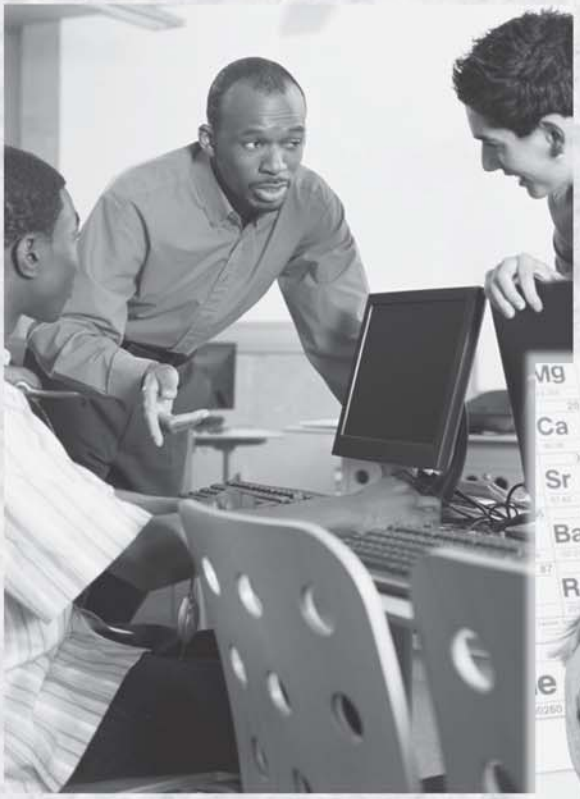
RESULTS

with

GLENCOE PHYSICAL SCIENCE

and

INTEGRATED PHYSICS AND CHEMISTRY



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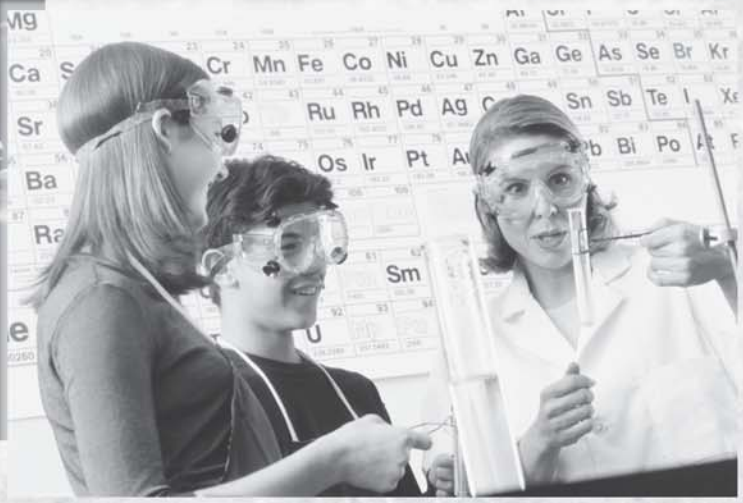

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With the development of the National Science Education Standards in 1996, educators throughout the United States have been inspired to raise the academic bar. It is more important than ever to ensure that our schools are reaching for the highest in 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 science to 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 ten schools in eight districts that have been successful in teaching chemical and physical 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 physical science curricula programs, as well as successful teaching practices.

The schools that use the physical 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, if available, 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 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 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 toolboxes must include the highest quality 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 Physical Science and ***Integrated Physics and Chemistry:***

- **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 each *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: MindJogger Videoquizzes, TeacherWorks™ and StudentWorks Plus™ CD-ROM Editions, Exam*View*® Pro Testmaker CD-ROM, Vocabulary PuzzleMaker, and Virtual Labs CD-ROM.

This report shares the stories of ten schools in eight districts that have implemented ***Glencoe Physical Science*** or ***Integrated Physics and Chemistry.*** 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 not 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 these 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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Central High School

Rapid City Area Schools 51-4, Rapid City, South Dakota

Rapid City (pop. 60,000) and the surrounding Black Hills, located in western South Dakota, are known for their natural beauty and outdoor recreation, including Mt. Rushmore. Educationally, South Dakota boasts the highest percentage of high school graduates, as well as being the only state in the U.S. with virtually every school wired for Internet access. Rapid City Area Schools serve almost 14,000 students annually, covering over 448 square miles. It is the second largest school district in South Dakota with 17 elementary schools, 5 middle schools, and 4 high schools/academies. Central High School is one of its 26 schools. The district's student body is 78% Caucasian, 16% Native American, 2% African American, 2% Asian/Pacific Islander, and 2% Hispanic/Latino.

Choosing Carefully

In 2001, Rachel Rasmussen, a 9th-grade physical science teacher at Central High School, began piloting textbooks with students to determine which should be chosen as the schoolwide physical science program for the coming years. Ms. Rasmussen describes the process: "I used two books during piloting, one of which was ***Glencoe Physical Science***, and tested how well the students did with them. I also rated the books and then had the students rate the books, because I didn't want my own prejudices to dominate. The kids liked ***Glencoe Physical Science*** a lot better than the other text, and so did I, so that made things easy. ***Glencoe Physical Science*** is more readable, and is structured overall in a way that makes sense, which really helps the students. We went with the earlier edition of this text in our last textbook adoption around 1994, so when I presented the information from the piloting to my colleagues, they already liked Glencoe from previous experiences with the older edition and thought they would be comfortable with the new one."

Central High School adopted ***Glencoe Physical Science*** for its 9th-grade students in the fall of 2002. Ms. Rasmussen describes the adoption and implementation process: "Glencoe had a representative come in before we adopted the program, and she gave us a very nice presentation. We were able to ask specific questions about the program and we could see how it was all put together. They also took us to a computer lab where they showed us all the technology-based features and supplements. Once we started the school year, our Glencoe representative came back and gave us the opportunity to ask questions again." Ms. Rasmussen summarizes this adoption as, "the best transition to a new book we ever have had. Glencoe gave us time, support, and everything else. Having great book reps makes a big difference." Since the implementation of ***Glencoe Physical Science***, Ms. Rasmussen has followed up with her colleagues: "I took a poll recently, and thankfully they are still content!"

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Meeting Students' Needs

Ms. Rasmussen spent the time piloting textbooks with her students to assure that the chosen textbook would meet all the needs of her students. She describes several features that make this possible: "First, the readability of a textbook is really important, and ***Glencoe Physical Science*** is appropriate for our average student as it isn't too high-level. The text also meets the needs of kids who are more academically advanced with its challenge sections. The students find the text diagrams to be especially helpful in explaining science concepts. This is important with physical science concepts that many students find difficult or abstract. The diagrams help to clarify and enhance student learning. I believe the book provides needed student practice in the thinking and doing of science, as well as challenges the students." She continues, "I like the variety of hands-on activities, such as the Foldables™, because they help the kids who learn better by using their artistic talents. Their drawing skills come out, which are truly amazing, and that helps the kids a lot. Having the Student Edition of the text available on the Web is good for when students forget their books when they go home, or if they just hate to lug them home every night!"

Ms. Rasmussen also comments on other features of ***Glencoe Physical Science***: "This book is more organized than others because it is divided logically into physics and chemistry, for the most part. The students get annoyed skipping around too much between these two subjects. Also, there are plenty of ways to change the pace from chapter to chapter when presenting the information. For instance, I use the MindJoggers from time to time as a chapter review, which makes learning the information more interesting for the students. I also can easily put together 3- to 4-page work packets for each chapter from all my resource materials, which students can use as study guides."

Maintaining High Standards

Educational achievement is impressive in South Dakota in comparison to the rest of the nation. The state is above national averages in many subject areas across many age groups. A key benefit of ***Glencoe Physical Science*** is the match between its content and state standards, as Ms. Rasmussen describes: "Our curriculum is required to align with the state standards. The national standards are a reference for our state standards, but we focus on aligning what we do with our state guidelines, and this book does a great job with physical science."

The Rapid City Area Schools and Central High School are no exception to South Dakota's academic reputation, as Ms. Rasmussen explains: "While we always strive to improve, our school scores are good and I know we have gone up in science recently!"

In conjunction with student success, outstanding teaching also is apparent at Central High School, exemplified by Ms. Rasmussen, voted Central's 2002 Science Teacher of the Year by her Department, and a 2004 nominee in Who's Who Among American Teachers®.

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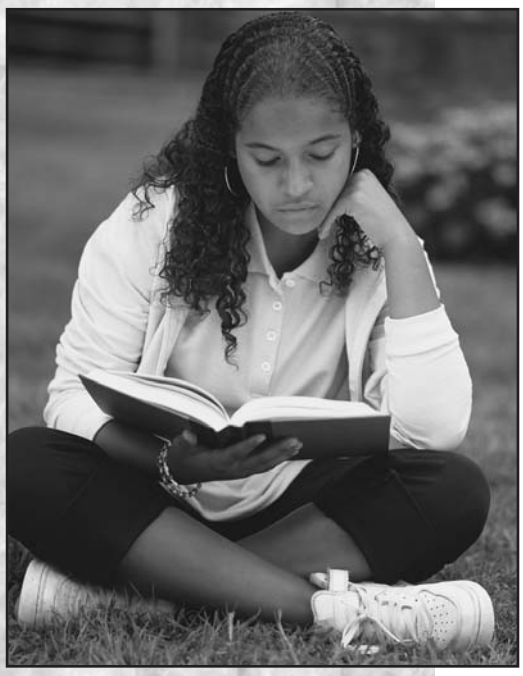
East Baton Rouge Parish Schools

Broadmoor Senior & Woodlawn High Schools, Baton Rouge, Louisiana

Situated on the Mississippi River, Baton Rouge, the state capital of Louisiana, is a thriving city of 230,000 people. It also is home to Louisiana State University, Southern University, and many businesses and industrial facilities.

The East Baton Rouge Parish School System, which serves as the public school system for the Baton Rouge area, has the second largest student enrollment in Louisiana. The Parish School System serves over 45,000 pre-kindergarten through 12th-grade students, and over 5,000 adult education students. The student body is 56% Caucasian, 42% African American, 2% Asian/Pacific Islander, 1% Native American, and 1% Hispanic/Latino. Woodlawn High School and Broadmoor Senior High School are two of 17 high schools in the East Baton Rouge Parish School System, each serving an urban and diverse school population, along with 30 middle schools and 59 elementary schools in the parish.



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Bringing in Change

The start of a new textbook adoption cycle brought ***Glencoe Physical Science*** to all honors physical science students in the East Baton Rouge Parish during the 2003–2004 school year. Kathy Holt, lead physical science teacher at Broadmoor Senior High School explains, "I recommended the switch to Glencoe. I had been using Glencoe samples I received during our last adoption cycle for ideas in my classes, and they worked really well. We knew we wanted something with more substance than our last textbook, which taught on a lower level and also had a lot of embarrassing mistakes. After my preview of ***Glencoe Physical Science***, I recommended it. I knew it would be easy for the kids to find the information they needed in this book and it was not too cluttered with things that were non-related. I just really liked the way the material was presented in ***Glencoe Physical Science***." She adds, "Fortunately, East Baton Rouge Parish came to the decision to adopt ***Glencoe Physical Science*** for honors classes. My school, Broadmoor Senior High School, uses it in all physical science classes, not just honors classes."

Resources for Teachers

Providing support and structure for teachers is a strength of ***Glencoe Physical Science,*** according to Ms. Holt: "I use the student outlines to introduce each chapter, and to look at each section individually. I really like the background history at the beginning of each chapter, too.

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Honors students ask a lot of good questions, and the background information sections help me prepare for those questions." Shelly Simmons, a 9th-grade physical science teacher at Woodlawn High School, remarks that "the labs, quick activities, math activities, and Mini Labs are exactly where you need them." Ms. Holt describes how ***Glencoe Physical Science*** has helped her with assessments: "Often everything I need is in the test bank and chapter tests, which offer a good range of questions. I combine them to create my own tests. I like to include the tables and graphs that are with the book questions already."

Time Well Spent

Ms. Simmons believes that ***Glencoe Physical Science*** helps her efficiently support her students. She describes: "The *Teacher Wraparound Edition* gives me strategies to go back and reach kids who are struggling, and ways to re-teach and explain things differently. For kids who are more advanced, it recommends challenges for them. In either case, the guesswork is taken out of it, and I can spend more time with the students and help them understand it or identify where I can help them more." She continues, "The resource materials complement what I teach very well; there is a wealth of information. Because it's right there already, it saves a lot of the time I would normally spend researching and planning."

Ms. Holt voices similar sentiments on how ***Glencoe Physical Science*** saves her time and effort: "One of the best things about this text is that you are given the state and national standards in the book, so it's very easy to see what's required and then pull out that information quickly. Objectives are right next to the standards. I used to dread doing lesson plans, but not anymore!"

Keeping Students Interested

Ms. Simmons finds ***Glencoe Physical Science*** a valuable resource for her students: "This textbook is a lot easier for our students to read, and I see them going back to it much more often than previous texts." Ms. Holt adds, "I know the kids like this book; I catch them reading things from other chapters. I also have kids this year who are repeaters, who used the old textbook last year and failed. These kids, especially, notice how much easier this text is for reading and learning the material."

Laurie Callahan, a 10th- through 12th-grade chemistry teacher at Woodlawn High School who uses ***Glencoe Physical Science*** text with some students, notices, "The kids really like the inserts from National Geographic and TIME, and features about accidents in science. These pieces show that these concepts have real-life applications, and that experiments aren't always done perfectly or don't necessarily work every time. It shows that things can be discovered by accident sometimes." Ms. Holt shares a similar view, "We find the TIME articles unbelievable! Kids are really 'wowed' by these, and they have meaning for them. There is one about neon lights in particular that I know stuck with them. Students have described being out with their parents and seeing what their parents thought was neon, but the students correct them saying, 'That's not neon; it must be some other gas.'"

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Francis Howell Central High School

Francis Howell School District, St. Charles, Missouri

Located on the Missouri River and only 30 minutes west of downtown St. Louis, the city of St. Charles, Missouri (pop. 60,000) is a historic community which attracts approximately 1.5 million visitors annually. St. Charles served as the organization point for Lewis and Clark's Expedition in 1804, and was Missouri's first state capital. Today, it is the second largest city in the St. Louis metropolitan area. St. Charles County has experienced some of the strongest growth rates in the nation, and is recognized as part of Missouri's Technology Triangle.

Francis Howell School District encompasses over 150 square miles in the southwest corner of St. Charles County, and is one of the largest school districts in Missouri with an enrollment of over 18,500 students (pre-kindergarten through 12th grade) in 22 schools. The district has earned the State of Missouri's highest overall accreditation from the Missouri Department of Elementary and Secondary Education (DESE). Demographically, Francis Howell School District is 95% Caucasian, 3% African American, 1% Native American, 1% Asian/Pacific Islander, and 1% Hispanic/Latino. Francis Howell Central is one of five high schools in the district, and serves over 2,100 students. The school is "committed to working in partnership with the community to provide a quality learning environment that promotes lifelong learning, academic excellence, confidence, self-motivation, and civic responsibility in today's society."

At the start of the 2002–2003 school year, the Francis Howell School District adopted the ***Glencoe Physical Science*** program for all of its physical science classes, serving about 500 freshman per school year.

Resources for Teachers

Natalie Frankenberg, a 9th- through 12th-grade teacher at Francis Howell Central, appreciates how materials in ***Glencoe Physical Science*** help her in teaching all kinds of students. She shares, "The text is suitable for students of various learning abilities because the information is presented in so many different ways. The *Teacher Wraparound Edition* gives us everything we need to be prepared to help all kids. I can tailor the lessons for the advanced students and students who need extra [support], because Glencoe provides a full range of ways to present the information." Stephanie Kreunen, a 9th-grade physical science teacher at Francis Howell Central adds, "There are great Labs and Mini Labs for the students. I also use visual materials for students who learn best visually, like the overheads provided, and I refer a lot to the diagrams, pictures, and tables in the text when I am going over the content in class."

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Glencoe Physical Science also provides a variety of assessment resources, as Ms. Kreunen describes, "I have a lot to choose from to assess my students' learning. I like the book questions, especially ones that demand applications of what has been learned, and critical-thinking questions. There's also the test booklet and a CD-ROM test generator. Even the end-of-chapter questions are really excellent." Ms. Frankenberg adds her thoughts on how the program assesses her students' understanding of materials covered: "As students read the text, there are section reviews which build up to harder questions. With the test generator being so flexible, a teacher can tailor tests to suit where the students really are."

Engaging All Students

Ms. Frankenberg believes that students find *Glencoe Physical Science* very understandable. She says, "This textbook is written at a level perfect for my 9th-grade students. There are review questions that are worded as applications on the topic being covered, not as memorization, which is a great way to get them to be engaged with science. They understand the applications and see the connections to the real world, so they don't complain." Ms. Kreunen adds, "This book has lots of up-to-date information about things that students can relate to, which helps them understand the concepts very well. And I really like how they tie in the other sciences. That integration is important."

Ms. Frankenberg also uses special features to engage students further: "I really like the Vocabulary PuzzleMaker, where you can create word searches and crossword puzzles. Vocabulary is often boring, but these techniques make the quizzes more interesting and fun. It really seems to work with kids with special needs, too." Ms. Kreunen adds, "Students find this [text] more engaging because they have so much they can do themselves. They love the hands-on aspects like those provided in the lab activities. It also allows them to work at their own pace."

Preparing for the Advanced Sciences

Ms. Frankenberg, who also teaches 11th-grade chemistry, finds that *Glencoe Physical Science* integrates many other branches of science well. "I really like the way that the book brings in biology and other sciences where appropriate. I am very aware of what these students will need later in more advanced courses, so I do my best to prepare them well using Glencoe's textbook. I think that many of the students I will have in a couple years in my chemistry classes will have a better foundation in chemistry because of this text."

From 2002 to 2003, scores on the science section of the Missouri Assessment Program (MAP) state test have increased at Francis Howell Central. In 2002, 12.7% of students were classified as "proficient/advanced." This group grew to 16.4% of students in 2003 and it appears these numbers will continue to grow in 2004. Ms. Frankenberg remarks, "Our test scores are often going up, but I think the scores have gone up even more than usual in the past two years. I feel that *Glencoe Physical Science* is very beneficial and most certainly gives our students more 'working knowledge' of science applications!"

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Galena Park Independent School District

Galena Park & North Shore High Schools, Houston, Texas

Galena Park Independent School District (ISD) is located in Harris County, the third largest county in the nation by population, and the most populous county (pop. 3.4 million) in the state of Texas. Harris County is located on the upper Gulf Coast in Southeast Texas. Galena Park ISD is a Texas Education Agency "Exemplary" District, which means that at least 90 percent of its students pass each subject area measured by standardized testing. The district serves 19,904 students in pre-kindergarten through 12th grade in 21 schools: 13 elementary schools, 5 middle schools, and 3 high schools. Its mission is to prepare students to be productive citizens and become lifelong learners.

Galena Park High School, in the city of Galena Park (pop.10,592), is located just 11 miles southeast of Houston, and has a Hispanic population significantly above the state average. Galena Park High School serves over 1,500 students in grades nine through twelve, and is 80% Hispanic/Latino, 11% Caucasian, and 9% African American. North Shore High School is located in Houston, the fourth largest city in the U.S., and the largest city (pop. 1.9 million) in Texas. North Shore serves over 2,000 students in ninth and tenth grades, 50% Hispanic/Latino, 31% African American, 16% Caucasian, and 3% Asian/Pacific Islander.

Discovering *Integrated Physics and Chemistry*

The science teachers at Galena Park Independent School District were in agreement that ***Integrated Physics and Chemistry*** was the program for their students. Desiree Ford, 10th-grade science teacher at North Shore High School, remembers the adoption process, "I liked Glencoe's program right away. The first thing that caught my attention was the variety of ancillary materials—Spanish materials, Note-taking Worksheets, and technology pieces, such as the Exam*View*®Pro Testmaker and Virtual Labs. Second, I liked how the book was written. I found ***Integrated Physics and Chemistry*** easy to read and there were quality pictures throughout." Linda Johnson, fellow 10th-grade science teacher at North Shore, adds, "Glencoe's materials were easier for students to read, more usable and student-friendly, and were adaptable to all levels of learners. Also, we are technology-driven, and Glencoe provided the technology pieces to keep us moving that way."

For the 2002–2003 school year, Galena Park Independent School District adopted Glencoe's ***Integrated Physics and Chemistry*** for its more than 1,400 10th-grade students (900 North Shore and 500 Galena Park).

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John Ridgeway, 10th-grade teacher at Galena Park High Schools, and Glencoe fan since the early 1980s, shares, "I think Glencoe's ***Integrated Physics and Chemistry*** program is top-notch for many reasons. It is a concise, readable textbook with bold, black print and excellent labeling. It also has excellent photographs, charts, and examples. Our students need to be shown practical applications and how it relates to them before it sticks with them, and Glencoe does that. It also has simple labs that require very little set-up." Mr. Ridgeway concludes, "We were all in agreement that we needed Glencoe's ***Integrated Physics and Chemistry*** program."

Positive Teaching Experiences

Not only is it important to select a textbook that meets the needs of the students, but meeting the needs of teachers also is important. Ms. Johnson comments, "Glencoe's ***Integrated Physics and Chemistry*** is so easy to use because of all the ancillaries and technology pieces. The technology pieces are particularly helpful and add versatility to my teaching." Ms. Ford agrees, and adds, "I believe it is really easy to use, mainly because of all the extra materials. I have so many options, and I don't have to teach the same way week after week—I can change it up, and the students don't get bored like they did with the last program we had." A favorite feature of Mr. Ridgeway's is the labs. "The labs with this program are simple, easy to set up, and that is key. The labs are just excellent."

One specific feature of the ***Integrated Physics and Chemistry*** program that was especially useful for Galena Park teachers was the Virtual Labs. Ms. Ford shares, "Last year we had really large classes of about 35 students, and we found it difficult to do traditional labs. There just wasn't enough room, and we couldn't monitor all 35 students with chemicals, which brought up the issue of liability. So, instead, we used Glencoe's Virtual Labs. They were a real lifesaver. They covered every topic in the book, saved time and materials, and the kids really liked them." Mr. Ridgeway adds, "The Virtual Labs are great. They are self-contained, and students don't need to get on the Internet. They are also safe. I think it would be hard for me to teach the class without the Virtual Labs."

Seeing Results

Since implementing ***Integrated Physics and Chemistry***, teachers have noticed improvements in their students. Mr. Ridgeway says, "I know that my students' skills have improved, because I see it in their test scores. I think that when the Texas Assessment of Knowledge and Skills (TAKS) results come in for the 2003–2004 school year that my students will have scored well, and if they don't I will be surprised."


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Ms. Ford comments, "My students are learning the materials faster and better with Glencoe's ***Integrated Physics and Chemistry*** because they find it more engaging." Ms. Johnson reports that her students "have scored some of the highest scores on the campus and even district-wide on district benchmark tests. Also, last year when we piloted the TAKS, many of our students were recognized for their stellar performance. I feel comfortable that we have prepared our students well with Glencoe's ***Integrated Physics and Chemistry*** for the 2003–2004 TAKS."

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Oak Hills High School

Oak Hills School District, Cincinnati, Ohio

Oak Hills High School is located in the city of Cincinnati (pop. 331,285), which is nestled along the hills of the Ohio River Valley. Cincinnati, once called "The Queen City of the West," still preserves the charm of an Old World city, while gaining stature as a world-class business environment with a generous share of Fortune 500 companies within its boundaries. The city is famous for many reasons: (1) In 1869 it had the first professional baseball team—the Cincinnati Red Stockings—now known as the Cincinnati Reds; (2) In 1902, the first concrete skyscraper in the U.S.—the Ingalls Building—was built there; (3) In 1935, the first night baseball game was played under lights.

Oak Hills High School is the only high school in the Oak Hills Local School District, which also includes five elementary and three middle schools. Oak Hills High School serves almost 3,000 of the district's 8,000 students. The student population is predominantly Caucasian.

Transitioning to *Glencoe Physical Science*

Shannon Whittie, 9th-grade physical science teacher at Oak Hills High School, remembers the process of reviewing textbooks in 2003 for the approximately 400 students in 9th-grade physical science classes: "Recently, our district made changes to its Science Standards, and our old textbook did not align with the new standards. We needed a book that did. Our entire department (six teachers) sat down and created a rating sheet to evaluate the different textbooks for adoption." The ***Glencoe Physical Science*** program impressed Oak Hills science teachers right away. Ms. Whittie shares, "The ***Glencoe Physical Science*** program had the quantity and quality of teacher materials that we were looking for, including technology pieces for teachers and students. Those were a very big factor in our decision. We were also looking for a program that a new teacher could just pick up and use with minimal training. Glencoe had that." Fellow 9th-grade physical science teacher Therese Gossett agrees with Ms. Whittie and adds, "The teacher support materials and the Virtual Labs definitely led to the selection of ***Glencoe Physical Science***. Glencoe's program contained more supplemental materials than any of the other programs we reviewed."

Oak Hills High School adopted ***Glencoe Physical Science*** for the 2003–2004 school year. Prior to its implementation, all Oak Hills physical science teachers attended a four-hour training provided by Glencoe. About the training, Ms. Whittie remarks, "In Glencoe's training, we learned how to use everything that came with the program, both in the text and in the supplementary materials."

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Positive Teaching Experiences

Ms. Whittie believes that "the majority of Oak Hills physical science teachers are happy" with the program and think that "it is great!" She shares, "Personally, I find ***Glencoe Physical Science*** very easy to use, especially since there is some type of resource available for every chapter. The test bank is my personal favorite; it works really well for me. Most of the Virtual Labs also work well for me. Another favorite of mine are the Note-taking Worksheets in the Chapter Resources. They make taking notes easy for the students during lecture—instead of them having to write everything down, they just have to fill in the blanks." Ms. Gossett also has her personal favorites, "I like the Foldables™ (graphic organizers), and the students like making them. I also think the students appreciate the Note-taking Worksheets. I often use the Teacher Resource Files because they provide some really nice reinforcement activities for the students."

Ms. Whittie finds that ***Glencoe Physical Science*** helps her meet the needs of the various learners in her class, both through instruction and assessment. "***Glencoe Physical Science*** provides plenty of activities and instructional strategies to meet the needs of all my students—visual learners, linguistic learners, etc. It also provides appropriate tools and opportunities to assess student learning with chapter tests, chapter reviews, different types of performance assessments, and labs. There are just plenty of ways to assess learning with ***Glencoe Physical Science***." Ms. Gossett adds, "It includes extensions and going-further activities for many of the concepts."

Both teachers also find that Glencoe incorporates inquiry learning well. Ms. Gossett comments, "Many of the labs in ***Glencoe Physical Science*** are inquiry-based, and some even have the students creating lab procedures and materials."

The Student Experience

Finding a science textbook that students like to use is important. Ms. Whittie shares, "My students can open the book and read it. They are not saying, 'This is too hard, and I hate reading.' It is more like, 'Okay, I can read this.' I don't hear them complaining anymore that they don't understand it." Ms. Gossett shares similar experiences with her students: "Glencoe is easier to understand and more interesting. I personally needed a textbook that students could use easily on their own, and still learn valuable lessons. Glencoe's textbook was a real lifesaver. It is a forward-thinking, student-centered program, and it is right on track!"

Matt Meadows

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Scott High School

Toledo Public Schools, Toledo, Ohio

Scott High School is located in the urban city of Toledo, which is located in Lucas County in northwestern Ohio. The city is 75 miles east of the Ohio-Indiana border, covers an area of 84 square miles, and borders on Lake Erie to the east and the state of Michigan to the north. Toledo is home to approximately 313,000 individuals, and is the fourth largest city in Ohio. The city's 36,000 plus students are served by Toledo Public Schools through 62 elementary, junior, and senior high schools. The district has seen outstanding results in raising the district's graduation rate from 59.5% in 1998–1999 to 70.6% for the 2002–2003 school year.

Scott High School serves over 1,500 predominantly African American students in grades 9–12. In 2003, 30 Scott High School seniors earned $765,000 in college scholarships and 80 students received academic awards for outstanding achievement. As part of the statewide Ohio High School Transformation Initiative, Scott received a grant from the KnowledgeWorks Foundation to transform its large school into a smaller, subject-centered "school within a school" to open in the 2004–2005 school year.

The 'Right' Text

Glencoe Physical Science is the physical science program of choice for Scott High School. It was adopted again this past year, according to 9th-grade physical science teacher, Robert Mendenhall. "We started using the newest edition of ***Glencoe Physical Science*** this past August (2003) in our freshman physical science classes with approximately 475 students. Before that we were using an earlier edition of the book." Tamara Smith, fellow 9th-grade teacher, adds, "Everybody likes the ***Glencoe Physical Science*** program and seems to have good things to say about it. Personally, I find the newest edition even easier to use than the last. Everything is there for you, right in one book. That is what I love about it." Mr. Mendenhall agrees.

Both teachers have certain features or aspects of the program that work really well for them. Mr. Mendenhall shares, "I particularly like the on-line version of the textbook. Being in an urban community, students don't like to carry backpacks, so they can access the textbook right on-line at home, or at the library if they need to. I also like the notes for the teacher in the *Teacher Wraparound Edition*. They help me lead my students in the right direction."

Ms. Smith also likes the notes for the teacher: "I am impressed with the amount of information provided to the teacher so that the teacher can

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be flexible and accommodating for various learning styles. Because everything is provided for me, I don't have to venture out and find things for myself. That is one thing that really impressed me and stood apart from other textbooks. Other things I like about ***Glencoe Physical Science*** are the Quick Demos, Bellringers, Mini Labs, the transparency activities, the Note-taking Worksheets, Chapter Resources, and the Vocabulary PuzzleMaker. With the transparencies I can assess their writing skills because the questions lead them to higher-order thinking and require more advanced responses. There are also a lot of fun activities for the kids to do, such as creating crossword puzzles."

Student Reaction

Positive reactions are not only from Scott High teachers, but also from its students. "With ***Glencoe Physical Science***, the concepts of physical science become 'real' to my students," comments Ms. Smith. She continues, "This edition has given me a lot of options to make physical science pertinent to my students' lives (urban, very low income). They used to be uninterested in science, and have a negative attitude, but I have noticed lately that kids are saying, 'I understand this and it makes sense now.' This edition lets me make it more real to them with more labs, demos, and more inquiry-based activities that get them interested. It's not just rote memorization. Anything quick and easy gets them going and involved. Even some of the questions in the margins get them involved in conversations and discussions, and I haven't seen this before. Because of this I have definitely seen an improvement in their performance. For example, we finished the unit on understanding the structure of an atom, and my students were definitely able to understand this important concept that they will see again in biology and chemistry. I thought that was really great, and I know they will remember it because ***Glencoe Physical Science*** made it so easy for me to teach the concept."

Mr. Mendenhall agrees with Ms. Smith: "My students seem to be following better with ***Glencoe Physical Science*** and their grades are getting better. We even had two 9th-grade students win first place at a science fair competition this past year. I really think that ***Glencoe Physical Science*** does a good job of preparing our students for higher levels of chemistry and physics, because it covers a wide variety of topics in an accurate and student-friendly manner."

Timothy Fuller

Closing Comment

Ms. Smith shares, "There is a wealth of information in the ***Glencoe Physical Science*** program. It has helped me to become a more thorough educator. I am able to competently address the needs of various learners."

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Summerville High School

Dorchester School District Two, Summerville, South Carolina

Summerville High School is located within the suburban community of Summerville, South Carolina (pop. 27,752). Dorchester School District Two, which includes Summerville High School, recently has experienced rapid growth due to its proximity to the city of Charleston, coupled with its reputation for academic excellence. Dorchester School District Two serves approximately 17,000 students—the ninth largest in South Carolina—in 9 elementary schools, 5 middle schools, 2 high schools, 1 alternative school (middle/high school), and 1 adult/community education program (pre-kindergarten to adult). The district's student body is 73% Caucasian, 24% African American, 1% Native American, 1% Asian/Pacific Islander, and 1% Hispanic/Latino. Compared with the state average of 60%, 27% of the student body receives free/reduced lunch.

District-wide, 64% of high school graduates attend post-secondary education, and the class of 2003 received approximately $13 million in scholarship money for further education. A district commended for excellence in teaching, 62 of its teachers have received national board certification. The bond between the Summerville community and its school district is very strong—there are over 500 business partnerships and 2,500 volunteers supporting the district schools, providing approximately 1 million hours of volunteer service per year. Currently, Summerville High School is the largest high school in the state of South Carolina, with a student population of approximately 3,100. The science department of Summerville High School proudly offers a variety of advanced science courses to students, including marine biology, environmental studies, forensic science, human anatomy, AP biology, and AP chemistry, among others.

Supporting Students

Summerville High School adopted the ***Glencoe Physical Science*** program at the beginning of the 2003–2004 school year, with roughly 1100 students. Ninth-grade physical science teacher Valerie Blunt recollects, "The text is very student-friendly, and that had a lot to do with the decision to adopt it. It can be so difficult to get students involved in textbooks, and this one interests our students. They can read it expeditiously, and they like the diagrams, pictures, and National Geographic information." Another 9th-grade physical science teacher, Diane Reeder, adds, "The writing is very concise in this text and it is laid out well in general. Because of that, the students don't balk at reading it, which for 9th graders is huge! They are really reading it, and that of course helps them tremendously in their learning."

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Ms. Blunt and Dr. Reeder both believe that ***Glencoe Physical Science*** can help all students. Ms. Blunt states, "In addition to the textbook, the transparencies are excellent tools. I use them often, sometimes as work at the beginning of class as an introduction to what we'll be covering that day. At other times, the transparencies are excellent for review at the end of class. The supplementary materials and activities, like the worksheets and the lab exercises we do, are very advantageous." Dr. Reeder adds, "I have a couple of homebound students, but they can follow along with the material from the Fast Files that come with each chapter. It has helped tremendously."

Helping Teachers

Wayne Putman, another 9th-grade physical science teacher at Summerville High School, describes how the supplementary materials can be equally beneficial for students and teachers, "The Chapter Resource booklet helps me a lot because I don't need to generate notes, and likewise, the students, because they don't have to take as many notes." Dr. Reeder comments on how ***Glencoe Physical Science*** has made teaching easier: "It's such an easy program to use as a teacher because all the materials line up with the chapter perfectly. I love all the information in the margins of the teacher textbook—it really helps with my lectures. It's made the lectures more interactive, because I am given helpful hints that help me engage the students so they interact more and participate." Ms. Blunt also notes, "As a teacher preparing lessons, I can turn to this textbook and see an overview of the lesson and materials. I can also use the test bank and find questions for assessments, like quizzes and tests."

Noticing the Difference

Finding changes in students, even during the first year of using ***Glencoe Physical Science,*** is possible, Dr. Reeder says, "Students' skills have definitely improved this year, and they're more interested and engaged in general. I notice that they can link concepts to formulas. This is not just memorization—they really understand the concepts. It's all because they can read the text so well and understand it. It's made all the difference in the world."

Ms. Blunt expresses similar experiences: "I believe the students find this text more engaging. For example, I remember one activity with models of the atom outlined in a National Geographic section. Seeing the models generated greater interest, which was really helpful to them in completing their assignment. The book is very resourceful; it contains information that makes teaching and learning more purposeful." She adds, "I have heard kids say that they like science a lot this year. One young man told me that his grade in science is the best grade on his report card."

CORBIS

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Tellico Plains High School

Monroe County School District, Tellico Plains, Tennessee

Tellico Plains, once a small Cherokee Indian Village called Telliquah, is a small rural village (pop. 859, area 1.6 square miles) located in the eastern part of Monroe County, the fifth largest county in Tennessee. It is just 58 miles southwest of Knoxville, Tennessee, and 111 miles north of Atlanta, Georgia. Monroe County is located along the North Carolina border in eastern Tennessee and includes beautiful landscapes such as the Appalachian Mountains and the Cherokee National Forest. The county's population (38,000) has increased more than 27 percent in ten years, and Tellico Plains is growing along with it.

Tellico Plains High Schools is one of 11 schools in the Monroe County School District. In 1995, over $4 million was spent to build the modern building that Tellico Plains High School now calls home. Tellico Plains High School serves approximately 460 predominantly Caucasian students of the 5,000 students in the district. The district's motto is "Educating for Tomorrow—Today."

Aligning Science District-wide

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Rick Saunders, science department chair and teacher at Tellico Plains High School, explains how Monroe County School District aligned science district-wide, "Our district was developing a county-wide science curriculum aligned with our standards that provided consistency from course to course. Teachers at the district's high schools and middle schools met and developed a curriculum that would flow from eighth to ninth grade, and then set out looking for textbooks that would flow as well. We wanted to adopt a new science program for middle schools that would provide a more solid foundation for high school, and a high school program that had more math, so that we could connect the two (science and math) in later science courses. The adopted programs would also have to provide good labs and lots of hands-on activities."

Monroe County School District adopted Glencoe's middle school science series, and readopted ***Glencoe Physical Science*** for 9th graders. Monroe County High Schools have used ***Glencoe Physical Science*** for eight years now. In the 2003–2004 school year, all students in 9th grade at Tellico Plains High School used the ***Glencoe Physical Science*** program.

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Reaching Every Learner

Mr. Saunders believes that ***Glencoe Physical Science*** provides him with everything he needs to reach his students. "***Glencoe Physical Science*** is more readable than other physical science textbooks. The reading level is not necessarily lower, but the phrasing is clearer, and the students seem to get it. ***Glencoe Physical Science*** builds on more basic principles in the early chapters to more advanced science in later chapters. It provides a lot of repetition from chapter to chapter with linking concepts, chapter previews, section reviews, and end of chapter reviews, as well as with the *Reinforcement and Study Guide*. So students are exposed to concepts which often leads to greater retention."

He continues, "***Glencoe Physical Science*** provides excellent visual aids, such as photographs, graphs, and charts that attract the attention of all learners. The program also incorporates a variety of very good inquiry-based, hands-on labs that ask a lot of thoughtful questions of the students. This is a particular strength of the book. I am also very happy with the variety of supplemental materials—they really make a big difference with the students. I think overall, that my students are more interested with Glencoe's program, and they are more eager to learn. I don't have as many kids goofing off anymore. This is probably because they can read the book and understand it."

Assessing Student Learning

Mr. Saunders finds that ***Glencoe Physical Science*** provides him with the appropriate tools and opportunities to assess student learning. "The student assessment sections in each chapter are a big help, as well as the workbooks that also assess student learning, and help me gauge if students are ready to move on or not. I really like the test bank, because it provides a variety of questions that help me assess the differing needs of students."

Although spring 2004 was the first time there was an end-of-course test for physical science, Mr. Saunders believes his students' skills are improving. He shares, "Chemistry teachers have told me that students are coming into chemistry with a much broader background now, and they don't have to spend as much time reviewing concepts. The ***Glencoe Physical Science*** program, which has a greater math-science correlation, is preparing them well for that class."

A Teacher's Last Word

Mr. Saunders sums up his opinion of ***Glencoe Physical Science***: "Overall the program makes it easy on the teacher. The way the book is designed and the way the concepts are arranged, there's good flow—leading you from goals and objectives to the chapter review and so on. It is a self-directing program."

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Other Comments

Ease of Use/Flexibility

I like the readability of ***Glencoe Physical Science*** and think it is well-written. I also think you can use ***Glencoe Physical Science*** many ways. For instance, I use things out of sequence; you can skip around, and that is a very good feature of this book—you don't have to go to Chapter 2 directly from Chapter 1. The pictures and graphics in ***Glencoe Physical Science*** are good, too.

Bill Mattison
Washington Park High School, Wisconsin

Glencoe's ***Integrated Physics and Chemistry*** is just easy to use. From my perspective it is laid out in a very logical order. The correlations to the Texas Essential Knowledge and Skills and TAKS are integrated well, so that makes things easier. The supporting materials are very well correlated. It is the easiest physical science textbook I have ever used. I also think the tests in Glencoe's ***Integrated Physics and Chemistry*** do a very good job. In the past I've written my own tests, but these work pretty well, so I don't have to.

I like the CD-ROM version of the text because it is easy to use at home and all the ancillary materials are on that. I have been a floating teacher this year and I don't have a classroom, so by being organized with the CD-ROM I can be flexible. I also really like the way the support materials are set up in individual booklets. In the past, you would get one big notebook, but this is much easier to use.

Richard Holt
Americas High School, Texas

Overall, ***Glencoe Physical Science*** is a good tool to use when teaching 9th-grade physical science. It is easy to understand and explains concepts in detail with many good diagrams.

David Hoffert
William Horlick High School, Wisconsin

We just adopted the newest edition of ***Glencoe Physical Science*** and the materials are so great! Everything is integrated so worksheets and lab materials are in each chapter, chapter-by-chapter, where they are supposed to be. So a teacher can just bring each chapter booklet home instead of lugging everything home.

Glencoe Physical Science is very helpful for the teacher and for students. All materials are sorted, and there are activities for students that address all types of learning styles—the MindJogger Videoquizzes, Vocabulary PuzzleMaker, and audio tapes. It's all very good. I especially love the outlines at the beginning of each chapter. I copy those off and my students have to go over the outlines so they know what we'll be learning in the upcoming chapter.

Bridgette Boudreaux
South Doyle High School, Tennessee

The Interactive [Chalkboard] CD-ROM that comes with ***Glencoe Physical Science*** is very helpful. Everything I need is right there and I can print it out. That makes things very easy. I also like the little notes in the teacher's edition of the book, like the FYI stuff—the little information that helps me learn more.

Peggy Minnick
North High School, Ohio

High-Quality Visuals/Examples

We like the presentation of ***Glencoe Physical Science***: It has the current graphics and pictures that are attractive to kids; and it has the Internet approach. The reading level of the text is grade appropriate; and the math isn't too in-depth. It is the best of all the books we looked at.

Bruce Carvalho
Bend Senior High School, Oregon

We chose ***Glencoe Physical Science*** because we thought it had a pretty good layout of the chapters and was divided well. It also did a good job of explaining each concept in depth, had good pictures and a lot of graphics and physical/visual aids to add excitement, making it more interesting for ninth-graders. The Spanish materials and the audio cassettes we use also. The layout and pictures did a good job of explaining, and the examples were up-to-date. There was a nice review at the end of each chapter and it also had questions for the students to do at the end of each section, which is another feature I liked.

David Hoffert
William Horlick High School, Wisconsin

Content/Skills-Building

We are really into science inquiry and we appreciate ***Glencoe Physical Science*** from that viewpoint. The labs are good points to leap off from. For Oregon standards, they have to be able to come up with their own labs and the book helps with that.

The Exam*View*® Pro Testmaker software that comes with ***Glencoe Physical Science*** has been very helpful. I like to write a different test for each chapter, each year. I don't want to teach to the test—I want to test after I've taught the materials, so I can pick and choose from the Exam*View*® Pro Testmaker software. The questions are already there for you—that's great!

Bruce Carvalho
Bend Senior High School, Oregon

Glencoe's ***Integrated Physics and Chemistry*** is a complete integrated physics and chemistry program that is correlated to our Texas objectives. It makes teaching the concepts of basic physics and chemistry easier. I appreciate the well-organized resources which are also supplied on a CD-ROM.

Richard Holt
Americas High School, Texas

I think ***Glencoe Physical Science*** prepares my students for more advanced chemistry because it has a lot of good scientific method in it. It also does very well in incorporating inquiry learning. It has good labs, as well as the analysis questions that ask students to think about what they have seen in the labs and lets them analyze the process.

The key to success for implementing ***Glencoe Physical Science*** is the variety of materials. No matter what you want to do with the book it is not the same old thing every day. You can do something different every day.

Melanie Anderson
Richwood High School, Louisiana

I think the labs in ***Glencoe Physical Science*** do a good job of incorporating inquiry learning or learning by discovery. What I like about the labs is that for the teacher who has varying time limits and space constraints the textbook does a pretty good job of mixing up the labs. There are very short ones that can be done quickly, then there are ones that require materials and are a bit longer, and then ones that have higher-level thinking questions.

The ***Glencoe Physical Science*** supplement that I use a lot is the Vocabulary PuzzleMaker. It is really easy to put things together as a last-minute time filler or nice review that is different. If I find myself with ten extra minutes I can quickly create one to use.

David Hoffert
William Horlick High School, Wisconsin

I think ***Glencoe Physical Science*** is building my students' skills, especially with the labs that they can do at school or at home. I assign them the Try At Home Labs to bring science home and show them that science isn't just in the classroom or in labs—science is everywhere.

The ***Glencoe Physical Science*** student CD-ROM with Virtual Labs and quizzes is outstanding! When students need extra help, they can get that hands-on feeling through the virtual labs. I also love the Exam*View*® Pro Testmaker software that comes with ***Glencoe Physical Science***. It cuts out so much time—you can tweak it and get exactly what you want. I really love the lab activities books in ***Glencoe Physical Science,*** too. Those can be done before or after the chapter. They are doable at the beginning and are inquiry based.

My advice to new teachers about ***Glencoe Physical Science*** is: Use what's provided—the transparencies, Virtual Labs, PuzzleMaker, and the Glencoe Web site. There's a wealth and variety of materials—just use all the facets of what Glencoe is providing. They did all the hard work for us.

Bridgette Boudreaux
South Doyle High School, Tennessee

Glencoe Physical Science is different from our previous textbook because it has review guides, sample tests, tests I can pull apart with the CD-ROM—adaptable things that I can put to use for my own students in addition to the ready-made materials. The reading guides and review guides in ***Glencoe Physical Science*** work really well for my students. I can use them as class work or drills or a test. The review guides have multiple functions, and should be used as necessary to teach or re-teach any topic.

Glencoe Physical Science is also good at incorporating inquiry learning/learning by discovery.

Frederick Bantz, Jr.
Hammond High School, Maryland

Student Response

Students find the ***Integrated Physics and Chemistry*** more engaging than other textbooks, because it has some interesting, eye-catching experiences.

Richard Holt
Americas High School, Texas

Students like ***Glencoe Physical Science***. They like the visually stimulating pictures. They also love the National Geographic articles and the online science activities, too. Many students have computers at home, but they sign up twice a week to use the computer in the classroom, too.

Bridgette Boudreaux
South Doyle High School, Tennessee

One student told me that ***Glencoe Physical Science*** actually made it fun. It was her first science class that she thought was fun. I think it's because we do a lot of hands-on activities, and the book helps with diagrams in doing this kind of learning.

Frederick Bantz, Jr.
Hammond High School, Maryland

Appendix

Research Supporting Content and Instruction
A Selected Annotated Bibliography

The following descriptions of research provide a brief overview of findings in chemistry and physics education and science education in general. Each of these, along with additional research, has played a role in informing the development of ***Glencoe Physical Science*** and ***Integrated Physics and Chemistry.*** 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.

Education Trust. (1999). *Dispelling the myth: High poverty schools exceeding expectations.* Washington, DC: The Education Trust.

Higher achievement is associated with the use of simulation and application software.

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.

Gabel, D.L. (Ed.). (1994). Handbook of research on science teaching and learning: A project of the National Science Teachers Association. New York: Macmillan.

This resource provides an overview of seminal research in science teaching and learning.

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 ***Glencoe Physical Science*** and ***Integrated Physics and Chemistry:***

- 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 pre-existing 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.

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.

Stadler, H., Benke, G., & Duit, R. (2001). How do boys and girls use language in physics classes? In H. Behrendt, H. Dahncke, R. Duit, W. Graber, M. Komorek, A. Kross, P. Reiska, (Eds.) *Research in Science Education—Past, Present, and Future.* Dordrecht, Boston, London: Kluwer Academic Publishers.

Students strengthen their understandings of concepts and vocabulary when they reformulate their understandings using everyday language and personal analogies.

Texley, J. & Wild, A. (2004). *NSTA Pathways to the Science Standards: Second High School Edition.* Arlington, VA: NSTA Press.

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

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 does text or lower-quality visuals.

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