

Prentice Hall Chemistry

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Scientific Research Base



TEACH • INSPIRE • CONNECT

Prentice Hall Chemistry Research Overview

The scientific research base used to develop *Prentice Hall Chemistry* describes how students learn science and provides classroom-based evidence to validate program efficacy. This body of research also indicates key elements of a textbook program that ensure students' success: support for reading and mathematics in science, consistent opportunities for inquiry, and an ongoing assessment strand.

In the following pages you will find summaries of the key concepts of the foundational research used to develop our program and specific references as to how this research was integrated into *Prentice Hall Chemistry*.

Pearson Prentice Hall's research is conducted in phases and is ongoing. The goal of establishing such rigorous research methods is to ensure that the program developed enables all students to learn the Chemistry skills and concepts they need for academic success and for everyday life. The phases of our research include:

(1) Exploratory Needs Assessment

Along with periodic surveys concerning curriculum issues and challenges, Pearson Prentice Hall conducts specific product development research, which includes discussions with teachers and advisory panels, focus groups, and quantitative surveys. We explore the specific needs of teachers, students, and other educators regarding each component of the *Prentice Hall Chemistry* program.

(2) Formative, Prototype Development and Field Testing

During this phase of research, we work to develop prototype materials. We then test the materials, including field-testing with students and teachers, and qualitative and quantitative evaluations of different kinds. We receive solid feedback about our lesson structure in our early prototype testing. Results are channeled back into the development of the program.

(3) Summative, Validation Research

Finally, Pearson Prentice Hall conducts longer-term research based on scientific, experimental designs under actual classroom conditions. This research identifies what works and what can be improved in the next revision of *Prentice Hall Chemistry*. Pearson Prentice Hall also continues to monitor the program in the market through ongoing dialogue with users. This allows us to perpetually refine our products and provide the best support to today's and tomorrow's teachers and students.

In preparation for the NCLB mandates for science anticipated for 2007, Pearson Prentice Hall is committed to providing scientific research to support the efficacy of our science programs in the classroom.

Our study designs will closely follow the criteria of No Child Left Behind. Since NCLB specifies a minimum level of improvement that students must achieve each year, actual Adequate Yearly Progress (AYP) will be reflected in the research used to validate the program.

Inquiry and Prentice Hall Chemistry

What Research Indicates

The National Science Education Content Standards define inquiry as the process in which students begin with a question, design an investigation, gather evidence, formulate an answer to the original question, and communicate the investigative process and results.

The National Research Council in *Inquiry and the National Science Education Standards* (2000), further identifies several “essential features” of classroom inquiry, including the following:

1. *Who asks the question?* That is, who asks the question that focuses the investigation (e.g., “What effect does the tilt of the earth have on seasons?” or “What effect does pH have on litmus paper?” or “Which antacid best neutralizes acid?”)? Is it the student or the teacher/book? In most curricula, these are an element given in the materials. As an educator you need to look for labs that, at least on a periodic basis, allow students to pursue their own questions.
2. *Who designs the procedures?* We are speaking here of lab procedures or the steps in an investigation. Who designs this process for gathering information? In order to gain experience with the logic underlying experimentation, students need continuous practice with designing procedures. Some labs, where the primary target is content acquisition, designate procedures. But others should ask students to do so.
3. *Who decides what data to collect?* This is similar to designing procedures, but the focus is on the data itself. What data is important and who determines that? Students need practice in determining the data to collect.
4. *Who formulates explanations based upon the data?* Do the text materials give the answers? Or do questions at the end of activities make students analyze and draw conclusions based on their data? The bottom line—Do the questions make students think?
5. *Who communicates and justifies the results?* Do activities push students to not only communicate but also justify their answers? Are activities thoughtfully designed and interesting so that students want to share their results and argue about conclusions?

Inquiry in Prentice Hall Chemistry

Prentice Hall Chemistry offers the most opportunities to get student to think like scientists and enables students to enhance their understanding by participating in the discovery.

Prentice Hall Chemistry encourages students to develop inquiry skills across the spectrum from teacher-guided to open-ended. Flexible lab options are included in every chapter, structured from directed to open-ended – providing the flexibility to address all types of learners and accommodate your class time and equipment requirements. Some focus on content acquisition, and thus the question and most of the procedures are specified.

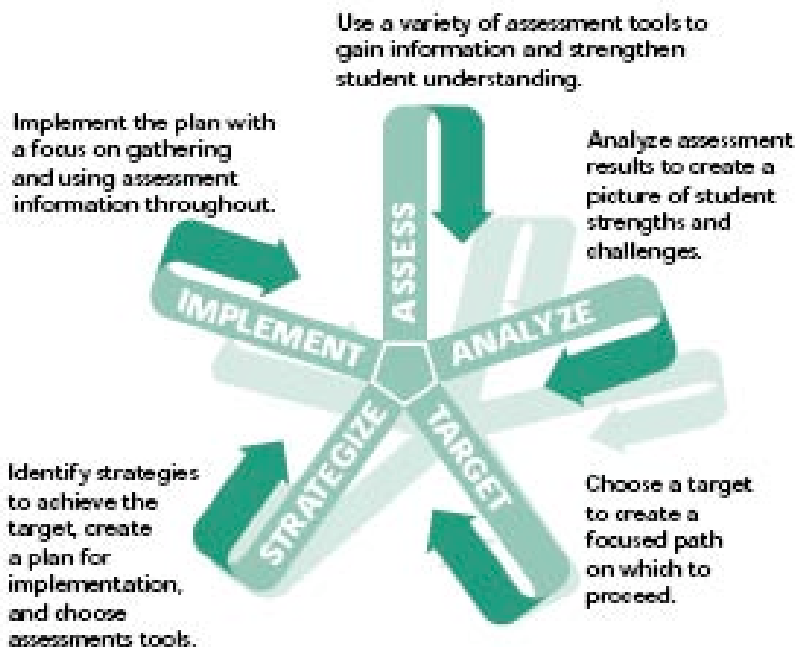
Assessment and *Prentice Hall Chemistry*

The primary goal of NCLB is to provide classroom teachers with better data from scientifically valid assessment in order to inform instructional planning and identify at-risk students who require intervention. It has been a common practice to teach a science lesson, administer a test, grade it, and move on. This practice is a thing of the past. With the spotlight now on improving student performance, it is essential to use assessment results as a way to identify student strengths and challenges. Providing student feedback and obtaining student input is a valuable, essential part of the assessment process.

What Research Indicates

An important assessment strategy is to ensure that students have ample opportunities to check their understanding of skills and concepts before moving on to the next topic. Checking for understanding also includes asking appropriate, probing questions with each example presented. This enables students and teachers to know whether the skills or concepts being introduced are actually understood.

Eileen Depka
Supervisor of Standards and Assessment
Waukesha, Wisconsin



Assessment in Prentice Hall Chemistry

The assessment strategies in *Prentice Hall Chemistry* will help both students and teachers alike ensure student success in content mastery as well as high-stakes test performance. A wealth of opportunities built into the Student Edition help students monitor their own progress. Teachers are supported with ongoing assessment opportunities in the Teacher's Edition and an easy-to-use, Examview®. These integrated, ongoing assessment tools assure success. Especially to support state and national testing objectives, Prentice Hall has developed test preparation materials that model the NCLB approach.

In the Student Edition

Caption Questions: Enhance critical-thinking skills and maximize the effectiveness of art, graphics, and narrative.

Checkpoint: Reinforce students' understanding of the material covered.

Section Assessments: Questions that model the way students think and review and assess the understanding the key concepts.

Comprehensive Study Guides and Chapter Assessments: Opportunities for students to check their own understanding and practice valuable high-stakes test-taking skills.

In the Program Resources

Examview® Computer Test Bank CD-ROM: Provides teachers access to thousands of modifiable test questions, hundreds of which contain algorithmically-generated variable data.

Interactive Textbook with ChemASAP: In addition to electronic animations and interactivities, the *Interactive Textbook* provides a wealth of assessment tools. Students can monitor their progress at point of use with ongoing assessment, help tutorials, and instant feedback.

Standardize Test Preparation Workbook: Includes topic-specific test prep items and practice tests that help teachers focus on improving test scores.

Reading Comprehension and *Prentice Hall Chemistry*

What Research Indicates

Modern understanding of comprehension emphasizes the importance of in-depth prior knowledge and how that knowledge is organized. Studies comparing novices and experts show that the conceptual organization of experts' knowledge is very different from that of novices. For example, experts emphasize core concepts when organizing knowledge while novices focus on superficial details. To facilitate comprehension, effective teaching strategies should support and scaffold students as they build an understanding of the key concepts and concept relationships within a text unit.

Three complementary strategies are very important in facilitating student comprehension of science texts. First, guide student interaction with the text using the built-in strategies. Second, organize the curriculum in terms of core concepts (e.g., Key Concepts in each Section). Third, develop visual representations of the relationships among the key concepts and vocabulary that can be referred to during instruction.

Dr. Nancy Romance
Florida Atlantic University

Reading in Prentice Hall Chemistry

The concept of 'considerate' text has been built into the student edition through the careful design of text features that provide instructional support for comprehension. Each of these instructional features provides a strong literacy framework for science teachers as they guide student interaction with the text. Each, in turn, also serves as a scaffold for students as they become more independent learners.

Before students read

The Guide for Reading introduces students to the key concepts and key terms they'll find in each section. The Reading Strategy is identified.

During the section

Boldface Sentences identify each key concept and encourage students to focus on the big ideas of science.

Reading Checkpoints reinforce students' understanding by slowing them down to review after every concept is discussed.

Caption Questions draw students into the art and photos, helping them connect the content to the images.

After students read

Section Assessment questions allow students to review key concepts.

Math in the Science Classroom and *Prentice Hall Chemistry*

What Research Indicates

Why should students concern themselves with mathematics in the chemistry classroom? Good science requires good data from which to draw conclusions. Technology enhances the ability to measure in a variety of ways. Often scientists must measure large amounts of data, thus an aim of analysis is to reduce the data to a summary that makes sense and is consistent with established norms of communication (e.g., mean, median, or mode), variability (e.g., range), and shape (graphic representations) can effectively reduce 500 data points to 3 without losing the essential characteristics of the data. Scientists understand that a trade-off exists between precision and richness as data is folded into categories, so margins of error can be quantified in mathematics terms and factored into all scientific findings.

Math Support in Prentice Hall Chemistry

Recognizing the need for math support, *Prentice Hall Chemistry* integrates mathematics instruction throughout the program and gives students ample opportunities to practice their math skills. The success of math instruction and practice in *Prentice Hall Chemistry* can be traced to nearly 20 years of interacting with chemistry teachers and students. Over the life of this chemistry program, Pearson Prentice Hall has developed strategies that allow students to see math as a tools, not an impediment, in learning and understanding chemistry concepts.

In the Student Edition

Sample Problems, CHEMath, Interpreting Graphs, and a Math Handbook all provide the practice and instruction, which encourages students to read and understand, plan and solve, and then evaluate their answers.

In the Teacher's Edition

Math support in the Teacher's Edition is geared toward the math objective on high stakes tests. Teaching notes provide the chemistry teacher with strategies for alternative instruction and additional practice. Sample Problems in the Student Edition are supported by additional Practice Problems in the Teacher's Edition.

In the Guided Reading and Study Workbook

These unique worksheets include Guided Practice Problems to help students master reading and enhance their study and math skills. Students can create a record of their work for study and review.

Differentiated Instruction and *Prentice Hall Chemistry*

What Research Indicates

All students are unique and their differences do not necessarily remain constant. Their strengths and needs change as their literacy develops and as they grow in their knowledge of science. Instruction that attempts to meet the needs of all students must be flexible and adaptable for each individual and assessment of students' strengths and needs must be continuous to ensure that each student learns all they can.

Instruction must be multi-sensory with learning opportunities that rely on all of the senses, and it must be scaffolded for each student's learning level. Further, instruction with multi-media enhances the probability of each student's learning.

*James Flood
Diane Lapp
San Diego State University*

Differentiated Instruction in Prentice Hall Chemistry

In the Student Edition

The considerate text structure offers ample reading support with elements before, during and after each section of the lesson. Frequent use of analogies is also part of a considerate text. The Guide for Reading helps students master concepts by introducing them to Key Concepts, Vocabulary, and a Reading Strategy. Section Assessments allow student to review Key Concepts at the end of every lesson. Additional differentiated strategies include:

Visual Learning: Graphs, charts, illustrations and photos work hand-in-hand with the text to clarify complex topics for those students who think and learn visually.

Active Learning: Inquiry Activities, Quick Labs, and Small-Scale Labs provide visual and tactile cues and offer opportunities for peer communication as well as encourage skills that are necessary for critical thinking. Internet connections through PHSchool.com and a partnership with NSTA bring timely, relevant, and appropriate chemistry topics to the classroom while engaging students with online interactivities.

In the Teacher's Edition

Chapter Planning Guides label activities by levels of difficulty, meeting the needs of all students. All program resources are identified by levels for Conceptual, for Standard, and for Honors.

The Teacher's Edition includes Differentiated Instructional Support Ideas. In order to facilitate use, these practical ideas for visual learning, English

language learners, less proficient readers, advanced learners, and inclusion/special needs are placed at point-of-use areas throughout.

For even more customize learning, the program resources include:

Guided Reading and Study Workbook: Instructional graphics provide visual reinforcement of complex topics.

Laboratory Manual and Small-Scale Chemistry Laboratory Manual: Lab options help teachers find the appropriate lab activities for every learning style.

Interactive Textbook with ChemASAP: The Student Edition Online and on CD-ROM allows students to interact with content, including reading aids, visual and interactive learning tools, and instant feedback assessment.