent. They are excellent at organizing the things that you are going to need to successfully teach each unit. The text is also laid out to meet all the state and national standards that students must show mastery in before they move on to the next level."

The flexibility of the program is also apparent to the teachers at DeVeaux Junior High. Ms. Vernile states, "I think the Glencoe Science program is the best answer for Toledo Public schools; we definitely made the right choice. This text is very easy to use for many different teaching styles." Mr. McGorty adds, "There are so many resources to choose from based on your style of teaching, any of which students can relate to. That makes this program easy for all teachers."

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Ferguson-Florissant School District

Berkeley Middle School, Berkeley, Missouri
Cross Keys Middle School, Florissant, Missouri

The Ferguson-Florissant School District stretches from the cities of Ferguson and Berkeley north to the city of Florissant, representing a population of approximately 84,000 residents over 92 square miles. Comprised of several suburban communities a few miles northwest of the city of St. Louis (pop. 350,000), the individual municipalities enjoy all the advantages of small-town life against the backdrop of a major metropolitan area. The Ferguson-Florissant School District, fully accredited by the Department of Elementary and Secondary Education, has earned a national reputation as an innovative educational leader. They work continually to help their students "master the basics, develop practical life skills, become problem solvers, learn to communicate and work effectively with others, and develop patterns of lifelong learning." The district is comprised of 17 elementary schools, 3 middle schools, and 3 high schools.

At the start of the 2003–2004 school year, all three middle schools in the district adopted ***Glencoe Science*** for their seventh- and eighth-grade science classrooms, including Cross Keys Middle School and Berkeley Middle School. Cross Keys Middle School, located in Florissant (pop. 51,000), serves approximately 900 students in seventh- and eighth-grade, with a demographic distribution that is about 50% African American, and 50% Caucasian. Berkeley Middle School, located in Berkeley (pop. 9,960), serves a student population of approximately 400 that is predominantly African American. District-wide, roughly 52% of the student population is eligible for free or reduced lunch.

Implementing *Glencoe Science*

Adopting a new textbook requires some adjustments for teachers. Sharon Gilmore, seventh- and eighth-grade science teacher at Cross Keys Middle School, describes how Glencoe representatives and materials helped her and her fellow teachers transition. "When we first adopted ***Glencoe Science,*** we had a publisher in-service day to learn about the program. This in-service was key to the success of teachers using this book, and was extremely helpful for me. We were given an outline of how the book was set up and the resources available, and were able to see from the beginning how objectives outlined in the book matched our state objectives. We also received training on the technology-based materials of the program. When you have that kind of training with a new program it makes you much more prepared, and makes every piece easy to use."

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Clarissa Bay, seventh-grade teacher at Berkeley Middle School, comments, "There are more teacher resources in this textbook than in any other text I have seen. We have a lot of options to choose from when thinking about what we are going to do in our classrooms from day to day. For instance, when it comes to assessment, I have lab activities, section reviews, chapter reviews, and tests to choose from. There are additional materials that supplement the textbook as well, such as the Chapter Resource Guides, and Virtual Labs that students do on the computer." Ms. Gilmore has had a similar experience: "***Glencoe Science*** is easy for me to use. Everything is listed in the Interactive Lesson Planner on the Teacher Resource CD-ROM; it has suggestions for time planning, whether you use block scheduling or otherwise, and there are huge selection possibilities for supplements and handouts. ***Glencoe Science*** always has assessment questions at the end of each section to see where students are as the topics progress. The book also has good chapter reviews. The Exam*View*® Pro Testmaker software lets me pick my own questions for my tests, and there are even additional short multiple-choice tests and practice for standardized state tests with ***Glencoe Science***."

Helping Students Succeed

Providing the tools and resources to help students succeed in school is key for teachers like Ms. Gilmore and Ms. Bay, and they are impressed with how the ***Glencoe Science*** program can help provide this foundation. Ms. Gilmore explains, "When teachers are trained how to properly use the program, it will be highly effective. I use the book to cover my eighth-grade objectives, and that involves a wide range of sciences. The material is good, and it is just the right level for my students, both the concepts and its readability. If used properly by teachers, I think this program adequately prepares students to go on to high school." She adds, "I think the textbook can accommodate all types of students. The Interactive Teacher Edition on CD-ROM lists which learning styles are addressed within each section and activity."

Ms. Bay also finds that ***Glencoe Science*** is helping her students succeed: "My students have no problem following this textbook. It gives them a lot of support. The graphics are excellent and the language is easy for students to read."


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Ms. Gilmore and Ms. Bay find that some activities for students are extremely helpful in their classrooms. Ms. Bay comments on Dinah Zike's *Teaching Science with Foldables*™: "I really like the Foldables™ that come with the program. They are just such a good note-taking technique." Ms. Gilmore adds, "Our Glencoe representative gave us a demonstration on Foldables™. I use them often with the students because they are hands-on work. I can't get them to like taking tests, but they appreciate the activities that aren't just pencil and paper!"

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Findlay City Schools

Central & Glenwood Middle Schools, Findlay, Ohio

The city of Findlay (pop. 38,967) is located in northwestern Ohio, about 50 miles south of Toledo, and 100 miles north of Dayton. Findlay City Schools serve almost 6,500 students in grades K through 12 in 16 schools—11 elementary, 3 middle, and 2 high schools. The mission of Findlay City Schools is to instill in all students the virtues, knowledge, and skills necessary to be lifelong learners who recognize their unique talents and use them in pursuit of their dreams and for service to society. Findlay students consistently achieve higher scores than state and national averages on standardized tests.

Central Middle School's 500 plus sixth- through eighth-grade students are 89% Caucasian, 5% Hispanic/Latino, 4% Asian/Pacific Islander, and 2% African American. Glenwood Middle School's 400 plus sixth- through eighth-grade students are 93% Caucasian, 4% Hispanic/Latino, 2% African American, and 1% Asian/Pacific Islander.

Aligning with Standards and Preparing for State Testing

In 2003, Findlay City Schools needed to find a middle school science program that aligned with Ohio's new state standards; one that did not teach an integrated approach for middle school science. Mike Eier, middle school science department chair and eighth-grade Earth science teacher at Glenwood Middle School, explains, "First, it was key that we find a middle school science program that met our new state standards and that was a traditional, rather than an integrated approach. Then, we looked at reading level, layout, content, and overall grade-level appropriateness. We looked at three or four different programs, and I think everyone ranked the ***Glencoe Earth Science*** program first." Joyce Pippert, also an eighth-grade teacher at Glenwood, adds, "I liked all the supplementary materials that included a lot more individual aids and clear instructions for both teachers and students. They were colorful, had a lot of visuals for the students, and seemed to be at the right reading level for eighth grade. ***Glencoe Earth Science*** had a lot of activities, and just seemed really interesting."

Findlay City Schools adopted ***Glencoe Earth Science*** for implementation in all three of its middle schools, beginning in the 2003–2004 school year.

Making Science Fun

"***Glencoe Earth Science*** makes science more interesting and fun for both teachers and students," according to Ms. Pippert. "For teachers, Glencoe makes everything easy to understand and use, and it offers many different supplementary materials and techniques that you can

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choose from that have been shown to work with students. For example, the Note-taking Worksheets help the students go through the materials and really understand it. Glencoe also provides a lot of labs that focus on discovery."

Mark Ritzler, an eighth-grade Earth science teacher at Central Middle School, comments, "Glencoe's instructions are very well-explained, and they have so many good materials and activities to use that it is just a matter of picking out what I want to supplement class with each day. The Virtual Labs are one of the many excellent resources that work very well for us. We are a downtown community, and have no green space, so the Virtual Labs have been a great asset. With them, we can do things we would normally do outside, but don't have the opportunity to do here. The Virtual Labs also provide an excellent opportunity to assess what students do and do not know. Another neat activity that Glencoe provides is where students design their own experiments. They can choose what material they will use and how to conduct the experiment. It gives students the opportunity to make their own choices and decisions."

See Results

Though ***Glencoe Earth Science*** has only been in use one year at Findlay City Schools, teachers are reportedly seeing results. Ms. Pippert reports, "I believe the biggest improvement I have seen this year is in their reading comprehension. One factor in reading comprehension is the interesting and colorful reading material, like we find in Glencoe's National Geographic features." Mr. Eier comments, "They have learned more of the vocabulary and the concepts because of the way they are emphasized in this program." Though Mr. Ritzler believes it is hard to comment on skill improvement after just one year, he shares, "I will say that my students enjoy this textbook—the pictures, the information, the Virtual Labs. I think they like ***Glencoe Earth Science*** more than what they have used in the past."

Involving Parents

Mr. Eier shares, "I think parents are happy that that they can sit with their children and look through the book with them." Mr. Ritzler says, "At our first Parents' Night, we gave parents a password to go online and use these resources. It has helped them become more involved with their students' education."

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Houston County School District

Northside & Warner Robins Middle Schools, Warner Robins, Georgia

Houston County (pop. 116,768), which contains the geographic center of the state of Georgia, is located 120 miles south of Atlanta. The largest municipality in Houston County is Warner Robins (pop. 48,000), which grew out of the U.S. Air Force base that was built there in 1941. The Houston County Board of Education serves a community of 23,500 students in and around Warner Robins through 22 elementary schools, 7 middle schools, 5 high schools, and 1 alternative school (grades 6–12). Their student population is approximately 62% Caucasian, 32% African American, 3% Latino, 2% Asian/Pacific Islander, and 1% Native American.

The Houston County Board of Education's motto is "A Standard of Excellence." This is supported by an impressive track record, including four Houston County Schools that were awarded the National Blue Ribbon School of Excellence by the U.S. Department of Education; 21 schools named Georgia Schools of Excellence a total of 29 times; and all schools accredited by the Southern Association of Colleges and Schools.

Supporting Teachers

Providing resources that can support teachers in their work is a priority for Glencoe's ***Introduction to Physical Science***. Daniel Peachey, a sixth-grade physical science and social studies teacher at Warner Robins Middle School, describes how ***Introduction to Physical Science*** has supported teachers since its adoption in the 2002–2003 school year: "My colleagues and I really like this book. There is so much that is done for the teacher, so we have free time to do all the other things we need to do to be successful. We're all dedicated teachers, but believe me, this program helps us do our work a lot better. For example, the Interactive Lesson Planner is great because it has the timing worked out already and I usually can follow the time frame well. In addition to this, the Interactive Teacher's Edition on CD-ROM and the Web site resources give a lot of great support in planning. I teach social studies too, and these resources help cut down on my prep time, which goes a long way. I probably use everything that comes with this program. All of it definitely helps my students."

Jacqueline McGhee, another sixth-grade physical science teacher at Warner Robins Middle School, shares, "As a classroom teacher, I can implement Glencoe's physical science program with no problem because everything is laid out for me. I think it is a great program with a wealth of information that is valuable to students and is easy for teachers to implement. I really like being able to modify materials to accommodate all my students. There are many modifications laid out in the text that I can apply in my classroom, so all students' needs can be met, and the process is simple for me."

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Having a book that aligns directly with district and state science standards can be one of the most helpful tools available to a teacher. Mr. Peachey states "Glencoe's ***Introduction to Physical Science*** aligns almost perfectly to Georgia standards. It's as if Glencoe wrote the science section of our big standardized test, the Criterion Reference Competency Test (CRCT)."

Utilizing Technology

Building students' proficiency with computer-based technology is a priority in Houston County. Mr. Peachey remarks, "Glencoe's use of technology is really impressive. There is a strong emphasis on Internet-based activities, and there are many Web site referrals that go along with the book, which are very useful. Each student also receives the Interactive Student Edition on CD-ROM to take home with them that has the book materials on it. For teachers, Glencoe has the Exam*View*® Pro Testmaker software that I use all the time. I can choose or change questions for tests. Glencoe's software works well, is up-to-date, and is user-friendly."

Mr. Peachey also uses the technology that Glencoe provides to help students with special needs: "For visual learners, the textbook is great, it's very engaging, but I have some kids that are auditory learners. Listening is better than reading the book for these students. I can also give them the 'reward' of listening to the MP3s of the text in the back of the class instead of reading, a way of making sure they don't feel different or ridiculed, and this really helps get the lessons across to them."

Learning By Inquiry

Giving students the opportunity for inquiry-based learning is a strength of Glencoe's ***Introduction to Physical Science,*** according to Houston County teachers. Shana Dyson Arline, sixth-grade physical science teacher at Northside Middle School, comments, "This book goes well beyond simple 'textbook learning'. It demands more than that on a regular basis. Students often encounter ideas in the book where they have to use an inquiry thought process to discover how things really work." Mr. Peachey echoes these sentiments: "I've noticed this book covers learning by discovery very well. Activities that come with the book, especially the labs, Mini Labs, and Try At Home Labs, are really great because they present problems, and students have to go through the activities to find out the solutions. Throughout the text they have to dig into the material and find the answers. They need to read and do the activities themselves. They all can succeed by learning this way, and they do succeed with this book. So far, this is the best program that I have used in my teaching. The students like it, the parents like it, it flows correctly, and the resources are second to none."

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Mundy's Mill Middle School

Clayton County School District, Jonesboro, Georgia

Clayton County is one of Georgia's smallest and most densely populated and urbanized counties, and is located 10 miles south of downtown Atlanta. For many years, it was a quiet, agricultural area, but today it has transformed into a thriving, progressive, urban environment, with a culturally diverse population of more than 250,000. Minority groups make up more than one-third of the population, and more than 40 different languages/dialects are spoken by children attending Clayton County Public Schools.

Mundy's Mill Middle School, located in Jonesboro (pop. 3,829), Georgia, Clayton County, is one of 49 schools in Clayton County Public Schools. It serves almost 850 students in grades six through eight. Its student population is 75% African American, 20% Caucasian, 3% Hispanic/Latino, 2% Asian/Pacific Islander, and 1% Native American. Its school motto is "Linking Learning to Life." In the past, Mundy's Mill Middle School has been chosen as a Georgia School of Excellence and a National Blue Ribbon School.

A New Approach

At the start of the 2002–2003 school year, Mundy's Mill Middle School implemented a new science curriculum utilizing Glencoe's middle school science programs. For sixth grade, Glencoe's ***Introduction to Physical Science,*** for seventh grade, ***Glencoe Life Science,*** and for eighth grade, ***Glencoe Earth Science.*** Krista Stuckey, a seventh-grade life science teacher and science department chair, explains, "With Glencoe's middle school science programs, you build from science to science, one at each grade level. I like it, and think it works for the students." Craig Coleman, a sixth-grade physical science teacher, adds, "We weren't really using a specific textbook program before. We now have a textbook program with some structure to follow, that is in a logical sequence, and it really works better. Before we were bouncing around a lot, but now with Glencoe we have a sequence to follow that I think is effective."

Prior to implementation, Clayton County Public Schools hosted a staff development event to train teachers how to use the labs and lesson planning tools provided with Glencoe's middle school science programs.

Supporting Teachers

Both Ms. Stuckey and Mr. Coleman are pleased with the great variety of materials that Glencoe's middle school science programs offer to support their teaching, specifically those with Glencoe's ***Introduction to Physical Science*** and ***Glencoe Life Science.*** Ms. Stuckey explains,

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"During the adoption process, I realized Glencoe had a lot of supportive materials for teachers, and it all looked very teacher-friendly. Since implementing, I've used as many of those materials as I could." Mr. Coleman adds, "Glencoe supports teachers by providing us with a lot of different resources. I believe all the options enhance my teaching of the subject."

Ms. Stuckey continues, "My colleagues and I really enjoy using the Foldables™ because they grab the attention of our artistic and visual students and help them study. I also really like the transparencies. They help me introduce a topic, and also help with classroom management; the students come in every day and know what to do."

Reaching Every Learner

Reaching every learner in the classroom is important for teachers at Mundy's Mill Middle School. Mr. Coleman comments, "When we were selecting textbooks, I wanted to make sure that the textbook was student-friendly, meaning at the appropriate reading level, and laid out in a format that was simple for kids to follow. Glencoe's ***Introduction to Physical Science*** is student-friendly, and is easier for students to use than any of the other textbooks that our county looked at. I think it is a good match for our students."

Ms. Stuckey shares, "***Glencoe Life Science*** provides us with many different materials to accommodate the various learning styles in our classrooms. For the students who need more help, they provide Directed Reading for Content Mastery, and Note-taking Worksheets. For our gifted students they provide enrichment activities and opportunities for cooperative learning. There are just a myriad of materials that we can use to reach our students. We can also vary our assessments with the Exam*View*® Pro Testmaker software." Another feature of ***Glencoe Life Science*** that Ms. Stuckey uses to meet the needs of her students is the Virtual Labs. She states, "I use them either as a culminating activity or as a reward after assessment. I think they help students who have trouble reading or grasping the concepts, because they can see and play with the concepts. It really helps. I can see my students just light up when they get it."

Ms. Stuckey continues, "Overall, I think the ***Glencoe Life Science*** textbook is more engaging for my students. I often see them skipping ahead and reading or looking at the pictures, and this is on their own time, for their own enjoyment. Because they are more engaged, they want to learn, and it shows. At the end of the year, I hear students saying, 'Science is my favorite subject.'"

Assessing Learning

At the end of the 2003–2004 school year, Ms. Stuckey gave her life science students a comprehensive examination that included three questions from each chapter. The assessment did not count for or against each student's grade, but helped Ms. Stuckey to evaluate her teaching and ***Glencoe Life Science***. She reported an average passing grade of 87% for her 142 students. She commented, "I think that is pretty good."

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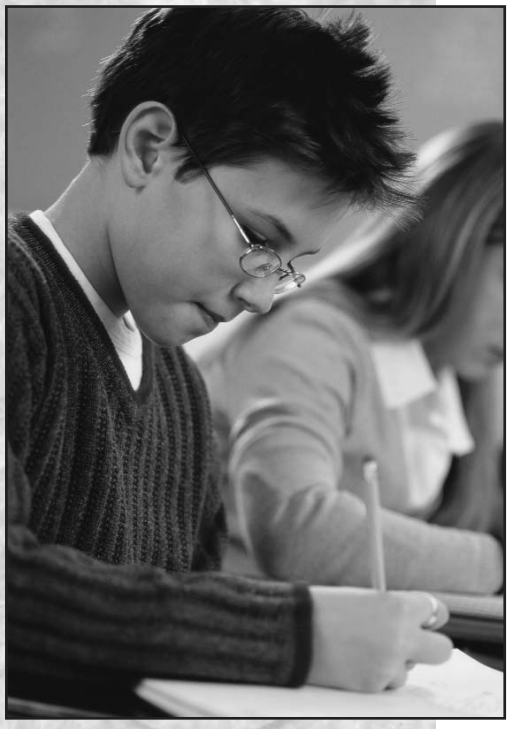
Upson-Lee Middle School

Thomaston-Upson County Schools, Thomaston, Georgia

Upson-Lee Middle School is located in Thomaston, Upson County, Georgia (pop. 27978) on the Flint River. Upson-Lee Middle School is one of five schools, and the only middle school in Thomaston-Upson County Schools. It serves approximately 1200 students in grades six through eight. Its student population is 63% Caucasian, 36% African American, and 1% each Hispanic/Latino, Asian/Pacific Islander, and Native American.

For the 2002–2003 school year, Thomaston-Upson School District adopted a middle school science program that provided plenty of teacher support—Glencoe's ***Introduction to Physical Science*** for sixth grade, ***Glencoe Life Science*** for seventh grade, and ***Glencoe Earth Science*** for eighth grade.



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Donna Turner, a seventh-grade life science teacher, shares, "When we went through the adoption process two years ago, the district provided science teachers with three textbook series to review. One of those was ***Glencoe Life Science***. It was the first time I had viewed the Glencoe book, and I really liked it. Specifically, I liked the teacher support materials and resources available, such as the option of integrating technology into science with activities such as the Virtual Labs and MindJogger Videoquizzes. These kinds of resources allow the students to be more interactive. I believe that my colleagues feel the same. If I had to pick just one reason for choosing Glencoe's middle school science programs, I would say it was the outstanding resource materials."

Allison Baker, also a seventh-grade science teacher and a member of the adoption committee, echoes Ms. Turner's comments, "Basically we liked the supplemental materials that Glencoe provided. They were better than any of the others we looked at, especially the Criterion Reference Competency Test preparation materials and the technology pieces."

Teaching with Glencoe Life Science

Upson-Lee's life science teachers unanimously find ***Glencoe Life Science*** very easy to use. Jeff Kelly, science and social studies instructional coach, says, "Everything is laid out for the teacher, as far as the standards that the topics cover, and the resource materials (CD-ROMs, activity books, etc.) are so easy to read and understand. Each *Teacher Wraparound Edition* gives real-life examples of how teachers are utilizing the text, and you just don't see that with other textbooks. They also provide resources to use with students who have special

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needs, and that makes it much easier on the teachers. Overall, the resource materials that Glencoe provides are better than the other science programs, and the real-life examples of teacher experiences and success stories make a big difference for us."

Ms. Baker shares, "***Glencoe Life Science*** is definitely easy to use. I like so many of the resources. The all-in-one resource book is really great, because you don't have to switch books when you want to look different things up. I particularly like the Note-taking Worksheets, and I almost always use them. They help me because I don't have to write down notes for the students, and they help the students because it gives them a good outline of the material. The Foldables™ are another of my favorites and are really good to use with students with special needs, because they are hands-on. These two resources, the Note-taking Worksheets and Foldables™, really help improve student skills." Ms. Turner agrees, "I think that the Note-taking Worksheets and the organization of the textbook has led to improved student skills in organization and outlining."

Ms. Turner echoes her colleagues' comments, and adds, "We have many students whose primary language is Spanish. Having the materials available in Spanish has been very helpful. The Exam*View*® Pro Testmaker software makes it possible to quickly translate tests into Spanish. We also use the Exam*View*® Pro to create our own tests. This resource provides a tool that is especially useful in working with students who have special needs. The resource allows us to modify the question or answer selections to meet the needs of our students. It also has a variety of question types to choose from, and it lets us write and add our own questions." Not only does Ms. Turner find ***Glencoe Life Science*** easy to use, but she states, "I believe that a new teacher could come in, receive the resource materials, and produce an effective program."

Making Science Come Alive

A focus of Upson-Lee Middle School's improvement plan, according to Ms. Turner, is learning by discovery. She states, "Doing science rather than just reading about it is really important. Glencoe does an outstanding job of providing plenty of opportunities for the students to investigate. ***Glencoe Life Science*** is just much more interactive, and the students really like that aspect of it. I often hear parents comment at open house that their children come home and talk about what we do in science, specifically with the Virtual Labs. One activity that the students enjoyed was building a skeleton with the Virtual Labs. In another activity, they had to determine which footprints belonged to which animals. The student enjoyed the challenge of this activity as they used critical-thinking skills to complete the activity. Glencoe provides many opportunities for students to focus on problem solving and critical thinking in an interactive format." Mr. Kelly adds, "Students were really 'hum-drum' about science until we starting using Glencoe's supplemental resources like the Virtual Labs and other technology pieces. Even the graphics come alive with Glencoe, and it's all very exciting for the students."

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Willink Middle School

Webster Central School District, Webster, New York

The town of Webster, New York (pop. 38,000) is a suburban community 15 miles north of the city of Rochester. Located in Monroe County, Webster is a community on Lake Ontario, home to the expansive research and manufacturing communities of the Xerox Corporation. The Webster Central School District serves over 9,000 students each year through 7 elementary, 2 middle, and 2 high schools, making it the second largest school district in the county. The Willink Middle School student body is predominantly Caucasian. Webster schools maintain a reputation for academic excellence in the Rochester metropolitan area, with students consistently performing at levels that meet or exceed New York State Standards.

At the start of the 2002–2003 school year, the Webster Central School District adopted the ***Glencoe Science*** integrated series for all of its middle school science classrooms. Maria Rigillo, a sixth-grade science teacher at Willink Middle School, recalls the adoption process: "A committee of teachers was assembled to make a decision about a new textbook, and Glencoe was considered based on the experience of a teacher who had used an older edition, which in itself was really outstanding. Seeing the latest edition, it became obvious that ***Glencoe Science*** was the most comprehensive series available, and that the textbook could unify the curriculum across the district. It was decided to bring in the latest ***Glencoe Science*** series for continuity across all middle school grade levels."

Meeting Educational Standards

Providing easy-to-use resources to help teachers cover state content standards is inherent in the design of ***Glencoe Science.*** Ms. Rigillo describes some features she finds helpful: "For teachers, the Chapter Resource book is really phenomenal. There is a clear overview of each chapter before it starts, and I am able to look clearly at all the state standards that I will need to cover in the upcoming chapter. ***Glencoe Science*** aligns very well with our district and state science standards. It often goes above and beyond what we are required to teach, letting me choose where to go in-depth. I don't like to skip pieces of the book because it's interesting information, but there is more available in the text than I can hold my students accountable for; it is that complete."

She continues, "There are numerous supplemental materials which work well for me. I use many of the booklets that come with the text, such as Directed Reading for Content Mastery, and Reading and Writing Skills Activities. I'm hoping to begin to incorporate more of the Interactive Student Edition on CD-ROM in my classes next year, building even

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more on the technology-based materials for the students. For student assessment, I use the unit tests and also the [review] at the end of each chapter for oral discussion. I think the labs can be a very useful assessment tool as well. Another technology resource I use that my students really like is the Vocabulary PuzzleMaker software that allows me to create crossword puzzles for the kids."

Meeting Students' Needs

Glencoe Science has been effective in meeting the needs of the students, according to Ms. Rigillo: "The ***Glencoe Science*** program has a range of activities for teachers to target different types of learners. There are great labs and Foldables™ which are great hands-on activities for a range of students. The graphics and pictures in the textbook are outstanding, so visual learning is interesting and well covered. Not all sixth graders are at the same reading level, and this book challenges many of the students, so the Note-taking Worksheets included are really important for slower readers because they focus on the highlights. Chapter Review pages and enrichment activities are provided for my more advanced students, so they are challenged as well."

Ms. Rigillo believes ***Glencoe Science*** does a good job of getting students thinking. She explains, "It asks questions that are thought-provoking throughout the chapters, and has inquiry-based labs which can be used as an introduction to the materials covered in chapters, and help students develop problem-solving skills."

Ms. Rigillo has also noticed an improvement in her students' skills. "I believe that some students' study skills have improved significantly. Foldables™ are phenomenal tools to improve study skills, and we use them often. It's difficult as a science teacher to know positively, but I also strongly believe that their reading skills are improving with this program. It is a challenging read for many of them, and they grow with it."

Matt meadows

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Other Comments

Ease of Use/Flexibility

I think ***Glencoe Earth Science*** is easy to use. The sequence is good, which is why I have no problems using it. It's also easy for all levels of students, and has a lot of resources from which you can choose. It also includes good inclusion strategies for gifted students and for the other side of the learning spectrum.

The Exam*View*® Pro Testmaker software that is included with ***Glencoe Earth Science*** gives a wide variety, type, and level of test questions. I have had stressful times with tests in other books, but this makes it easy to find good questions that fit the level of my students.

Earth science is such a hard topic to bring into the classroom, but the Virtual Labs with ***Glencoe Earth Science*** make it doable.

Jan Hersh
Crabapple Middle School, GA

I think ***Glencoe Life Science*** is user-friendly and makes things easy on a teacher because it has lots of activities for the students. For the teacher it has supplemental materials like the Exam*View*® Pro Testmaker software, and the Vocabulary PuzzleMaker software. Teachers don't have a ton of time to do these things and these have made it easier. For example, with the ***Glencoe Life Science*** Exam*View*® Pro Testmaker software you can make a really good test—you can edit the test, add questions, and move things around. And you have so many options for kinds of questions. We also have the Interactive Teacher and Student Editions on CD-ROM.

Jeff Weaver
Fannin County Middle School, Georgia

Glencoe Life Science is definitely flexible and accommodating for various learning styles. As a teacher, you have a lot of choices—you can give the Note-taking Worksheets to a student who can't keep up with regular notes, or give enrichment activities to the gifted students. There are materials for each level, and to re-teach to each level—you don't need to reinvent the wheel. It allows you to have some differentiation going on in the classroom.

Cait Flones
Westfield Community School, IL

Glencoe Texas Science is very helpful for non-English speakers because the modifications are already built in. I had a few students who were English Second Language (ESL) learners and it was very helpful for them. They could read and comprehend more than they could with another book. They were extremely successful in some cases—they came in from different countries during the middle of the year and were able to earn A's.

Judy Witkowski
Frankford Middle School, TX

Using ***Glencoe Earth Science*** is easy because there are numerous resources that go along with it—the Chapter Reviews, the Foldables™, everything that you could possibly need—and teachers who have never taught before don't really need to go find materials, because everything is there.

Susan Pritchett
East Hall Middle School, GA

High-Quality Visuals/Examples

The pictures in ***Glencoe Life Science*** are great. They are bright and colorful and they have information that can do more than words alone, which means a lot at this age—a picture can tell more than two pages of text sometimes.

Jeff Weaver
Fannin County Middle School, Georgia

Color is used as an organizing feature of the text. The different section titles are color-coded, which makes it easier for the kids to flip through and find what they are looking for. The National Geographic Visualizing Science, TIME Magazine, and Science and Language Arts features are interest grabbers in ***Glencoe Texas Science,*** and give our kids some really good ideas. Reading these materials piques their interest and makes them want to learn more, even sometimes on their own.

Melissa Van Houten
Frankford Middle School, TX

Content/Skills-Building

The supplemental materials with ***Glencoe Texas Science*** save me lots of time and help clarify a lot of things for the students. We use the activity worksheets; the Teaching, Section Focus, and Assessment Transparencies; the Exam*View*® Pro Testmaker software to make up quizzes; and the Chapter Study Guide.

Judy Witkowski
Frankford Middle School, TX

Glencoe Texas Science is very informative, descriptive, and colorful. Some of the pictures are very engaging. Having the online resources is a really good thing, too—all my students have access to and have used the online tools.

Glencoe Texas Science is just packed with information. It prepares kids really well for the future, more than anything I've ever used or seen.

Melissa Van Houten
Frankford Middle School, TX

I like the way the content is laid out in ***Glencoe Earth Science.*** The graphics are good, and the content is not too lengthy; I can easily break it into lessons. I also like the software, the practice book, and the Foldables™, which give the students a different way to take notes. Overall, it is a good textbook with excellent supplementary materials and I am very pleased with it. I also think ***Glencoe Earth Science*** provides plenty of opportunities in the textbook, and through numerous labs, to incorporate inquiry learning.

Susan Pritchett
East Hall Middle School, GA

Glencoe Earth Science has a lot of technology links that I don't think are covered as well by other books. There is an Interactive Student Edition on CD-ROM that students can check out, which saves the kids from carrying the book and helps them practice with this technology. The Virtual Labs in ***Glencoe Earth Science*** are also really good, and I love the National Geographic inclusion. They are easy to read, so accurate, and are my favorite part of the textbook itself. Between all the teachers we utilize just about everything that Glencoe has provided.

Jan Hersh
Crabapple Middle School, GA

Student/Parent Response

I think there are more things in ***Glencoe Texas Science*** that help kids relate information to everyday life; it connects their lives or something they've seen to what they are learning.

Melissa Van Houten
Frankford Middle School, TX

Parents love the fact that we have an Interactive Student Edition on CD-ROM. The average weight of the backpack is sometimes greater than the weight of the sixth grader! They don't have to drag it back and forth and that is great. The CD copy is well-connected to the textbook itself. Glencoe's Interactive Student Edition on CD-ROM is very well-made.

Jan Hersh
Crabapple Middle School, GA

Appendix

Research Supporting Content and Instruction
A Selected Annotated Bibliography

The following descriptions of research provide a brief overview of findings in science education in general. Each of these, along with additional research, has played a role in informing the development of the ***Glencoe Science*** middle school series. The authors for each program continue to update the materials as new studies are published and new research on instructional methods becomes available. The sum of the knowledge revealed by these studies continues to support and enhance the philosophy of this program.

American Association for the Advancement of Science (AAAS), Project 2061. (1993). *Benchmarks for Science Literacy.* Washington, DC: AAAS.

This document outlines the fundamentals of science literacy and provides a solid foundation upon which national and state science standards were based.

Armbruster, B. B. (1996). Considerate texts. In D. Lapp, J. Flood, & N. Farnan (Eds.). *Content area reading and learning: Instructional strategies.* Needham Heights, MA: Allyn & Bacon, 47–57.

Comprehension is improved when main ideas appear prominently in introductions, summaries, and headings, not buried within paragraphs.

Banks, J. A. (2001). *Cultural Diversity and Education: Foundations, Curriculum and Teaching.* Boston: Allyn and Bacon. (4th edition of *Multiethnic education: Theory and practice.*)

Effective strategies for teaching include using examples from many cultures, helping students understand implicit bias, and using a variety of teaching skills for diverse groups.

Barr, B. B. (1994). Research in Problem-Solving: Elementary School. In D. L. Gabel (Ed.), *Handbook of Research on Science Teaching and Learning*. New York: Macmillan, 237–247.

Problem solving is supported by student-generated questions related to discrepant events, guidance in asking productive questions, activities causing students to reflect on strategies they used, helping students evaluate their hypotheses, and social interaction related to the problem before the experiment.

Barton, M. L., & Jordan, D. L. (2001). *Teaching reading in science: A supplement to the Second Edition of Teaching Reading in the Content Areas Teacher's Manual.* Aurora, CO: Mid-continent Research for Education and Learning.

This resource describes some of the latest research on reading and learning science and provides tips for helping students to utilize textbooks more effectively.

Black, P., & William, D. (1998). Assessment and classroom learning. *Assessment in Education,* 5(1): 7–74.

There is no single, simple method for formative assessment; a variety of approaches are successful. An extensive research review indicates that formative assessments produce significant learning gains. Achievement gains associated with formative assessment appear to be greater than most other interventions. Student self-assessment increases understanding of science concepts and critical-thinking ability.

Bransford, J. D., Brown, A. L, & Cocking, R., (Eds). (1999). *How People Learn: Brain, Mind, Experience, and School.* Washington, DC: National Academy Press.

Students need to understand major concepts, build a base of factual information, and know how to apply their knowledge. Class discussions help students develop language for expressing science concepts, making ideas explicit, and providing reasoned arguments. Effective problem solvers constantly monitor their understanding and adjust their strategies as they work.

Center for Science, Mathematics, and Engineering Education (CSMEE). (2000). *Inquiry and the National Science Education Standards: A Guide for Teaching and Learning.* Washington, DC: National Academy Press.

Meta-analyses done in the 1980s on the inquiry-based curriculum projects of the 1960s and 1970s (e.g. BSCS), show that inquiry-based teaching produced positive results in cognitive achievement, process skills, and attitudes toward science. Additionally, students can do investigations prior to learning vocabulary. As they build explanations for their observations, the names (vocabulary) for the concepts become useful and meaningful. The words are symbols for their understanding.

Corno, L. (1994). Student volition and education: Outcomes, influences, and practices. In B. J. Zimmerman and D. H. Schunk, (Eds.). *Self-regulation of learning and performance.* Hillsdale, NJ: Erlbaum, 229–254.

Attractive, relevant-to-students presentations of key concepts motivate students to learn.

Dickson, S. V., Simmons, D. C., & Kameenui, E. J. (1995). *Text organization and its relation to reading comprehension: A synthesis of the research.* (Technical Report No. 17). Eugene, OR: National Center to Improve the Tools of Education, University of Oregon.

A synthesis of research finds that the following characteristics assist reading comprehension:

- Page layout that makes the organization of the content evident
- A consistent pattern within each lesson or chapter
- Providing students with explicit instruction on the text structure.

Fellows, N.J. (1994). A window into thinking: Using student writing to understand conceptual change in science learning. *Journal of Research in Science Teaching,* 31(9), 985–1001.

Writing is a powerful classroom assessment tool, enabling science teachers to see how well students understand concepts and whether they have misconceptions.

Good, T. L. & Brophy, J. E. (2003). *Looking in classrooms.* Boston: Pearson Education, Inc.

Questions that require students to analyze or apply information produce more learning than questions that ask students to simply recall or recognize information.

Griffin, C., Simmons, D. C., & Kmeenui, E. J. (1992). Investigating the effectiveness of graphic organizer instruction on the comprehension and recall of science content by students with learning disabilities. *Journal of Reading, Writing & Learning Disabilities International,* 7(4), 355–376.

Graphic organizers are highly effective. They combine the linguistic mode (words) with the nonlinguistic mode (symbols, lines, arrows). They can be used with descriptive, time-sequence, process, generalization, and concept patterns.

Helgeson, S. L. (1994). Research in Problem-Solving: Middle School. In D. L. Gabel (Ed.), *Handbook of Research on Science Teaching and Learning*, New York: Macmillan, 248–268.

For effective problem solving, science process skills and content should be integrated over several weeks, using hands-on, inquiry activities and concentrating on problem-solving skills. Improving students' problem-solving skills leads to a more positive attitude and to self-confidence in students' science abilities.

Hodson, D. (1998). *Teaching and learning science: Towards a personalized approach.* Buckingham, United Kingdom: Open University Press.

Writing helps students connect science knowledge, inquiry processes, values, and vocabulary with everyday language and students' experiences.

Holliday, W. G., Yore, L., & Alvermann, D. E. (1994). The reading-science learning-writing connection: Breakthroughs, barriers, and promises. *Journal of Research in Science Teaching,* 31, 877–894.

Pronunciation and other decoding skills are prerequisites to comprehension.

Jonassen, D., & Carr, C. (2000). Mindtools: Affording multiple knowledge representations for learning. In S. LaJoie (Ed.), *Computers as Cognitive Tools,* Mahwah, NJ: Lawrence Erlbaum Associates, 165–196.

Computer technology offers several kinds of tools for learning—organization tools (databases, concept mapping), dynamic modeling tools (spreadsheets, modeling software), knowledge construction tools (hypermedia), and conversation tools (e-mail and online discussion).

Lee, O., & Fradd, S. H. (1998). Science for all, including students from non-English language backgrounds. *Educational Researcher,* 27(4), 12–21.

ELL students benefit from authentic communication and a variety of communication, including writing, speaking, drawing, using tables, and making graphs.

Lemke, J. (2002). Teaching All the Languages of Science: Words, Symbols, Images, and Actions. http://academic.brooklyn.cuny.edu/education/jlemke/papers/barcelon.htm.

Drawing can powerfully express spatial and quantitative meaning; verbal forms (reading, writing and speaking) are better for reasoning.

Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2001). *Classroom Instruction that Works,* Alexandria, VA: Association for Supervision and Curriculum Development.

This resource describes effective methods of teaching and classroom management that apply to all disciplines. Some key components that apply to the Glencoe Science middle school series:

- Cooperative learning has a highly positive effect when compared with strategies in which students compete with each other and strategies in which students work on tasks individually.
- Focused practice, in which one aspect of a complex, multi-step process is targeted, is effective when practicing scientific inquiry.
- The use of graphic organizers, such as Foldables™ and concept maps, and other nonlinguistic representations has been shown to have a positive effect on students' understanding of science concepts.

Marzano, R. J. (2000). *A new era of school reform: Going where the research takes us.* Aurora, CO: Mid-continent Research for Education and Learning.

The many variables that make up teacher effectiveness are grouped into three categories: instruction strategies, curriculum design, and classroom management. Effective curriculum design includes clear and organized learning objectives as well as well-spaced and paced activities that help students meet objectives.

Matthews, B. (2004). Promoting emotional literacy, equity and interest in science lessons for 11–14 year olds: The improving science and emotional development project. *International Journal of Science Education,* 26(3), 281–308.

Students can increase their interest in science, as well as develop social and emotional skills, through collaborative group work in mixed-gender groups.

National Institute of Child Health and Human Development. (2000). Report of the National Reading Panel. *Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction: Reports of the Subgroups* (NIH Publication No. 00-4754). Washington, DC: U.S. Government Printing Office, 4-52. http://www.nichd.nih.gov/publications/nrp/report.htm

A variety of comprehension strategies have been shown to significantly improve comprehension—comprehension monitoring, cooperative learning, graphic organizers, question answering, question generation, and summarizing. Learning vocabulary in context is valuable.

National Research Council. (1996). *National Science Education Standards.* Washington, DC: National Academy Press.

The National Science Education Standards provide the foundation for state science standards. The national standards describe content standards as well as standards for teaching, professional development, and assessment.

National Research Council and the Institute of Medicine. (2004). *Engaging schools: Fostering high school students' motivation to learn.* Committee on Increasing High School Students' Engagement and Motivation to Learn. Board on Children, You, and Families, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Students are motivated by instruction connected to their preexisting understandings, interests, and real-world experiences, active involvement in problem solving and real-world applications, and varied instruction that is appropriately challenging.

Palincsar, A. S., & Brown, A.L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction,* 2, 117–175.

Comprehension strategies include making readers aware of their own cognitive processes, guiding readers, modeling the strategies, and having readers practice these strategies until they are internalized. Reciprocal teaching by students is effective. Students predict, ask questions about the text, seek clarification, and summarize.

Pressley, M. (2002). *Reading instruction that works: The case for balanced teaching.* 2nd Ed. New York: Guilford Press.

Effective comprehension strategies include questioning, visualizing, clarifying, elaborating, inferring, concluding, summarizing, and predicting.

Rakow, S. J. (Ed.). (2000). *NSTA Pathways to the Science Standards: Guidelines for Moving the Vision into Practice, Middle School Edition.* Arlington, VA: NSTA Press.

This resource describes an overview of successful practices for middle school science education, including incorporating science standards, assessment, professional development, and teaching methods.

Rivard, L.P. (1994). A review of writing to learn in science: Implications for practice and research. *Journal of Research in Science Teaching,* 39(8), 969–983.

Meaningful writing tasks can lead to improved student learning in science. Students can increase their understanding when they put concepts into their own words. Writing is a tool for making sense of new information. Authentic writing tasks in which students communicate with a real audience, rather than a teacher, are more effective.

Rosebery, A., Warren, B., & Conant, F. (1992). Appropriating scientific discourse: Findings from language minority classrooms (Working paper 1–92). Cambridge, MA: TERC.

ELL students can learn science inquiry and concepts while learning English. Through scientific inquiry, students develop abilities in reasoning, observation, and logical analysis.

Sadler, D. R. (1989). Formative assessment and the design of instructional systems, *Instructional Science.* 18, 119–44.

Self-assessment by pupils is an essential component of formative assessment. Students need to know the learning objective, their current level of understanding, and steps to take to reach the objective.

Saul, E. W. (Ed). (2004). *Crossing Borders in Literacy and Science Instruction: Perspectives on Theory and Practice.* Newark (DE): International Reading Association and Arlington (VA): National Science Teachers Association.

These authors discuss the latest research on how to teach reading and other literacy strategies while teaching science.

Schwab, J. (1966). *The Teaching of Science.* Cambridge, MA: Harvard University Press.

By reading and discussing reports of scientific research, analyzing the process and evaluating alternative experiments or explanations, students build an understanding of scientific inquiry as it is used by scientists.

Scruggs, T. E., Mastropieri, M. A., Bakken, J. P., & Brigham, F. J. (1993). Reading versus doing: The relative effects of textbook-based and inquiry-oriented approaches to science learning in special education classrooms. *The Journal of Special Education,* 27(1), 1–15.

This study suggests that students with learning disabilities learn more with an inquiry-oriented approach.

Shymansky, J. A., Kyle, W. C., & Alport, J. M. (1983). The Effects of New Science Curricula on Student Performance. *Journal of Research in Science Teaching,* 20(5), 387–404.

Inquiry-based teaching can lead to enhanced critical thinking, inquiry abilities, and positive attitudes toward science.

Willows, D. M. & Houghton, H. A. (1987). *The psychology of illustrations: Basic research* (vol. 1). New York: Springer-Verlag.

High-quality visuals encourage students' mental images that help them recall information better than do text or lower-quality visuals.

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