Understanding Teacher Users: Mining Usage Patterns and User Profiles

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http://edm.usu.edu

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WHERE DISCOVERIES BEGIN

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INSTRUCTIONAL TECHNOLOGY & LEARNING SCIENCES

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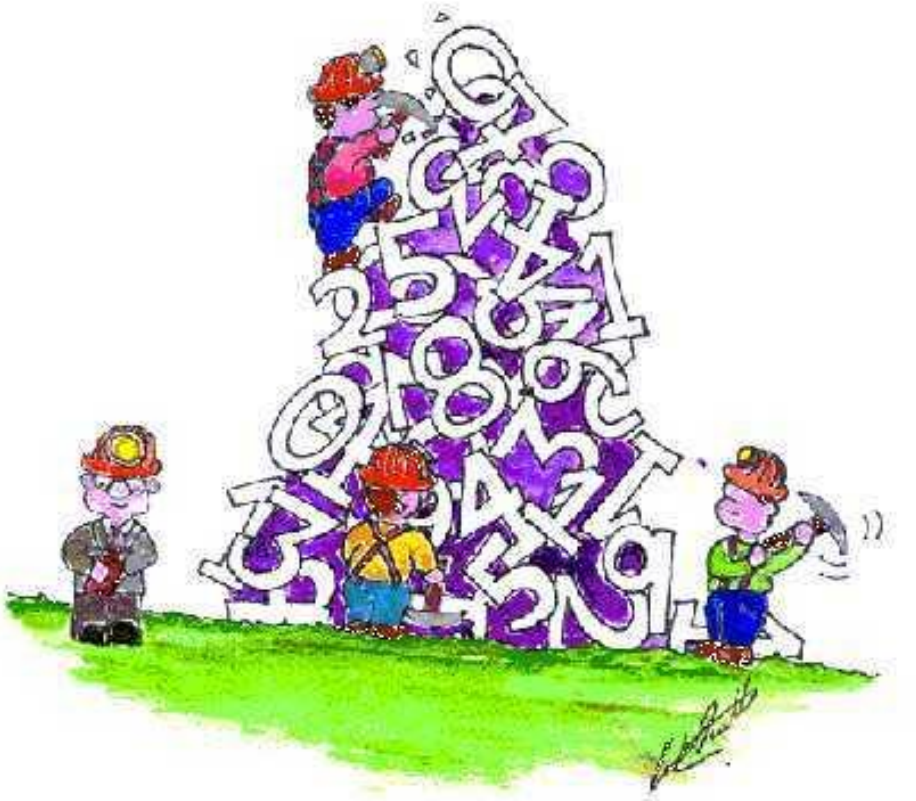
Introduction

Data mining focuses on discovering novel information from large amounts of data

Education Data Mining (EDM) focuses on developing methods for exploring unique data from educational disciplines



Overview

1. Project context: the Instructional Architect (IA.usu.edu)
2. Goals and driving questions
3. Data sources
4. EDM and Data Triangulation
5. Lessons learned

Context: The Instructional Architect

Weathering and Erosion

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

Glacier Peak, Washington

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

Click on the map to see photos of places in the United Stat
Examine a landscape formed by erosion

Have you made your list? Now read on:
The Earths surface is constantly being changed. Water, ice
erode the surface of the earth.
Were these things on your list?

Ocean waves are a powerful force creating erosion. Watch
Notice the dates at the bottom of the pictures.
Examine an example of wave erosion

Parke D. Snavely, Jr., USGS

1890

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

INSTRUCTIONAL ARCHITECT
A service of NSDL

Ms. Johnson's Resources

Quicklinks:
- create new project
- resume editing current project

move resource(s) to folder | MOVE RESOURCE

make a new folder: | CREATE FOLDER

Gather new resources:

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

(* denotes used resources)

Dissection				
Froguts *	resource info		comment	delete
Virtual Frog Dissection Kit Version 2.0	resource info		comment	delete
Fake Resource *	resource info	edit		delete
Fractions				
NLVM: Fractions *	resource info		comment	delete
Visual Fractions	resource info		comment	delete
Fraction Help	resource info		comment	delete
Circle -- Fractions	resource info	edit		delete
MathForum: Find Grampy *	resource info		comment	delete
Visual Fractions	resource info		comment	delete
Fractions are FUN! *	resource info		comment	delete

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

INSTRUCTIONAL ARCHITECT
A service of NSDL

Author Project (step 2 of 5): Content

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:

```
<h2>Let's make weather</h2>
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: <ol><li>What happened to the weather? <li>What were the measurements on the side?</ol>
<b>[R:15676]</b>

<h2>What's the weather on your birthday?</h2>
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: <ol><li>What day is your birthday? <li>What is the average high? Low?
<li>When will the sun be seen if there weren't any mountains? When will the sun set? <li>What are the chances of precipitation happening on that day?</ol>
<b>[R:15521]</b>

<h2>Wild Word Searches</h2>
The following site has set up a word search about weather.
```

SAVE

PROJECT THEME

SAVE & PREVIEW

IA Usage

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

2. Key Questions

- What does Educational Data Mining reveal about teacher users?
- How can we combine usage data with more 'conventional' data to evaluate results?

3. IA Data Sources

Web usage data:

- *Web server log* – since 2001
- *Google Analytics (GA)* – since mid-2006
- ***IA relational database* – since 2005**

Other:

- Registration profile:
  - subjects • grade level • zip code • **teaching experience** • **comfort with technology**

4. Educational Data Mining

Based on Knowledge Discovery from Data Mining Framework:

Phase I – Data Preprocessing: Data cleaning, integration, and selection

Phase II – Applying Data Mining Algorithms: Latent Class Analysis

Phase III – Interpreting, Post-processing, Evaluating

Why LCA?

- Has probability distribution
- Measures: Log-likelihood, Bayesian Information Criterion, p-values
- Allows mixed data types
- Can include demographic and other exogenous variables

User Model for Clustering Analysis

Feature Category	*Features*
IA Projects: Authoring	# of projects
	# words project overview
	# words project content
	# project resources
IA Projects: Usage	# student visits
	# public visits
Navigation	# visits to the IA
	# browsed projects
	# copied projects

Q1. EDM Results

Analysis of 348 users who:

- Registered in 2009 (N=1149)
- Logged in more than 2 times
- Created at least one public project
- Not in overlapping patterns

3 Clusters of Users

		Cluster 1		Cluster 2		Cluster 3	
N		108		114		126	
Label		Key brokers		Lukewarm classroom practitioners		Ineffective islanders	
		Mean/median		Mean / median		Mean /median	
Project authoring	# of projects	2.55	2	**5.14**	**5**	**1**	**1**
	# words overview	29.01	20.1	**9.20**	**8**	23.62	15
	# words content	**297.11**	**196**	**15.09**	**15**	156.00	109
	# project resources	6.24	5	**1.92**	**2**	4.63	4
Project usage	Max student visits	36.74	0	**9.17**	**5**	**0**	**0**
	Max public visits	**6.38**	**2**	1.18	1	**0**	**0**
Navigation	# visits to the IA	13.41	10	7.86	6	**3.98**	**4**
	# project browses	**19.54**	**16**	8.91	0	4.22	3
	# copied projects	1.58	1	**0**	**0**	**0**	**0**

3 Clusters' Defining Features

		Cluster 1	Cluster 2	Cluster 3
N		108	114	126
Label		Key brokers	Lukewarm classroom practitioners	Ineffective islanders
Project authoring	# of projects		more than one	one
	# words overview		low ~ medium	
	# words content	medium ~ high	low ~ medium	
	# project resources		low	
Project usage	Max student visits		medium ~ high	zero
	Max public visits	medium ~ high		zero
Navigation	# visits to the IA			low ~ medium
	# project browses	high		
	# copied projects		zero	zero

3 Clusters' Defining Features

zero ○ low ● low ~ medium ●● medium ●●● medium ~ high ●●●● high ●●●●●

		Cluster 1	Cluster 2	Cluster 3
N		108	114	126
Label		Key brokers	Lukewarm classroom practitioners	Ineffective islanders
Project authoring	# of projects		●●●●	●●
	# words overview		●●	
	# words content	●●●●	●●	
	# project resources		●	
Project usage	Max student visits		●●●●	○
	Max public visits	●●●●		○
Navigation	# visits to the IA			●●
	# project browses	●●●●●		
	# copied projects		○	○

Q2. Data Triangulation

- **Does cluster membership relate to teacher registration information?**
- **Examined via *multinomial logistic regression*:**
  - **Teaching experience**
  - **Information literacy**

Data Triangulation Findings

- Comfort with Technology:
  - Lukewarm classroom practitioners claimed higher comfort than key brokers ($p < 0.05$)
- Teaching Experience:
  - Key brokers had more than lukewarm classroom practitioners ($p < 0.00$)
  - Key brokers had more than ineffective islanders ($p < 0.05$)

5. Some Lessons Learned

- Data pre-processing is hard
- Driving questions are critical, but revisit often
- User model is important
- Usage data is a measure of behavior, but inferences about intent are possible
- Combining data sources (at very different granularity levels) remains an open problem

Questions?

- For more info:
  - EDM.usu.edu
  - IA.usu.edu