

# Designing For Inquiry Learning: A Comparative Study of Technology Professional Development

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# The Need

- High quality, accessible, and free, online learning resources increasingly available via emerging *CyberLearning Infrastructure*
- Offers great opportunities for learning
- Many barriers exist for teachers, including lack of knowledge, time, tools
- Teacher Professional Development (PD) is a proven approach to overcoming these barriers
- Need evaluation and refinement of PD models

# Purpose

- **Evaluate impact** of a technology-oriented teacher **professional development** (PD) model that helps teachers **find** high-quality **online learning resources** and **use** them in **designing** effective **learning activities** for their students
- Compare impact of **tech-only PD** with one that combines **tech with designing for inquiry learning**
- Inquiry approach: Problem-Based Learning (PBL)

# Context: The Instructional Architect

## Weathering and Erosion

Identify the objects, processes, or forces that weather and erode

### Glacier Peak, Washington

Brainstorm a list of all the forces that might change the surface

Click on the map to see photos of places in the United States

### Examine a landscape formed by erosion

Have you made your list? Now read on:

The Earth's surface is constantly being changed. Water, ice, and wind erode the surface of the earth.

Were these things on your list?

Ocean waves are a powerful force creating erosion. Watch the video. Notice the dates at the bottom of the pictures.

### Examine an example of wave erosion



Parke D. Snavely, Jr., USGS

1890





## Conservation - This is Your Land - a problem and solution project.

Students will watch a PowerPoint presentation by The Bear River Watershed Council with photos taken by volunteers from the Logan and Ogden Ranger Districts. Working in pairs students will discover problems and solutions and write them down in two lists. With these facts each student will create his or her own problem and solution poem.

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America has National, State, and Regional Parks and Forests that belong to everyone. How do you use this land? How do you think others should use the land?

For the first half of the project you may work with a partner to discover the problems and solutions. When you have made your lists of problems and solutions, you will work alone to create your poem.

If your teacher hasn't printed out the worksheet for you, go to this link to find it.

[Problem Solution Poem worksheet](#)

Turn your worksheet over to write on the back. Fold your paper in half. In one column write down the problems. In the other column write the solutions. Try to choose things that you personally can do.

Watch this PowerPoint, take notes as you watch.

[This Land is Your Land](#)

If you don't have enough information, you can go to these sites to find more facts.

[SUWA - Facts about Off Road Vehicle Damage](#)

[SUWA - What you can do to help](#)

# Instructional Architect

## Users:

- **Teachers** can design web-based **IA projects**
- **Students** can access teacher's IA projects using class login
- **All** can browse public IA projects

## Teachers can:

- **My Resources:** search for NSDL resources and add online resources
- **My Projects:** create web pages with text and links to resources

## Quicklinks:

- create new project
- resume editing current project

make a new folder:

## Gather new resources:

- search NSDL
- browse IA projects
- add your own resources

(\* denotes used resources)

Dissection			
<input type="checkbox"/> Froguts *	resource info	comment	delete
<input type="checkbox"/> Virtual Frog Dissection Kit Version 2.0	resource info	comment	delete
<input type="checkbox"/> Fake Resource *	resource info	edit	delete
Fractions			
<input type="checkbox"/> NLVM: Fractions *	resource info	comment	delete
<input type="checkbox"/> Visual Fractions	resource info	comment	delete
<input type="checkbox"/> Fraction Help	resource info	comment	delete
<input type="checkbox"/> Circle – Fractions	resource info	edit	delete
<input type="checkbox"/> MathForum: Find Grampy *	resource info	comment	delete
<input type="checkbox"/> Visual Fractions	resource info	comment	delete
<input type="checkbox"/> Fractions are FUN! *	resource info	comment	delete

# Introduction to the IA (con't)

## My Projects

- Teachers **create** an IA project
- Teachers **share** it with the public or only their students
- Teachers can **view** and **copy** existing public IA projects



## Quicklinks:

- search NSDL
- browse IA projects
- add own resource

**MY SAVED RESOURCES & FOLDERS** (\* denotes used resources)

### Dissection

- **Froguts** [R:31318]  
text/html Internet Scout
- **Virtual Frog Dissection Kit Version 2.0** [R:31317]  
text/html SCORE Science
- **Fake Resource** [R:160068]  
text/html Web

### Fractions

- **NLVM: Fractions** [R:17054]  
url IA
- **Visual Fractions** [R:33452]  
text/html Internet Scout
- **Fraction Help** [R:17066]  
url IA
- **Circle – Fractions** [R:33466]  
text/html Web
- **MathForum: Find Grampy** [R:17033]  
url IA
- **Visual Fractions** [R:61592]  
text/html Math Forum
- **Fractions are FUN!** [R:160232]  
text/html IA
- **Varnelle Moore's primary math activities** [R:38471]

Project Title:

Weather

Project Overview:

Students will complete the following activities to learn how to observe and describe patterns of change in weather. They will also record and report changes in weather. This project was inspired by Shauna Read.

Remember to  **SAVE** your work frequently.

Project Body:

**Let's make weather**

At the following site you have the opportunity to create your own weather. I want you to change the weather at least four different times and tell me the following: **What happened to the weather? What were the measurements on the side?**

**What's the weather on your birthday?**

The following site lets you choose a month and a day of the year to find out what the weather averages have been for the last 30 years. Select your birthday and write down your responses to the following questions: **What day is your birthday? What is the average high? Low? When will the sun be seen if there weren't any mountains? When will the sun set? What are the chances of precipitation happening on that day?**

**Wild Word Searches**

The following site has set up a word search about weather.

[PROJECT THEME](#)  **SAVE** **SAVE & PREVIEW**

# IA Usage

<i>Since 2005</i>	<i>~N</i>	<i>12-month growth</i>
Registered users	5,600	42%
IA projects created	12,200	58%
Online learning resources used	54,000	57%
IA project views	> 1 mil	66%

# Methods

- Compare 2 Professional Development implementations:
  - *Tech-Only* ( $N = 18$ ) vs. *Tech+PBL* ( $N = 18$ )
  - Inquiry approach: Problem-Based Learning (PBL)
  - K-8 teachers in rural school districts
  - Over 3 months, 3 workshops, between-class activities

Phase	Technology - Only PD	Technology + PBL PD	Data Collected
Session 1.	<ul style="list-style-type: none"> <li>• Intro to online resources</li> <li>• Intro to IA: Walk through sample project creation</li> <li>• Participants select design problem</li> <li>• Individuals design IA project(s)</li> </ul>	Same	<ul style="list-style-type: none"> <li>• Pre-survey</li> </ul>
In-between	<ul style="list-style-type: none"> <li>• Design and implement IA project(s) with students</li> <li>• Provide reflection paper on barriers and successes in implementation</li> </ul>	Same	<ul style="list-style-type: none"> <li>• Student survey</li> <li>• Project coding</li> <li>• Web usage</li> </ul>
Session 2.	<ul style="list-style-type: none"> <li>• Small then large group discuss implementation experiences</li> <li>• Review use of the IA, including advanced features</li> <li>• Design a new IA learning activity</li> <li>• Share ideas</li> </ul>	<ul style="list-style-type: none"> <li>• Small then large group discuss implementation experiences</li> <li>• Review use of the IA</li> <li>• <b>Engage in inquiry-oriented activity</b></li> <li>• <b>Large group inquiry-oriented discussion</b></li> <li>• <b>Design own PBL learning activity</b></li> <li>• Share ideas</li> </ul>	
In-between	<ul style="list-style-type: none"> <li>• Design and implement new IA project(s) with students</li> <li>• Write reflection paper on barriers and successes</li> </ul>	Same	<ul style="list-style-type: none"> <li>• Student survey</li> <li>• Project coding</li> <li>• Web usage</li> </ul>
Session 3.	<ul style="list-style-type: none"> <li>• Small then large group discuss experiences: Technology</li> <li>• Review technical use of the IA, including advanced features</li> </ul>	<ul style="list-style-type: none"> <li>• Small then large group discuss experiences: Technology</li> <li>• Review technical use of the IA</li> <li>• Small then large group discuss PBL implementation experiences</li> </ul>	<ul style="list-style-type: none"> <li>• Post survey</li> </ul>

<i>Research Question</i>	<i>Data Source</i>	<i>Analysis</i>
1. What is impact of the two PD implementations on participants' knowledge about, attitude towards, and experience with technology integration?	Pre/post survey	ANOVA
2. What is the impact of the two PD implementations on participants' usage of the IA?	Web Usage Data	Descriptive
3. What is impact of the two PD implementations on design choices made by teachers in their IA projects?	PBL Alignment, Project Design	Project Coding
4. What is impact of the two PD implementations on students' knowledge and attitudes?	Pre/post survey, Web Usage Data, Student Survey, PBL Alignment, Project Design	HLM

# IA Project Coding

- Alignment to PBL:
  - 14-point scale
- Project design:
  1. *offload* (primarily links to other online resources)
  2. *adaptation* (a mid-point)
  3. *improvisation* (largely teacher-created instructional content with support from links to online resources).

# Results

- #1: Impact on teachers:
  - Both groups showed significant gains in **experience** & **knowledge**, large effect sizes. No significant gains in **confidence**
  - **Experience** scores showed a significant interaction ( $p < .05$ ) While both groups showed large gains, the *tech+pbl* implementation group reported significantly larger gains
- #2: Impact on usage:
  - Overall **usage is high** (logins, online resources used, IA projects created, student accesses)
  - No group differences

## Results (cont'd)

- #3: Impact on teacher design of learning activities:
  - PD did not change teacher usage of PBL and all used negligible levels of PBL in their IA projects
  - 85% *Tech+PBL* IA projects were more that “offloads”
  - 65% *Tech+Only* IA projects were more that “offloads”
- #4: Impact on students:
  - In progress, using HLM
  - Student survey instrument shows high reliability



# Conclusions

- Both implementations showed high teacher and student usage of the tools, and significant gains in teacher reported knowledge and experience
- Little impact on use of *inquiry-learning*, but greater evidence of “pedagogy” in *Tech+PBL* group
- Student instrument shows reliability; analyses in progress

# Questions?

- For more info:
  - [DLConnect.usu.edu](http://DLConnect.usu.edu)