

GLENCOE  
**PHYSICS**  
PRINCIPLES & PROBLEMS

Transform Your  
Classroom!

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# Transform Your Classroom!

***Physics Principles & Problems:** Leveraging technology to drive personalized student success while engaging and motivating students with hands-on, project-based activities and real-world applications.*

The increased pace of change in education in the last few years has created seismic shifts in the delivery and consumption of educational materials. Students want to connect what they learn in the classroom to what they see happening in the real world – today!

Helping students draw these parallels and keeping them engaged is what McGraw-Hill Education is all about. We deliver to you the most effective, innovative, and inspiring high school physics curriculum that meets both Next Generation Science Standards (NGSS) and local science standards.

*Physics: Principles & Problems* combines dynamic content, engaging lab experiences, and a rich array of resources. Whether you're looking for a hybrid digital-print or a digital-first program, *Physics: Principles & Problems* gives you proven, comprehensive content with real-world applications to help your students lead the way in physics!

## Motivate students to engage real-world problems with these interactive digital tools:


- **Concepts-in-Motion**
- *Science and Engineering Practices Handbook*
- **Virtual Investigations**
- **Project-Based Learning Activities (PBLs) and Applying Practices Worksheets**

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\*Next Generation Science Standards is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.



A young girl with dark skin and short, curly hair is the central figure. She is wearing a purple and pink plaid button-down shirt over a green backpack. She is looking upwards and to the right with a hopeful expression. In the background, a boy in a blue shirt and striped shorts is walking away, also carrying a backpack. The setting is a dense forest with tall trees and green undergrowth.

**We firmly believe that  
the betterment of people,  
communities, and the world is  
grounded in education without  
limits – exclusive to no one,  
personalized to everyone.**





# RAMP UP THE ENGAGEMENT...

## With Interactive Learning

Motivate your students with hands-on, project-based activities and real-world application. These program resources ramp up your students' engagement with physics like never before!

- **Student eBook** with highlighter and note-taking tools.
- ***Sciences and Engineering Practices Handbook*** with accurate reference material and real-world examples.
- **Online Personal Tutor** to guide students through select physics content.
- **ConnectED Mobile** gives you the ability to manage all your teaching content offline.



# Engaging Student Resources

Give your students the resources they need to maximize physics-in-action! The **Student eBook** helps students turn physics in the real world into learning moments by giving students access to their program materials and resources anytime and anywhere.

Empower students to learn from physics as-it-happens with the **Student eBook** which learners can access anytime and anywhere using the Open eBook icon.

## Help students build active learning skills using these interactive tools:

- Step-by-step example problems with coaching notes and practice problems at point-of-use.
- Highlighter and note-taking tools.
- Worksheets and digital asset links in **ConnectED**.

The **ConnectED Mobile** app gives you complete access to your eBook, alongside planning tools, reference materials, and other program resources. **ConnectED Mobile** is available on select iOS and Android™ devices.

The image shows two digital interfaces. On the left is the 'Virtual Investigations' window, which has tabs for 'Laboratory', 'Conceptual Activity', and 'Quantitative Activity'. The 'Soccer Kick' activity is selected. It features a grid with a vertical axis labeled 'm' (0 to 30) and a horizontal axis labeled 'm' (0 to 45). A soccer player is positioned at the origin. Below the grid are sliders for 'Initial Speed' (5 m/s), 'Kick Height' (0 m), and 'Kick Angle' (10°). To the right of the grid are buttons for 'Time', 'Horizontal velocity', and 'Vertical velocity'. On the right is a tablet displaying the 'Student eBook'. The eBook page is titled 'REAL-WORLD PHYSICS' and 'Ultrasound Waves and Medicine'. It includes a table of sound speeds in various media, a diagram of the human ear, and text explaining the detection of pressure waves and the use of ultrasound in medicine.

Medium	m/s
Air (20°)	331
Air (25°)	343
Helium (20°)	965
Water (20°)	1482
Seawater (20°)	1533
Aluminum (20°)	4760
Iron (20°)	4994

**Detection of Pressure Waves**

Sound detectors transform sound energy—the kinetic energy of the vibrating particles of the transmitting medium—into another form of energy. A common detector is a microphone, which transforms sound energy into electrical energy. A microphone consists of a thin disk that vibrates in response to sound waves and produces an electrical signal.

**The human ear** As shown in Figure 2, the human ear is a sound detector that receives pressure waves and converts them to electrical impulses. The tympanic membrane, also called the eardrum, vibrates when sound waves enter the auditory canal. Three tiny bones in the middle ear then transfer these vibrations to fluid in the cochlea. Tiny hairs lining the spiral-shaped cochlea detect certain frequencies in the vibrating fluid. These hairs stimulate nerve cells, which send impulses to the brain and produce the sensation of sound.

The ear detects sound waves over a wide range of frequencies and is sensitive to an enormous range of amplitudes. In addition, human hearing can distinguish many different qualities of sound. Knowledge of both physics and biology is required to understand the complexities of the ear. The interpretation of sounds by the brain is even more complex, and is not totally understood.

**The Human Ear**

A diagram of the human ear showing the Auditory canal, Malleus, Incus, Stapes, and Auditory nerve.

The eBook in ConnectED Mobile is available offline for home use if students do not have access to the web.



# Real-world Connections

Be confident helping students achieve more! Use the *Science and Engineering Practices Handbook* to introduce the practices to students and support their scientific investigations and engineering projects.

A reference book, the *Science and Engineering Practices Handbook* provides students with background information, definitions, examples, and Quick Practice activities to stimulate learning through practice.

**The *Science and Engineering Practices Handbook* is an easy-to-use reference for all eight practices.**

1. Asking questions (for science) and defining problems (for engineering).
2. Developing and using models.
3. Planning and carrying out investigations.
4. Analyzing and interpreting data.
5. Using mathematics and computational thinking.
6. Constructing explanations (for science) and designing solutions (for engineering).
7. Engaging in argument from evidence.
8. Obtaining, evaluating, and communicating information.

The image shows a computer monitor in the background displaying a website titled "PHYSICS". The website has a navigation bar with links: Home, Plan & Present, Manage & Assign, Assess, and Resources. Below the navigation bar is a "Lesson Search" section with dropdown menus for "Physics and Machines" and "Energy". To the right of the search section is a "Results" section showing "Results Per Page 12". In the foreground, a printed page from the *Science and Engineering Practices Handbook* is shown. The page is titled "Defining Problems" and contains the following text:

**Defining Problems**  
Defining problems is an engineering practice that underlies any technological solution. The different components of this practice are briefly summarized below.

1. Engineers design solutions to problems.
2. Problem statements outline the problem and the solution.
3. Asking questions is part of engineering as well as science.

Defining problems doesn't involve a dictionary or a math worksheet. Engineers study how people do things and try to make the experience better. If people don't have a way to do something yet, engineers invent it. Engineers have to consider many factors when defining a problem.


**Seeking a Solution**  
Engineers identify problems for people and society and then design solutions to those problems. The solution could be a process, a system, or an object, such as a tool. Space suits worn by astronauts are technological solutions designed by engineers. When coming up with any solution, engineers must consider many criteria.

**Criteria** are requirements or specifications for a product to be successful.

Criteria for a space suit may include the size of the person wearing it, how easy it is to move around in, and the temperatures it can withstand. Engineers also have certain constraints on every solution.

**Constraints** are limitations on a product's design.

For example, some materials may not be durable enough or may be too expensive to use. Major constraints include time, energy, space, and the availability of tools and materials. Other important constraints are the number of people working on the project, how much money is available for the project, and what information about the project exists.



Space suits have many criteria for safety and functionality.

Science and Engineering Practices • Asking Questions and Defining Problems  
10  
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**Find the Practices Handbook in your teacher resources.**



# Interactive Student Resources

Written to meet each Next Generation Science Standard (NGSS) performance expectation, **Applying Practices Worksheets** and **Project-Based Learning Activities** (PBLs) challenge your students to solve real problems in the real world. These sheets are editable, downloadable, accessible online, and designed to meet specific performance expectations.

Interactive student resources, learning activities, and worksheets are embedded for point-of-use access. Students can use these dynamic resources immediately to practice new concepts.

## Students practice physics in action with these learning tools.

- **Project-Based Learning Activities** that integrate traditional science content with engineering content.
- Design-your-own labs.
- Guided Laboratory Investigations.
- Modeling activities.
- Research and communicate projects.

Home | Connected | Help | Logout

Standards

TEACHER CENTER

PD

Applying Practices W..

Modeling Fission, Fusion, and Radioactive Decay

PhysicsLAB-Stair Cil...

Modeling Fission, Fusion, and Radioactive Decay

For this activity, you will use a model to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. You will also model the amount of energy released in each process relative to other kinds of energy transformations. This worksheet will help you plan, develop, and execute your models.

**Develop Your Model**

1. In your own words, describe what process or question your model will illustrate.
2. What type of model will you use? What materials will you need to develop your model?
3. Use the space below to sketch a prototype of your model. If you need more space, you can use a separate page.
4. Complete your model. Below, explain how it works and describe how it addresses the process or question.

Applying Practices • Modeling Fission, Fusion, and Radioactive Decay

1

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**Find Applying Practice Worksheets** in your teacher resources and teacher blades. Also accessible at point-of-use in student resources.





# TIME SAVING TECHNOLOGY...

## Creates interactive digital solutions

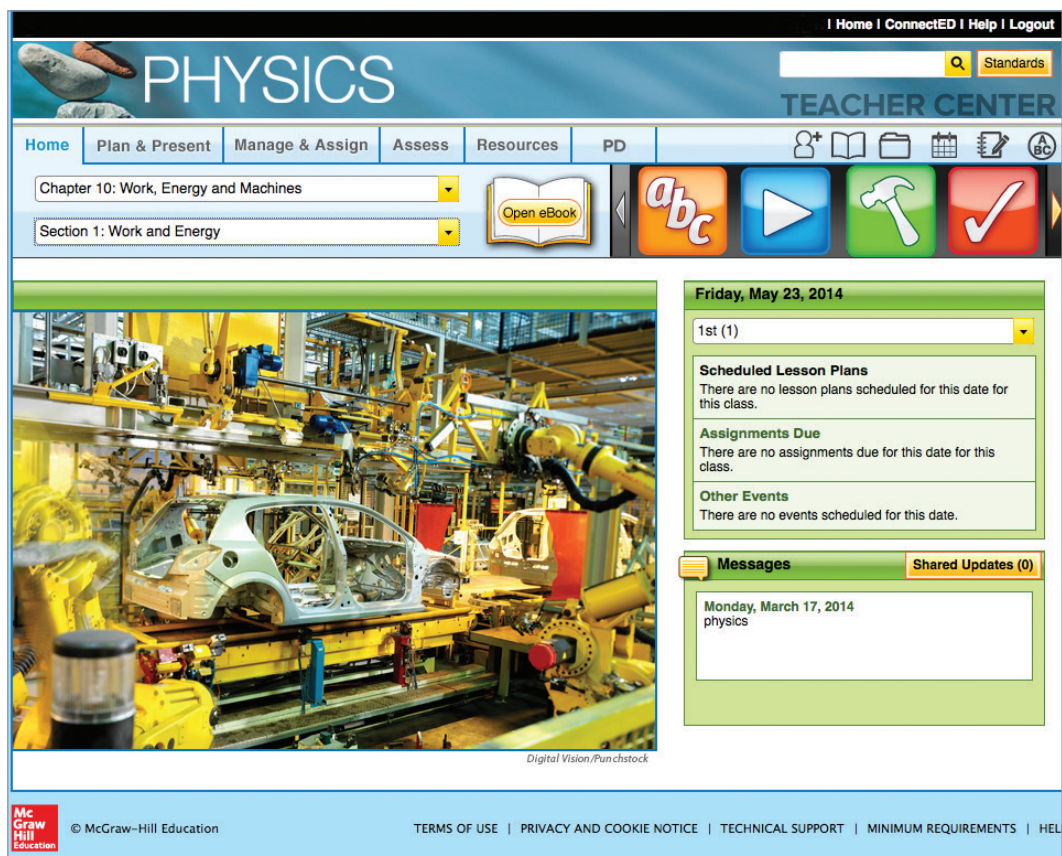
To meet you wherever you are on the digital spectrum, *Physics Principles & Problems* interactive learning and teaching resources are easy-to-use, whether you're a technology novice, digital native, or somewhere in the middle.

- **ConnectED** is your digital teaching platform making it easy and convenient to customize lessons, review assignments, and communicate with students.
- **eSolutions** manual with always up-to-date answers and available 24-7 helps you identify knowledge gaps with premade or customized problem sets.

# Effective Teaching and Learning

The new **ConnectED** digital platform for high school science brings a new level of engagement and effectiveness to your classroom.

A one-stop shop where you access Student eBooks, assessments tools, worksheets, presentations, messaging tools, and so much more!



## Plan, Teach, and Assess with *ConnectED*

- Plan and present personalized lessons with intuitive editing tools.
- Send and receive classroom assignments electronically to your students' **ConnectED** accounts.
- Create and customize premade diagnostic and summative evaluations using eAssessment.
- Access and review notes students take in their eBooks to plan class time and assignments more effectively.
- Search curriculum by keyword or standard.
- Offers tools such as My Files, Planner, Notebook, and eGlossary.
- Communicate with students using Message Center.



The screenshot displays the ConnectED Student Center interface. At the top, there's a navigation bar with 'Home', 'Homework', 'Resources', and 'Collaborate' tabs. A search bar and 'Standards' link are also present. The main content area shows a 'DUE (0)' section with a '+] DUE LATER (0)' link and a 'HOMEWORK HISTORY (0)' section. A 'Media' window is open, showing a handwritten physics problem by 'Mr. McChesney'. The problem asks for the components of weight for a 562 N crate on a 30.0° inclined plane. Handwritten solutions show  $F_g = 562 \text{ N}$  and  $\theta = 30.0^\circ$ . A diagram shows a crate on an inclined plane with force vectors. Another diagram shows a Bohr-style energy level diagram for Potassium (K) with a 3D atomic model. The interface also shows a date: 'Today is Thursday, July 17, 2014'.

Expanded features such as Personal Tutors and Cyber Science™ go beyond the limitations of the printed page.

## Apply Interactive Practice

Students have their own digital learning platform called **ConnectED Student Center**, complete with student worksheets and digital resources. Assignments you create appear in their to-do lists. Students can message you directly and submit their work.

With **ConnectED Student Center**, your students can access their class resources anytime, anywhere.

Use expanded Student Center features such as Personal Tutors and Cyber Science 3D™ videos to go beyond the limitations of the printed page and bring science into your student's lives like never before.

# 24-7 access

Use the **eSolutions Manual** to design a dynamic learning environment and effectively personalize content to meet each students' specific learning needs.

Replace your traditional manual with this digital **eSolutions Manual** to effectively create customized homework assignments and assign ready-made practice activities.

The **eSolutions Manual** can help you use class time more effectively. Use the “view online” feature in class and project questions and solutions on a screen or interactive whiteboard to make class time more interactive and productive.

Display questions one at a time, and reveal steps to help students work through problem sets individually or collaboratively.

The screenshot displays the eSolutions Manual interface. On the left, a sidebar lists chapters from 1 to 23, including topics like Physics Toolkit, Representing Motion, Accelerated Motion, Forces, Displacement and Force, Gravitation, Rotational Motion, Momentum, Energy, States of Matter, Vibrations and Waves, Sound, Fundamentals of Light, Reflection and Mirrors, Refraction and Lenses, Interference and Diffraction, Static Electricity, Electric Fields, Electric Current, and Series and Parallel Circuits. The main area shows a 'No Image Available' placeholder. Below this, there are sections for 'Include:' (Answers, Solutions) and 'Select:'. A 'Finish' button is visible in the top right corner.

Access your **eSolutions Manual** anytime and anywhere using **ConnectED** or **ConnectED Mobile**.

**Exercise 1**

**Section 1 Temperature, Heat, and Thermal Energy: Practice Problems**

When you turn on the hot water to wash dishes, the water pipes heat up. How much heat is absorbed by a copper water pipe with a mass of 2.3 kg when its temperature is raised from 20.0°C to 80.0°C?

**SOLUTION:**

$$Q = mc\Delta T$$
$$= (2.3 \text{ kg})(385 \text{ J/(kg}\cdot\text{K)})$$
$$(80.0^\circ\text{C} - 20.0^\circ\text{C})$$
$$= 5.3 \times 10^4 \text{ J}$$

## The **eSolutions Manual** features:

- All questions from the Student Edition.
- The flexibility to show answers, solutions, both, or neither.
- The ability to make customized worksheets from questions in the Student Edition, using evens, odds, or all problems.





# EFFECTIVE RESULTS...

## To support student success

**Easy-to-use eAssessment and reporting tools equip you with the data you need to make informed instructional decisions and keep students engaged.**

- **eAssessment** supports diverse types of evaluations and includes online scoring and report generation for digital and/or print distribution.
- **LearnSmart®** an interactive and adaptive learning system, effectively differentiates and supports struggling and advanced learners alike.
- **Professional Development** resources including pertinent information on new science standards and implementation best practices are available to you at point-of-use.

# Turn Students into Star Performers

Turn your classroom into a physics success center with **eAssessment**. This robust resource gives you powerful tools to assess student progress and make data-driven instructional decisions.

The **eAssessment** reporting feature means you'll always have access to valuable data on individual students and whole classes to help you differentiate and support student mastery of concepts appropriately.

## Other features of eAssessment to help increase your efficiency:

- Question Bank with questions organized by strand, subject, and lesson.
- Assessment creation or customization of premade assessments.
- Report generation on proficiency and accuracy.

Identify students with knowledge gaps to make data-driven instructional decisions with **eAssessment**.

The screenshot displays the McGraw-Hill eAssessment interface. On the left, a navigation pane shows a tree structure of content: 'My Question Sets', 'Shared Content', 'fr', 'Physics: Principles and Problems' (expanded), 'Chapter 1', 'Chapter 2', 'Chapter 3' (selected), 'Chapter 3 Additional Challenge Problems', 'Chapter 3 Pre AP Critical Thinking', 'Chapter 3 Set (Student Edition)', 'Chapter 3 Supplemental Problems', 'Chapter 4', 'Chapter 5', and 'Chapter 6'. Below this is a 'Tests' section with 'My Tests', 'Shared Content', 'Physics: Principles and Problems' (expanded), 'ch6', 'ch6', 'ch6', and 'Chapter 1'.

The main content area is titled 'Chapter 3 Additional Challenge Problems (Ancillary)'. It shows a 'Multiple Choice' question: 'The driver of a car traveling at 110 km/h slams on the brakes so that the car undergoes a constant acceleration, skidding to a complete stop in 4.5 s. 1. What is the average acceleration of the car during braking?' with options a. 20.041 m/s<sup>2</sup>, b. 20.15 m/s<sup>2</sup>, c. 26.9 m/s<sup>2</sup>, and d. 224 m/s<sup>2</sup>. The answer is marked as 'c'.

Below the question is a graph of 'Velocity v' vs 'Time (s)'. The velocity starts at 30 m/s and decreases linearly to 0 m/s at 4.5 s.

An 'Assignment Results' window is overlaid on the right. It shows 'Date: June 11, 2014', 'Assignment: Practice Homework', 'Student: Sample Student', 'Class: 2nd Period', 'School: SAMPLE SCHOOL', 'Term:', and 'Score: 13 / 87'. Below this is a table of results:

Question #	Question Type	Points	Response
X 1	True / False	0 / 1	T
X 2	True / False	0 / 1	F
3	True / False	1 / 1	T
4	True / False	1 / 1	T
X 5	True / False	0 / 1	T
6	True / False	1 / 1	F
7	True / False	1 / 1	T
8	True / False	1 / 1	F
9	True / False	1 / 1	F
X 10	True / False	0 / 1	F
11	True / False	1 / 1	T
12	True / False	1 / 1	F
X 13	True / False	0 / 1	T
14	True / False	1 / 1	T

**eAssessment** suite collects valuable data for every student and the class.

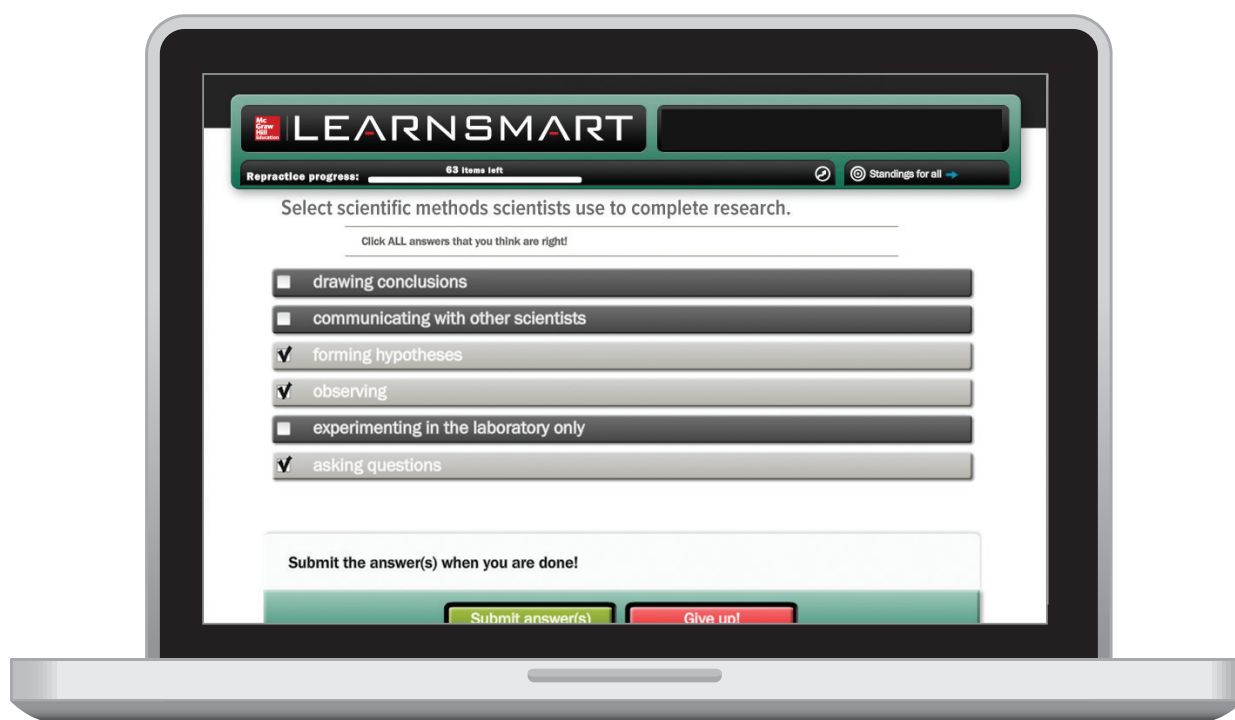


# Increase Knowledge Retention

Increase retention of material, improve students' performance, and make your class more interactive and productive with proven adaptive learning system, *LearnSmart*®.

As an interactive and adaptive learning system, *LearnSmart*® is designed to help students learn faster, study more efficiently, and retain more knowledge for greater success. Both dynamic and progressive, *LearnSmart*® adjusts physics concepts to align with each student's progress, based on their demonstrated skill and performance.

No two students learn the same way. *LearnSmart*® personalizes content for each student's unique learning needs.



## Pinpoint knowledge gaps for individual students and across classes.

Empower students to personalize their learning experience with optimal learning paths so they spend more time on what they don't know with *LearnSmart*®.

- Practice of basic physics concepts to improve recall and application before moving on.
- Additional exposure and increased practice to master new concepts.
- Presentation of concepts individual students struggle to master.

# Transform Your Classroom

In just a few clicks, you can quickly access relevant, timely, and ongoing **Professional Development** videos and webinars available to you, on-demand.

Directly embedded in *Physics Principles & Problems* is your interactive professional learning program. Learn how other science educators have successfully implemented the program and increase your awareness of new science standards.

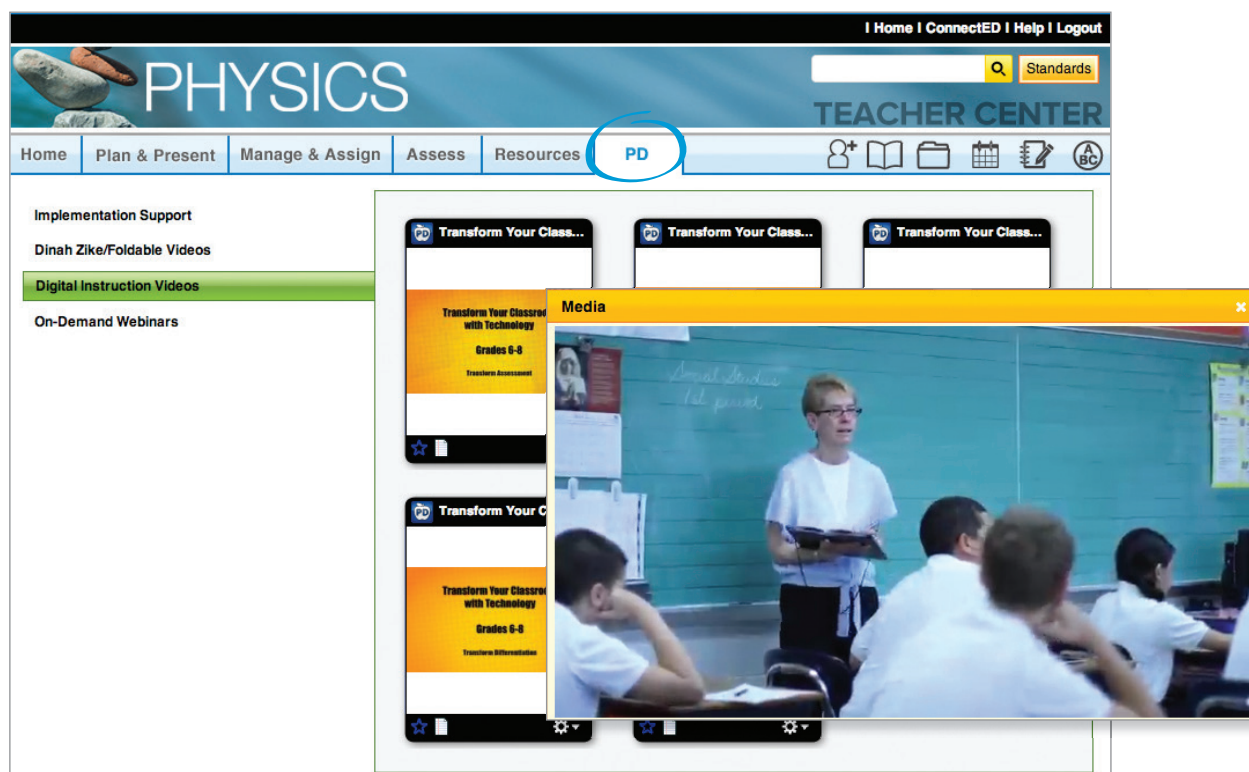
## Relevant Resources for science educators.

Rich, web-based resources include modeled classroom instruction videos, implementation support, technology resource optimization, and professional learning community support.

**Use the ConnectED, Professional Development tab to access on-demand webinars and these free video libraries:**

- Dinah Zike/Foldable Videos
- Mathematical Practice Videos
- Pedagogical/Instructional Support Videos
- Digital Instruction Videos
- STEM Videos

Customized,  
comprehensive, and  
expertly-crafted  
solutions translate into  
meaningful program  
success.

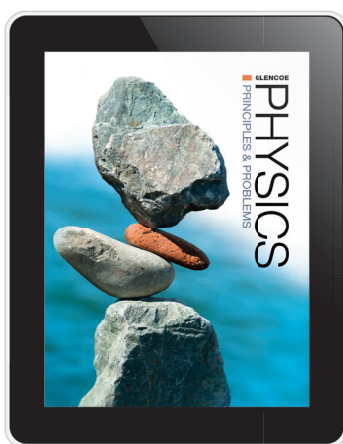




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