Developing Sustainable Online Learning at Scale to Accommodate Diverse Learning Preferences and Needs

Francis Eberle
Executive Director, NSTA

Al Byers
Assistant Executive Director, e-Learning

Flavio Mendez
Sr. Director, NSTA Learning Center
Drivers Behind our Model:
The Professional Development Landscape

A significant, positive correlation exists between student achievement and teachers’ content knowledge (subject matter AND pedagogical content knowledge).

Detrimental classroom effects when teachers do not feel confident in their knowledge of science.

Drivers Behind our Model: Professional Development Stats

• What is return-on-investment for face-to-face professional development?


• How many have completed an online professional development course?

You are not alone: In 2008 over 3.9 million learners in the US took a course online...

(The Sloan Consortium: Staying the Course: 2008; Project Tomorrow; National Survey on Internet Use; 2008).
A Critical Piece of the Solution

The NSTA Learning Center

• Self-Directed, On-Demand Access
• 5,000+ resources & opportunities
• Tools to help adult teachers organize, personalize, and document their growth over time.

http://learningcenter.nsta.org
Scalable, Sustainable, and Customized Professional Development

The Learning Center

Search Engine
Teacher PD Indexer
Online PD Catalog

University Online Affiliates
Regional/State Face-to-Face PD
E-Journal Articles
Interactive SCORM Learning Objects
F2F Symposia & PD Institutes
Enhanced Podcasts
Live Web Seminars
e-Books and online Chapters
Moderated Online Short Courses

Professional Development Resources and Opportunities

My PD Plan & Portfolio
My Calendar
My Library
My Notepad
My Transcript
Admin Report
NSTA Certification
June 2010 Collection: 5,000+ PD Resources and Opportunities Available

SciGuides [33]
Science Objects [74]
SciPacks [19]
Archived Seminars/Podcast [390+]

Web Seminars [120+/yr]
Online Courses [30+/year]
NSTA Short Courses [7/year]

Journal Articles [3100+]
NSTA Press Books [250+]
e-Books [135+]
e-Chapters [810+]

Symposia [5-9/year]
PD Institutes [6-10/year]
Summer Academies [4/year]
NSTA Conferences [4/year]

http://learningcenter.nsta.org
Over 62,600 Individual accounts with over 436,000 resources being used across all teachers’ personal libraries as of June 2010.
Featured e-PD resources in the Learning Center

supported by
Featured e-PD resources

• 2 hour free online learning experience in a particular topic
• Interactive simulations
• Questions to promote interaction and learning
• Based on science literacy goals in science education standards
• Seventy-four (74) Science Objects are currently available
**Animation Analysis**

The following animation shows a ball rolling along a track. Replay the motion a number of times and then answer the multiple-choice questions that follow. In answering these questions, feel free to replay the animation if necessary. Select the icon to launch the animation in a new window.

![Animation of a ball rolling on a track](image)

**Practice**

Okay, now that those mental wheels are turning, see if you can answer these questions. If you miss an answer or two or three, it might be worth your while to review the appropriate sections of this Science Object.

**Q** What is the approximate position of Point E in relationship to Point A?

○ E is about 350 centimeters away from A, at an angle of about 80 degrees with respect to Line Y.
Featured e-PD resources within the Learning Center

Sample Interactives and Media

- Make a Reef
- Position/Motion
- Speed/Velocity
- Seismic Waves
- Journey to Planets
What type of pattern did you observe?

- I didn't run the simulation, but I can imagine what will happen.
- The more the track changed in shape, the higher the ball rose in vertical height at the end of the track.
- The ball would rise to a different vertical height at the end of the track depending on the track chosen.
- The ball rose to approximately the same vertical height no matter what track was used in the simulation.

Check

Tries Remaining: 3

Hands-On Activity

You can do this simulation in real life. All you need is a section of Hot Wheels® track, a marble or ball bearing, a ruler, and a friend to help. Then select the link to go to the Activity:

Hands-On Activity

Press "Next" at the top of this window to go on to What's the Point?.

Hands-On Activity

Grab a ruler or meterstick, a marble or a ball bearing, and about a meter-long section of Hot Wheels® track. If you don't have access to kids' toys, just use anything you can find that's flexible and will allow a marble to roll along it. What works well is a section of clear plastic tubing (try the hardware or plumbing supply store) and a ball bearing that's small enough to roll freely inside the tubing.

Find a friend or family member to help you with this next part. Hold the track in a U shape so the lowest part just touches a table top or a floor, as seen in Figure 3.10.

Figure 3.10

Now measure the vertical distance from the floor or table to one end of the track. For the directionally challenged, that vertical distance is shown in Figure 3.11.

If your memory isn't great, write this distance down. You'll need to keep this one side of the track at that same vertical distance as you do the next few things. With your accomplice helping you, hold the track in a U shape with the bottom of the U touching the table or floor; holding your end at the vertical distance you've measured, drop the marble at the top of that end of the track.
Featured e-PD resources within the Learning Center

Supported by

- NSTA
- Science Objects
- SciPacks
- SciGuides
- NSTA Symposia
- Quality Learning Experiences
- NSTA Web Seminars

Sally Ride Science
- NSTA Press
- FDA
- NSDL
- National Science Digital Library
- National Institutes of Health
- NSF
- NOAA
- NASA
3-5 Free Science Objects

NSTA SciPack

Content Mentor
Unlimited Email Support

Assessment and Certification Opportunity

Pedagogical Implications Content
<table>
<thead>
<tr>
<th>SciPack Topics and Production Status, Jun 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Earth &amp; Space</strong>&lt;br&gt;<strong>9 Topics</strong>&lt;br&gt;Earth, Sun &amp; Moon&lt;br&gt;Gravity &amp; Orbits&lt;br&gt;The Solar System&lt;br&gt;The Universe&lt;br&gt;Weather &amp; Climate&lt;br&gt;Rock Cycle&lt;br&gt;Plate Tectonics&lt;br&gt;Earth’s Changing Surface</td>
</tr>
<tr>
<td><strong>Physical</strong>&lt;br&gt;<strong>7 Topics</strong>&lt;br&gt;Force &amp; Motion&lt;br&gt;Energy&lt;br&gt;Nature of Light&lt;br&gt;Chemical Reactions&lt;br&gt;Electric &amp; Magnetic Forces&lt;br&gt;Atomic Structure</td>
</tr>
<tr>
<td><strong>Life</strong>&lt;br&gt;<strong>13 Topics</strong>&lt;br&gt;Cell Structure &amp; Function&lt;br&gt;Coral Reef Ecosystems&lt;br&gt;Science of Food Safety&lt;br&gt;Resources &amp; Human Impact&lt;br&gt;Nutrition</td>
</tr>
<tr>
<td><strong>Completed</strong>&lt;br&gt;<strong>In Production</strong>&lt;br&gt;Earth’s History&lt;br&gt;Elements, Atoms &amp; Molecules</td>
</tr>
<tr>
<td><strong>Coming Soon</strong>&lt;br&gt;Heredity &amp; Variation&lt;br&gt;Biological Evolution&lt;br&gt;Natural Selection&lt;br&gt;Interdependence of Life</td>
</tr>
</tbody>
</table>
Featured e-PD resources within the Learning Center

supported by
Sea ice extent is shrinking.

- Large interannual variability
- Downward trend
- Rate of decline: ~ 6.5% per decade
Wealth of Data for District and State Departments of Education
Web Accessible SciPack Pre/post Assessment Scores for District/State deployments after completing SciPacks

**Energy Assessment**
- 911 Pre-tests taken with a 67% avg score
- 201 Post-tests taken with an 84% avg score
- Totals as of 1/14/2010

**Cell Structure and Function Assessment**
- 234 Pre-tests taken with a 61% avg score
- 60 Post-tests taken with a 72% avg score
- Totals as of 1/14/2010

Average scores pre and post for different dates.
District Administrator Reports: PD Resource Preferences

Anaheim CEMSS 7th grade Admin Page

Welcome to your NSTA resource administrator page.

Data below is provided to assist you in tracking activity and progress of your program participants. The URL for the Teacher Access Page is: http://learningcenter.nsta.org/cemss-7. The Promo Code is cemss-7

Overview

Total Products Added by Type

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Number Added</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Object</td>
<td>163</td>
</tr>
<tr>
<td>SciPack</td>
<td>146</td>
</tr>
<tr>
<td>Journal Article</td>
<td>133</td>
</tr>
<tr>
<td>SciGuide</td>
<td>45</td>
</tr>
<tr>
<td>Web Seminar Archive</td>
<td>28</td>
</tr>
<tr>
<td>Book Chapter</td>
<td>27</td>
</tr>
</tbody>
</table>

10 Most Recent Additions

<table>
<thead>
<tr>
<th>User</th>
<th>Title</th>
<th>Type</th>
<th>Date Added</th>
</tr>
</thead>
</table>
Web Accessible and Exportable Reports:
Product Usage, Pre/Post Assessments, Login history

Anaheim CEMSS 7th grade Admin Page
Welcome to your NSTA resource administrator page.
Data below is provided to assist you in tracking activity and progress of your program participants.
The URL for the Teacher Access Page is: [http://learningcenter.nsta.org/cemss-7](http://learningcenter.nsta.org/cemss-7). The Promo Code is cemss-7

### Individual Users

Click on a user's name to see all of the resources they've added to their library via the subscription.

- **Export Pre/Post-Test Results (sorted by SciPack)**

<table>
<thead>
<tr>
<th>User</th>
<th>MemberID</th>
<th>Date Registered:</th>
<th># of Products Added via Subscription:</th>
<th>Pre/Post Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Smyth</td>
<td>1296827</td>
<td>5/20/2009 4:33:00 PM</td>
<td>7</td>
<td>View Results</td>
</tr>
<tr>
<td>Betty Davis</td>
<td>1232605</td>
<td>5/20/2009 1:39:00 PM</td>
<td>24</td>
<td>View Results</td>
</tr>
<tr>
<td>Ron Smith</td>
<td>1550625</td>
<td>5/20/2009 1:44:00 PM</td>
<td>5</td>
<td>View Results</td>
</tr>
<tr>
<td>Samuel Adams</td>
<td>1469390</td>
<td>5/20/2009 4:46:00 PM</td>
<td>19</td>
<td>View Results</td>
</tr>
</tbody>
</table>
Learning Center Tools for Individual Teachers
Welcome to Your Professional Development Web Space!

Through the resources on this site you can begin to build your professional development plan, track your activities and assess your progress. You can start at the “Explore Learning Opportunities” section or by writing your game plan with the PD Plan and Portfolio tool. Whatever you decide, that’s the beauty of this space. So, let’s get started!

http://learningcenter.nsta.org
Welcome to your collection of professional development resources. Select from the links and tabs below to access your NSTA resources, your uploaded items, organize them into collections, and then share your collections with others. Please use the "My Library" Help Guide (1.24 MB PDF) if you need assistance adding resources or creating collections in your library.

**Do-it-Yourself Learning**
- SciGuides (25 items)
- SciPacks (13 items)
- Science Objects (49 items)
- Podcasts (10 items)
- Web Seminar Archives (16 items)

**Books & Articles**
- Book Chapters (19 items)
- eBooks (15 items)
- Journal Articles (124 items)

**Live Online Seminars & Classes**
- Web Seminars (6 items)

**In Person Experiences**
- No Items
Resource Upload

New to the Learning Center! Enjoy the convenience of having all your electronic resources in one location. Upload up to 1.5 GB of your resources to your Learning Center library, add them to your collections, create notes about them, and e-mail them to your friends. File formats include PowerPoint presentations, Word documents, Excel spreadsheets, PDF files, image files, and more. Each file must be 10 MB in size or smaller. Please read the Terms and Conditions.

You are currently using 0.0% of your 1.5 GB

You have 1.50 GB of available space

My Uploaded Resources

Ice Climbing.jpg
Image from NASA education professional development experience at Lake Placid, NY. Climbing ice wall

Exploring Tides Simulation (Explore Learning)
Gain an understanding of high, low, spring, and neap tides on Earth by observing the tidal heights and the positions of the Earth, Moon, and Sun. Tidal bulges can be observed from space, and water depths can be recorded from a dock by the ocean.

Seasonal Weather Temperatures.xls
Small data set of real-world authentic data for students to analyze for seasonal variation and patterns in temperature

DistrictPersonal Lesson Plan.doc
Lesson plan shared between school district aligned with curriculum and unit on weather

NASA Satellite Visualizations of Sea Surface Temperatures.ppt
Visualizations help scientists predict El Nino cyclical weather events
Welcome to your collection of professional development resources. Select from the links and tabs below to access your NSTA resources, your uploaded items, organize them into collections, and then share your collections with others.

Collections enable you to group together and organize your NSTA resources. You may also share collections with friends and colleagues.

### Start a New Collection

<table>
<thead>
<tr>
<th>Title</th>
<th>Created</th>
<th>Currently Sharing With</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>3/17/2008</td>
<td><a href="mailto:rfoley@nsta.org">rfoley@nsta.org</a>, <a href="mailto:abyers@nsta.org">abyers@nsta.org</a>, <a href="mailto:ehausknecht@nsta.org">ehausknecht@nsta.org</a>, <a href="mailto:alsbyers@yahoo.com">alsbyers@yahoo.com</a></td>
<td>[ edit name ] [ delete ]</td>
</tr>
<tr>
<td>Atomic Structure</td>
<td>10/1/2009</td>
<td>NA</td>
<td>[ edit name ] [ delete ]</td>
</tr>
<tr>
<td>Cells and Organisms</td>
<td>3/17/2008</td>
<td>NA</td>
<td>[ edit name ] [ delete ]</td>
</tr>
<tr>
<td>Chemistry</td>
<td>3/17/2008</td>
<td>NA</td>
<td>[ edit name ] [ delete ]</td>
</tr>
<tr>
<td>Earth Structures and Processes</td>
<td>3/17/2008</td>
<td><a href="mailto:jlayman@nsta.org">jlayman@nsta.org</a>, <a href="mailto:tradford@nsta.org">tradford@nsta.org</a></td>
<td>[ edit name ] [ delete ]</td>
</tr>
<tr>
<td>Earth Sun and Moon</td>
<td>3/17/2008</td>
<td>NA</td>
<td>[ edit name ] [ delete ]</td>
</tr>
</tbody>
</table>

- Earth Sun and Moon
  - 7 items
Create and Forward Personal Collections

- Web Seminar Archives
- Science Objects
- Individual user selected URLs
- Journal Articles
- Individual user Files (word docs, images, excel)
PD Indexer

- Diagnose gaps in Content Knowledge Understanding
- View Recommended Resources and Opportunities for Consideration

The Professional Development Indexer helps you diagnose your needs in specific science content areas and provide suggestions of NSTA e-PD resources and opportunities you may want to consider as you plan your professional development (PD). The indexer does not assign a grade or present a score to the questions you answer, but saves a list of recommended resources for later review.

You have two options for indexing your PD needs. First, you may review all of the content areas across any of the three science disciplines provided: physical, life, or earth and space science by clicking the “Diagnose All Subjects” button with a specific discipline. This will present you with five questions randomly selected from each content area for that discipline. Or, you may select one or more content areas within a discipline by checking the appropriate boxes and then selecting the “Diagnose Selected Subjects” button. This will present 10 questions from each science content area selected.

**Earth and Space Science Indexer**

Content Areas Covered:
- Rock Cycle
- Earth, Sun, and Moon
- Gravity and Orbits
- Solar System
- Plate Tectonics
- Universe
- Oceans Effect on Weather and Climate
- Earth’s Changing Surface

**Completed Indexer Results**
- Rock Cycle, Earth...
  Results 3/23/2007 Delete
- Solar System, Pla...
  Results 11/5/2008 Delete
- Gravity and Orbit...
  Results 11/17/2009 Delete
- Solar System
  Results 10/5/2009 Delete
- Oceans Effect on...
  Results 11/21/2009 Delete

**Life Science Indexer**

Content Areas Covered:
- Cell Structure and Function
- Coral Reef Ecosystems
- Science of Food Safety

**Completed Indexer Results**
- Cell Structure an...
  Results 9/4/2009 Delete
Calgary (Canada) is located at a latitude north of the equator similar to London (England), as indicated in the map above. However, the winter climate is very different. Which of the following is part of an explanation for this difference?

- Warm Atlantic Ocean current transfer heat energy to regions surrounding London, resulting in more rainfall and cooler winter temperatures.
- Calgary is surrounded by large land masses that do not retain heat as readily as large masses of water, keeping inland temperatures cooler during winter months.
- London is closer to large, cold bodies of water that keep temperatures cooler during the winter months.
Category: Earth and Space Science Indexer
Date: 11/21/2009

About Your Feedback

Collapse All Recommended Resources

Oceans Effect on Weather and Climate

Your score: 4 out of 10 correct

Oceans Effect on Weather and Climate

Web Seminar Archive

This Web Seminar, sponsored by the National Science Foundation, NOAA, and NASA, took place on May 22, 2008, from 6:30 p.m. to 8:00 p.m. Eastern Time. Presenting was Dr. Mary Albert, Senior Research Engineer at the U.S. Army Cold Regions Research and Engineering.

Member Price: Free
Nonmember Price: Free

Free

Grade Level: Elementary School, Middle School

Oceans Effect on Weather and Climate: Changing Climate
Science Object

Science Objects are two hour on-line interactive inquiry-based content modules that help teachers better understand the science content they teach. This Science Object is the fourth of four Science Objects in the Ocean’s Effect on Weather and Climate.

Member Price: Free
Nonmember Price: Free

Free

Grade Level: Elementary School, Middle School, High School
My PD Plan and Portfolio

Free tool within the Learning Center

Define/Measure Goals

Category: My Content Knowledge
Goal: Review/Improve Physical Science Understanding
My Tasks:

Instructions and How-To Animations

Identified Professional Development Resources

<table>
<thead>
<tr>
<th>PD Resource to Address Goal</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perspectives: Action Research: Inquiring Into Science Teaching and Learning</td>
<td>NSTA Learning Center Resource</td>
</tr>
</tbody>
</table>

Expected Date of Goal Completion
5/30/2008

Goal Statement
I plan to improve my understanding and comprehension of major physical science concepts by participating in online courses and experiences relating to force and motion.

Why I chose this goal, and where I am now
- Empty - Add information

Standards
Standards for Professional Development for Teachers of Science: Knowledge and Understanding of Science Understand the fundamental facts and concepts in major science
Learning Center
Research Findings
Over 200 unique deployments across 60 State/District Partnerships as of June 2010

- West Virginia Department of Education
- New Hampshire Department of Education
- Hawaii Department of Education
- Nebraska Department of Education
- Fairfax County Public Schools, Fairfax, VA
- Cincinnati Public Schools, OH
- Louisville County Public Schools, Louisville, KY
- Gwinnett and Forsyth County Public Schools, Atlanta, GA
- Lincoln County Public Schools, NE
- LASER Alliance, Mountain to Harbor Alliance, WA
- Marysville Joint Unified School District, CA
- Zero-G Flight Initiative
- Montana Status University, Bozeman, MT
- Petaluma City Schools, Petaluma, CA
- Shelby County Public Schools, TN
- Duval County Public Schools, Jacksonville, FL
- Texas Education Service Center, University of Texas,
- Texas A&M, Texas Centers for Excellence in Science and Mathematics (36 centers across Texas)
- PRISM Grant Program, MT
- Stamford County Public Schools, Stamford, CT
- University of Maryland Baltimore County, MD
- Atlanta Public Schools System, Atlanta, GA
Three Recent Studies

• Quasi-experimental design study across 3 districts finding **significant gains in teacher content knowledge and self-efficacy.** (2008)

• One 2 pretest-posttest delayed-treatment control group design with random assignment finds **significant gains in teacher content knowledge, teacher self-efficacy, and students’ learning for grades 5-8 in treatment group.** (2010)

• One descriptive study underway using repeated measures ANOVA finds **significant gains in teacher learning** for pre-posttest and pretest-final assessment for 103 teachers in grades 3-6. (2010)
SciPack Three District Pilot

**Participant Feedback: Confidence in teaching subject matter:**
- 7%: Very Confident *Before* completing F&M SciPack
- 60%: Very Confident *After* completing F&M SciPack
- 98%: Found SciPack content relevant to their needs
- 96%: Would recommend SciPack to their colleagues
- 98%: Found interactive simulations worthwhile to their learning

**Pre/Post Assessment and Final Assessment Results**
- Horizon Research Instrument: Positive *significant gains in learning* between pre/post test
- Final assessment: 92% passed the final assessment

Evaluation of Online, On-Demand Science Professional Development Material Involving Two Different Implementation Models (Sherman & Byers)

*Journal Science Education and Technology*
February, 2008 (Vol. 17, No. 1)
Houston ISD Learning Center SciPack Efficacy Study

- Two pretest-posttest delayed-treatment control group design involving random assignment
- 56 teachers from grades 5-8 across (2 SciPacks compared)
- Significant gains in teachers’ content knowledge in treatment group vs. control (Repeated Measures ANOVA)
- Significant gains in feelings of preparedness to teach concepts
- Significant gains in students’ learning across both groups with significantly higher gains scores in treatment group
- Qualitative Teacher Comments: I have a better understanding of Newton’s Law, so I can envision the things I see. The Force and Motion, I thought the interactives were really, really good.
Independent SciPack Dissertation Study

- Quantitative Descriptive Study (Correlation, Paired-Samples T Test, and Repeated Measures ANOVA using pretest-posttest, Likert Scale interaction preference survey and Kolb LSI 3.1)
- 103 teachers from grades 3-6 complete pre/post and final (Analysis across 7 different SciPacks)
- Teachers’ scored significantly higher on the posttest (M=82.39, SD = 7.04) then the pretest (M= 61.31, SD, = 18.45), t (101) = 11.63, p < .001
- Teachers’ scored significantly higher on the final assessment (M=79.14, SD = 12.91) than on the pretest (M=61, SD = 18.45, t (101) = 10.84, p < .001
- Seems to suggest when SciPacks are used as part of a blended PD solution teachers demonstrate content knowledge growth across multiple instruments and over time
I think this content type: Simulations

- facilitates my learning science content.
- helps my retention of the science content over time.
- I would like to see more of this content type.
I think this content type: Hands-On

- Facilitates my learning science content.
- Facilitates teaching the science content to my students.
- Is engaging to me.
- Helps my retention of the science content over time.
- I would like to see more of this content type.

1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree
I think this content type: Personal Feedback

The NSTA Learning Center
Research and Dissemination

- Facilitates my learning of science content: ***Strongly Agree***
- Helps my retention of the science content over time: ***Strongly Agree***
- I would like to see more of this content type: ***Strongly Agree***
I think this content type: Interactive Reference
A Critical Piece of the PD Solution

The NSTA Learning Center

Francis Eberle
feberle@nsta.org

Al Byers
abyers@nsta.org

Flavio Mendez
fmendez@nsta.org

learningcenter.nsta.org