# Teacher Learning and Technology – a Learning Sciences Perspective

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National Science Foundation
WHERE DISCOVERIES BEGIN

Instructional Technology and Learning Sciences
*Emma Eccles Jones College of Education & Human Services*

UtahState University

# Teacher learning and LS

A long focus on:

- How and when teacher learning takes place
- Teachers' use of new technologies, and how they support teacher learning
- How do these lines of inquiry relate to your context?

# *CrowdTeaching*: Supporting Teachers as Designers in Collective Intelligence Communities

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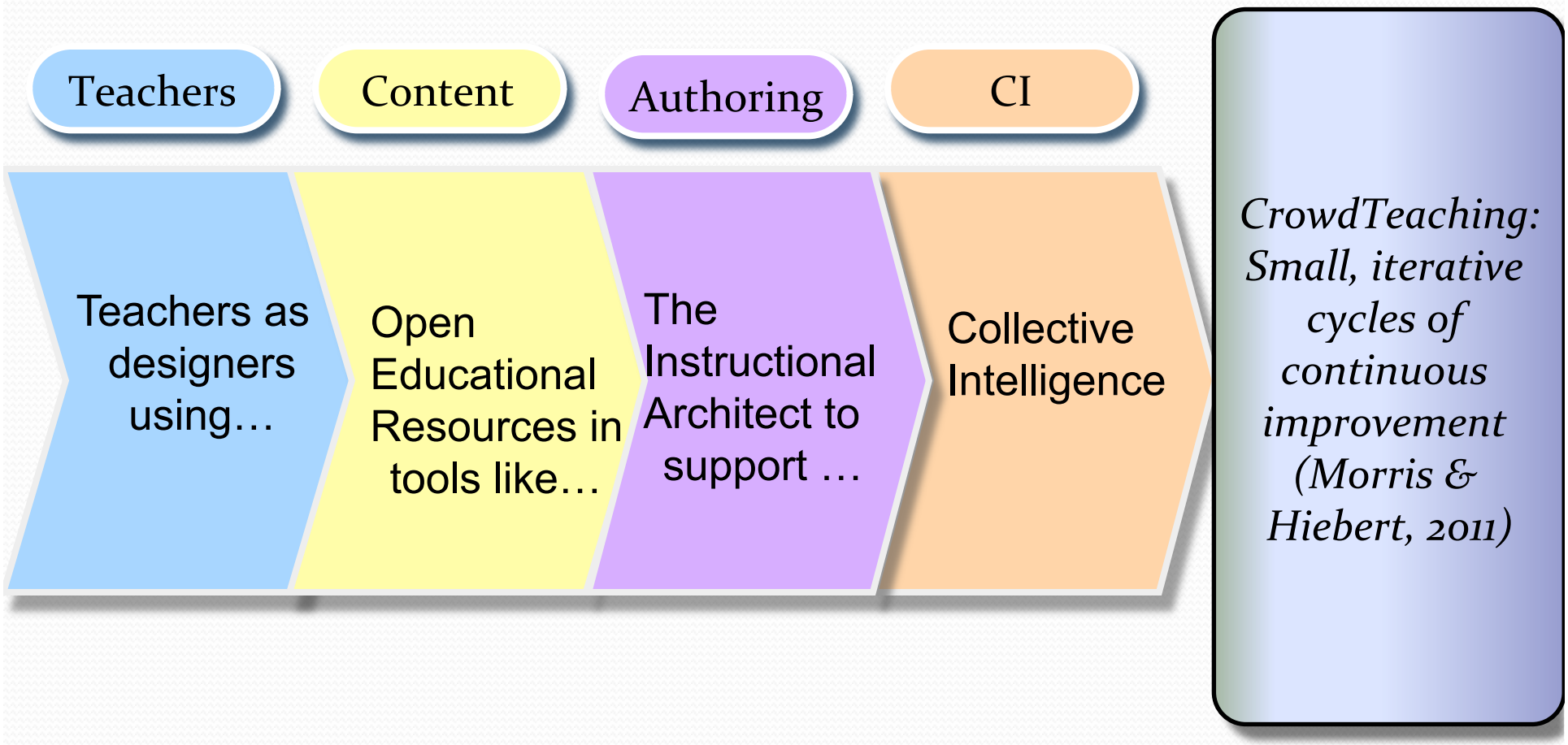
# Paradigm Shifts

- Renewed interest in “Teachers as Designers”
- Widespread availability of Open Educational Resources
- Free, easy to use authoring tools
- Participatory Web culture, supporting collective intelligence:
  - Wikipedia, Linux, others?


Teachers
Content
Authoring
CI
Teachers as designers using…
Open Educational Resources in tools like…
The Instructional Architect to support …
Collective Intelligence
CrowdTeaching: Small, iterative cycles of continuous improvement (Morris & Hiebert, 2011)

# Context: IA.usu.edu

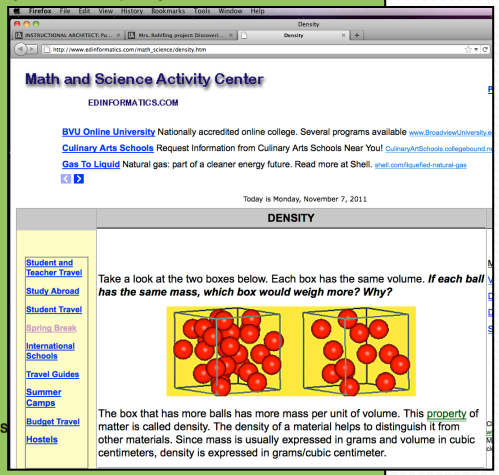
- **My Resources:** Search for and integrate OER
- **My Projects:** Create, publish, view, copy IA projects

# IA Projects

http://ia.usu.edu/viewproject.php?project=ia:17017

Apple Yahoo! Google Maps YouTube Wikipedia News (639) Popular

**Problem Presentation:**
You and your friends have been camping. As you leave the camp site, you discover a very large tree has fallen on the trail. It is too large to climb over or go around. So, you take a different route, which leads you to a large lake. The only way to get to the other side is to go across it. Since there are no rafts around, you realize will need to build one. You see around you: bricks, logs, long, thick tree branches, metal tent poles, and shovels. Last year you learned about density and what helps objects float. You now need to figure out what objects will float and how density works.




**Current Knowledge:**
What are some things you already know about density in order to solver this problem? How could this information help you s

**Information Sources:**
You will need to gather more information about density so you can solve the problem of building the raft.
Click on the link to discover more about density. **Interactive Density Game**

Continue with the next website that will give you more information about what density it and how to calculate density. **Calculating Density Interactive Page**

**Information Seeking:**
You should now have enough information to solve the problem with your friends at the lake and be able to build a raft. However, if you would like to read more about density on your own, you may do your own internet search. You can either use Google, or open another tab use a search engine of your choice. **Google website**

**What Have You Learned?**
At the start of this website, you were asked what you already know about density. I would like you to now share what you have learned about density by doing this activity.

What did you not know about density before that you know now?
What resource helped you best understand what density is?
Do you feel you have a better understanding of what density is?

**Solution:**
Your job now is to describe the best solution to the problem about building a raft. What materials are best to use and why? Are there objects that should NOT be used? Carefully explain your solution and why that is the best solution for this problem.

**Reflection:**
How did this activity better help you understand density?
Were you able to come up with a reasonable solution to the problem?
Explain how this activity will help you remember density in the future.

## Forces of Motion

Answer the questions on a sheet of paper

http://teachertech.rice.edu/Participants/louviere/Newton/

# IA Usage

| *Since 2005* | *N* | *12-month growth* |
|---|---|---|
| Registered users | 7,600 | 42% |
| IA projects created | 17,600 | 58% |
| Online learning resources used | 76,000 | 57% |
| IA project views | > 2.5 mil | 66% |

# Collective Intelligence

Malone et al., 2009:

- *What* is the goal of the community? *How* do they do it?
  - Creating artifacts? Picking winners?
- Who is engaged in tasks?
  - Egalitarian crowd or hierarchy?
- Why do they engage in these tasks?
  - Money, glory?

Consider the previous examples: how do these different questions apply?

## *Create and Decide Dimensions in the Instructional Architect*

| What | | Who | Why | How |
|---|---|---|---|---|
| **Create** | IA project | Teachers, individually | Motivate students; supplant and supplement textbook; increase efficiency | **Create** personal collection of IA projects |
| **Decide** | View IA project | Teachers, individually | Leverage wisdom of crowd, learn from peers and resources | **View** public IA projects |
| **Decide** | Copy IA project | Teachers, individually | Leverage wisdom of crowd, improve efficiency and effectiveness | **Copy** public IA projects to personal collection |

# Creating Shared Artifacts

Morris & Hiebert, 2011

- Continuous improvement is best supported by the creation of public and changeable knowledge artifacts in which participants jointly solve, share, and refine problems of practice.
- When artifacts are public and jointly created, multiple sources of innovations are possible, resulting in their incremental improvement.
- How does Collective Intelligence support this vision?

# Research Questions

**RQ1**

Teachers: How do teachers engage in CI activities within the IA?

**RQ2**

Artifacts: How do teacher Collective Intelligence processes relate to *useful* IA projects?

# Study Design

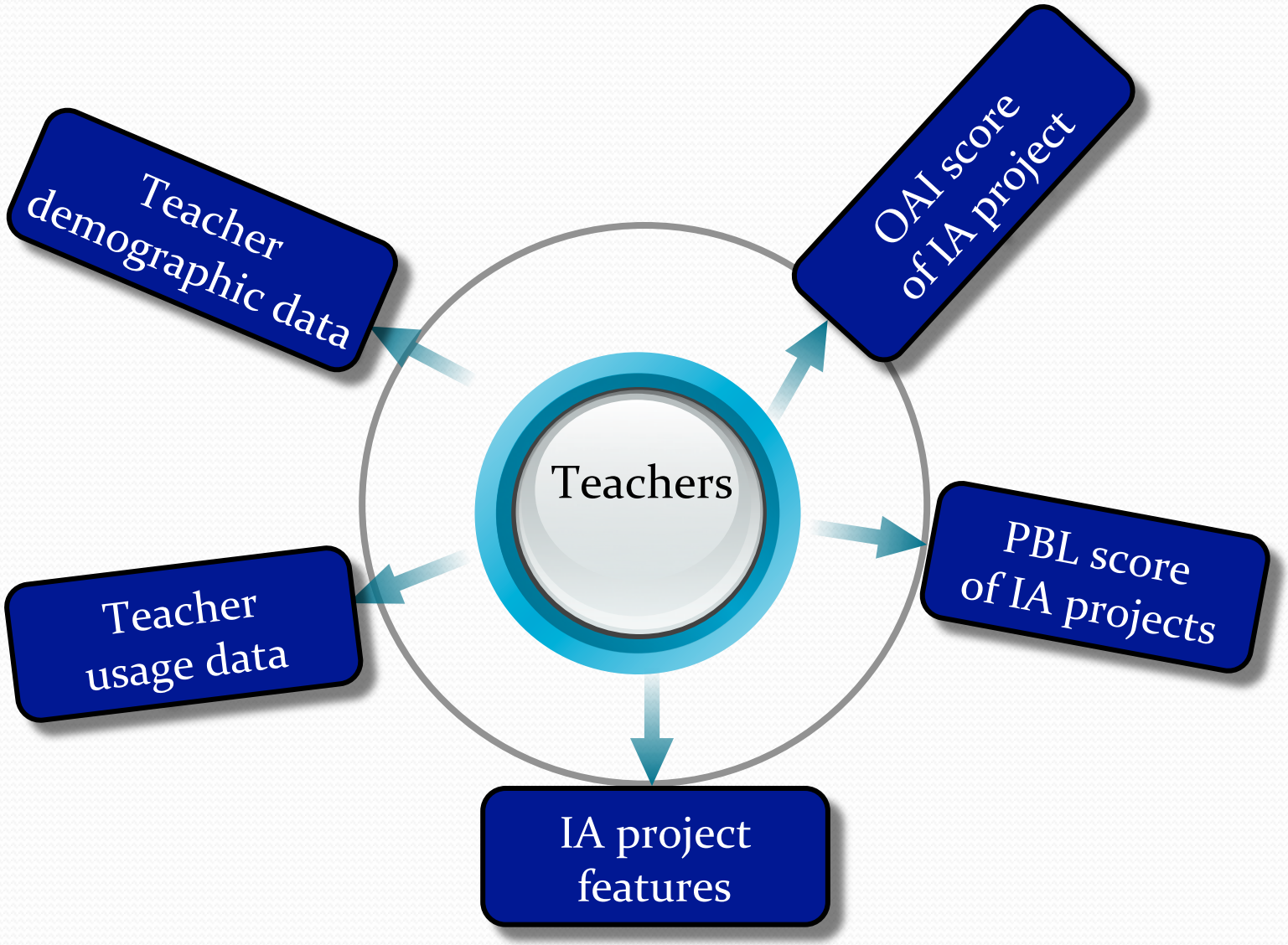
Dataset for RQ1

- 757 users who created an account during 1 year
- Of these, 200 indicated they were teachers
- Created 520 IA projects

Dataset for RQ2

- 36 middle school mathematics and science teachers
- Created 351 IA projects as part of PD
- Analyzed 2 from each (72) that were used in classrooms

# Data Sources



*Data Source Details*

| Data source | Description |
|---|---|
| Teacher demographic data | Demographic data were collected via IA profiles created when teachers registered for an account in the IA, including self-reported years of teaching experience and comfort level with technology. |
| Teacher usage data | Automatically collected IA user data included number of: logins, total IA projects created, public IA projects created, and OER used. |
| IA project data | Automatically collected IA project data included number of words, links, and edits. |
| Problem-based learning alignment score | IA projects created by PD participants were hand-scored by three raters, using a refined problem-based learning rubric agreement. Possible scores ranged from 0 to 22 points. Inter-rater reliability was high (ICC=.86). |
| OAI score | IA projects created by PD participants were hand-scored by one rater using the OAI rubric, with possible scores being Offload=1; Adaptation=2; Improvisation=3. To measure inter-rater reliability, a second coder scored a random subset. The resulting intra-class correlation coefficient was.87, indicating high reliability. |

# Evaluating CI Artifacts

**Two measures:**

- Creating inquiry-based IA projects:

  Raters used PBL rubric with 11 elements in four categories rated on a 0-2 scale

- Integrating OER into IA projects:

  Raters used “Offload to Adaptation to Improvisation” scale (Brown and Edelson, 2003)

# *Problem-Based Learning Alignment Rubric*

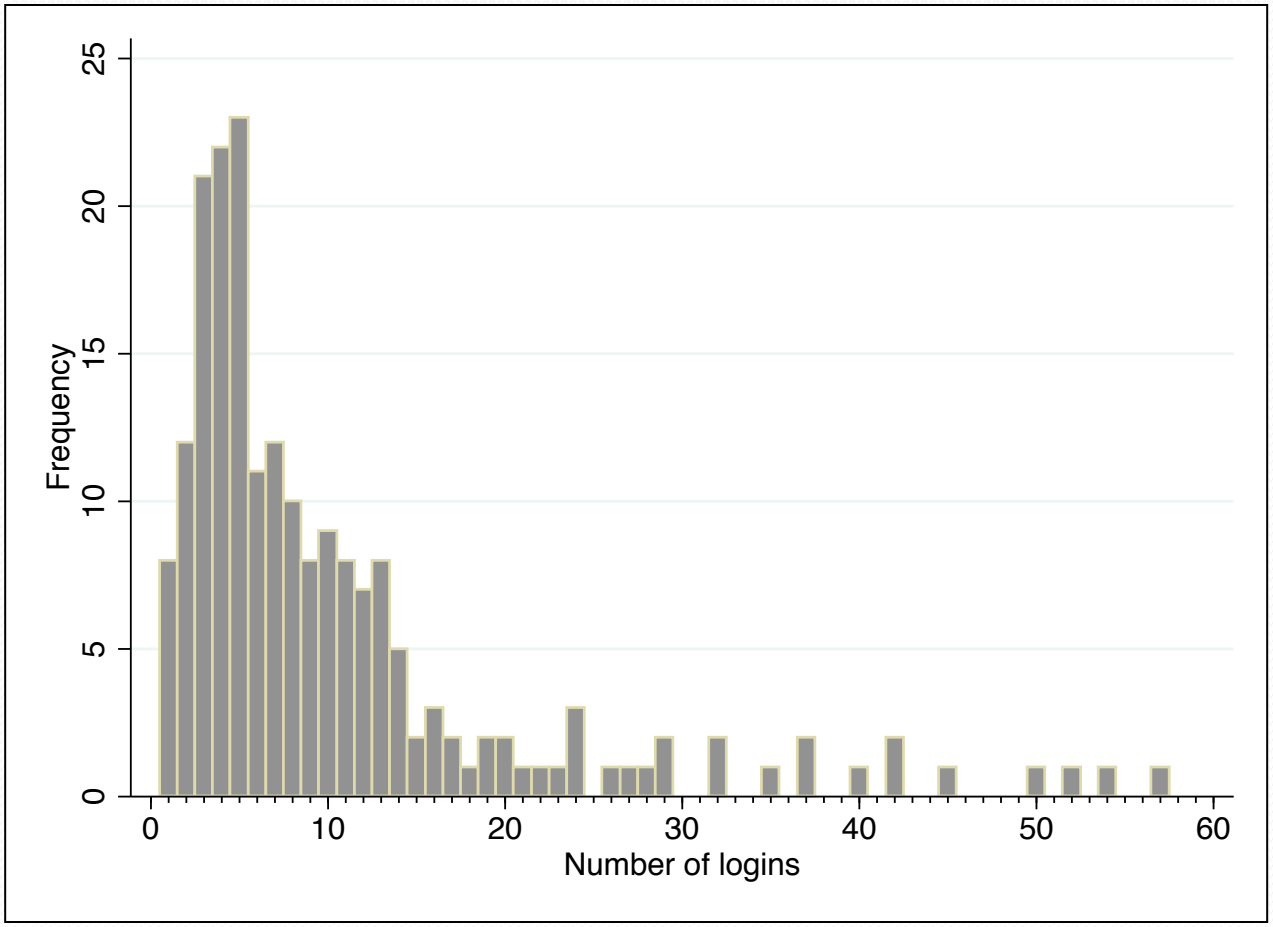
| Criteria | Not Present (0) | Emerging (1) | Present (2) |
|---|---|---|---|
| **Authentic Problem** | | | |
| Cross-disciplinary | Content draws from a single discipline (e.g., statistics) | Content draws from two closely related disciplines (e.g., statistics and algebra) | Content draws from a diverse set of disciplines, reflecting the kind of complexity found in real-life settings (e.g., statistics and rhetoric) |
| Ill-structured | Learners are provided with clear directions | Learners are provided with parameters but need to make some decisions about how to proceed | Learners need to act within parameters and are faced with competing constraints, forcing a "satisficing" solution (e.g., students are asked to pick food that is cheap as well as healthy) |
| Real Life | No ties to real-life practice | Attempted ties to real-life practice. Something done by professionals, or authentic for students. | Learning is clearly tied to real-life practice. For example, the problem is phrased in the first person for students, and they are given artifacts associated with the problem |
| Begins with a problem | No contextual problem is presented to learners | Learners are asked to solve a contextual problem (content first) | Learners are asked to solve a contextual problem (problem first, then content) |
| **Learning Processes** | | | |
| Learning Goals | Students play no role in deciding what to learn | Students have limited choice about what to learn | Students choose the majority of what they learn |
| Resource Utilization | Learners are not prompted to locate/use any resources | Learners are asked to search for resources **or** utilize provided resources | Learners are asked to search for resources **or** utilize provided resources. **Additionally**, they are encouraged to pay attention to the quality of resources they find or use. |
| Reflection | Learners are not asked to reflect | Learners are asked to discuss what they have found **or** judge the merits of their own actions **or** the actions of their peers | Learners are asked to discuss what they found **and** judge the merits of their own actions or the actions of their peers |
| **Facilitator** | | | |
| Metacognition | Unclear exactly what facilitators do during the activity | As part of the activity, facilitators engage in some meta-cognitive prompts | As part of the activity, facilitators focus their efforts on providing meta-cognitive prompts (e.g., How helpful is your current line of reasoning? What do you need to do next? Can you summarize our discussion to this point?) |
| Information Source | Facilitators are primary source of info. This comes either directly from the instructor or from a mandated set of materials. | Information comes partly from facilitators and is partly found by learners | Information is found primarily by learners. Sources include searching or distilling relevant information from a larger set of provided materials. |
| **Group Work** | | | |
| Learners interact in groups | The learning experience is done individually | Parts of the learning are done individually, and parts are done as a group | The majority of the learning is done in groups |

## *Brown and Edelson's Continuum of Curriculum Use (OAI Scale)*

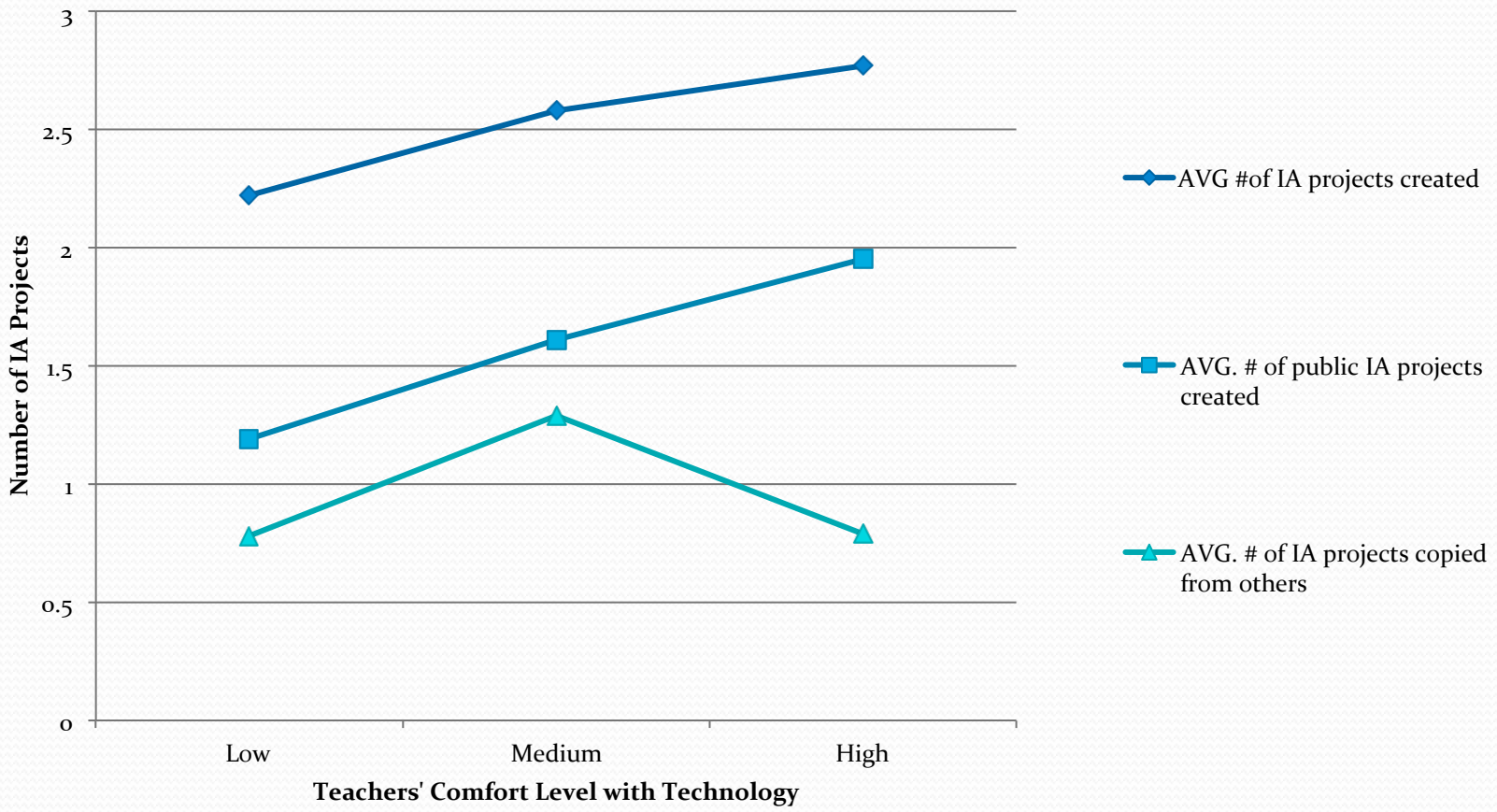
| Score | Name | Definition |
|---|---|---|
| 1 | Offload | Teachers provide links to OER with little additional teacher-created instructional guidance (e.g., no explanations or instructions). Use tends toward lists of links (perhaps with added navigational information). |
| 2 | Adaptation | A midpoint, with only some of the elements listed below. |
| 3 | Improvisation | Teachers link to OER as a starting point or reference but have clearly designed their own elements, for example, learning goals, instructional activities, descriptions of resource use, or assessment items. |

***RQ1:*** *Descriptives of Teachers' (N=200) Activity and Their IA Project Features (Data Collected Over a 1-Year Period)*

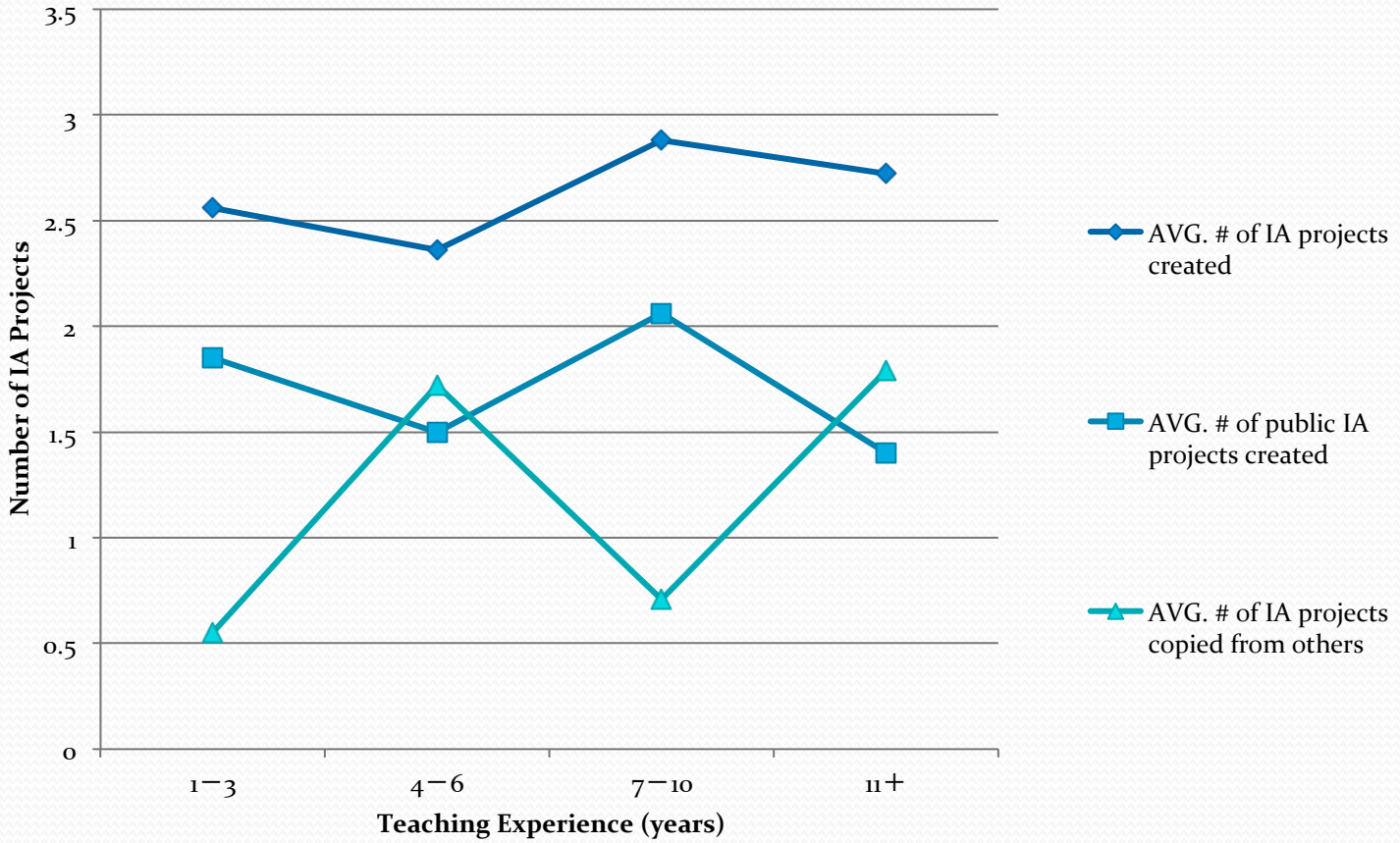
| | Variable | *Mean* | *Median* | *SD* | *Min* | *Max* |
|---|---|---|---|---|---|---|
| IA projects features (N=520) | # of words | 186.02 | 94 | 308.02 | 0 | 2692 |
| | # of links | 4.23 | 3 | 4.17 | 5 | 28 |
| | # of edits | 2.87 | 2 | 3.29 | 0 | 21 |
| Teacher activities (N=200) | # of logins | 10.38 | 7 | 10.59 | 1 | 57 |
| | # of OER used in all IA projects | 16.82 | 10 | 24.02 | 0 | 217 |
| | # of IA projects created | 2.6 | 2 | 2.04 | 1 | 10 |
| | # of public IA projects created | 1.73 | 1 | 1.95 | 0 | 10 |
| | # of IA projects copied from others | .58 | 0 | 1.46 | 0 | 9 |
| | % of IA projects copied from others | 15.22 | 0 | 29.50 | 0 | 100 |
| | # of IA projects viewed | 12.98 | 7 | 17.44 | 0 | 134 |




Histogram of teachers' (N=200) number of logins over a 1-year period




# Teachers' (N=200) creation activity categorized by their comfort level with technology




# Teachers' (N=200) creation activity categorized by their teaching experience

# Summary of RQ1

- Varying levels of teacher activity (zipf),
- Somewhat mediated by comfort with technology, but not teaching experience
- More consuming (viewing) than producing
- More viewing than copying
  - Participation inequality

What projects are valued in the IA community? How do we know?

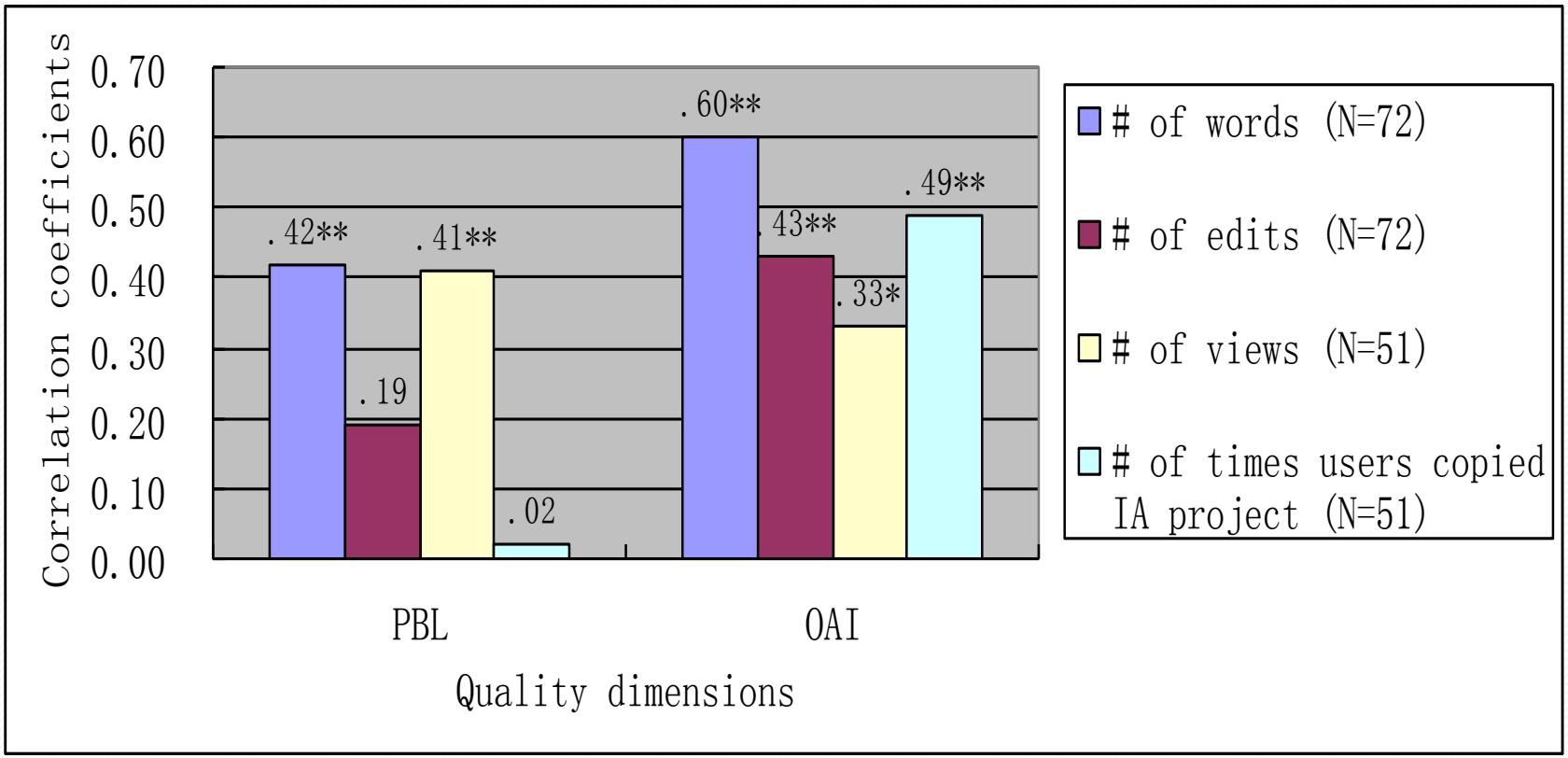
- Examine IA project alignment with 1) inquiry learning and 2) use of OER

## ***RQ2:*** *Descriptives of Users' (N=36) Activity and IA Project Features (Data Collected over a 1-yearPeriod)*

| | Variable | *Mean* | *Median* | *SD* | *Min* | *Max* |
|---|---|---|---|---|---|---|
| IA project features (N=72) | PBL Alignment Score | 3.32 | 2 | 3.45 | 1 | 17 |
| | # of words | 169.86 | 113.50 | 168.28 | 9 | 859 |
| | # of links | 5.36 | 4 | 4.50 | 0 | 37 |
| | # of edits | 69.94 | 51 | 63.70 | 5 | 388 |
| | # of times viewed (N = 51)* | 336.84 | 199 | 391.96 | 13 | 1995 |
| | # of times copied (N = 51)* | 0.47 | 0 | .95 | 0 | 4 |
| Teacher activities (N=36) | # of logins | 31.42 | 27 | 28.02 | 6 | 179 |
| | # of resources used in all IA projects | 33.72 | 23 | 31.39 | 8 | 179 |
| | # of IA projects created | 9.50 | 7 | 9.07 | 2 | 57 |
| | # of public IA projects created | 4.08 | 3 | 7.98 | 0 | 49 |
| | # of IA projects copied from others | 2.25 | 1 | 2.78 | 0 | 12 |
| | % of IA projects copied from others | 25.49 | 18.33 | 25.78 | 0 | 80 |
| | # of IA projects viewed | 20.39 | 21 | 11.86 | 2 | 52 |

*Note*: * Only public IA projects can be viewed and copied

# Correlations between IA project features, PBL and OAI Scores




*Note:* * $p < .05$; ** $p < .01$

# Summary of RQ2

- "In the wild" users showed overall lower levels of activity
- Two key IA project features (# of views and # of words) were significant and positive predictor of PBL alignment score
- No teacher characteristics correlated with PBL alignment or OAI score
- Two key IA project usage features (# of copies and # of words) were significant and positive predictor of OAI score

# Conclusions

Indirect proxy of utility:
- # of words
- # of views
- # of times copied

Scaffolds in the IA interface could better represent these utility proxy to better leverage crowd wisdom

Limitation: small number of teachers and small number of IA projects

"Good artists copy, great artists steal"

-- stolen from Picasso

# Questions?

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