Brigham Young University

From the SelectedWorks of Heather Leary, Ph.D.

April, 2012

Comparing Technology-Related Teacher Professional Development Designs: A multilevel study of teacher and student impacts

Andrew Walker, *Utah State University*
Mimi Recker, *Utah State University*
Lei Ye, *Utah State University*
Linda Sellers, *Utah State University*
Heather Leary, *University of Colorado at Boulder*, et al.

Available at: https://works.bepress.com/heatherleary/49/

Comparing Technology-Related Teacher Professional Development Designs:

A Multilevel Study of Teacher and Student Impacts

Andrew Walker (andy.walker@usu.edu)
Mimi Recker
Lei Ye
M. Brooke Robertshaw
Linda Sellers
Utah State University

Heather Leary
University of Colorado at Boulder

National Science Foundation
WHERE DISCOVERIES BEGIN

NSDL
THE NATIONAL SCIENCE DIGITAL LIBRARY

Problem statement

- Open-access online learning resources and media
  - engaging, visualizations/modeling, affordable, localization.
  - (McArthur & Zia, 2008; Borgman et al., 2008; Patton & Roschelle, 2008).
- Well suited to inquiry oriented activities like PBL
  - (Gurell, Kuo, & Walker, 2010)
- Teacher struggle with: Incorporating resources, tools and instructional approaches
  - (Kramer, Walker, & Brill, 2007; Mardis, 2007; Recker et al., 2005).

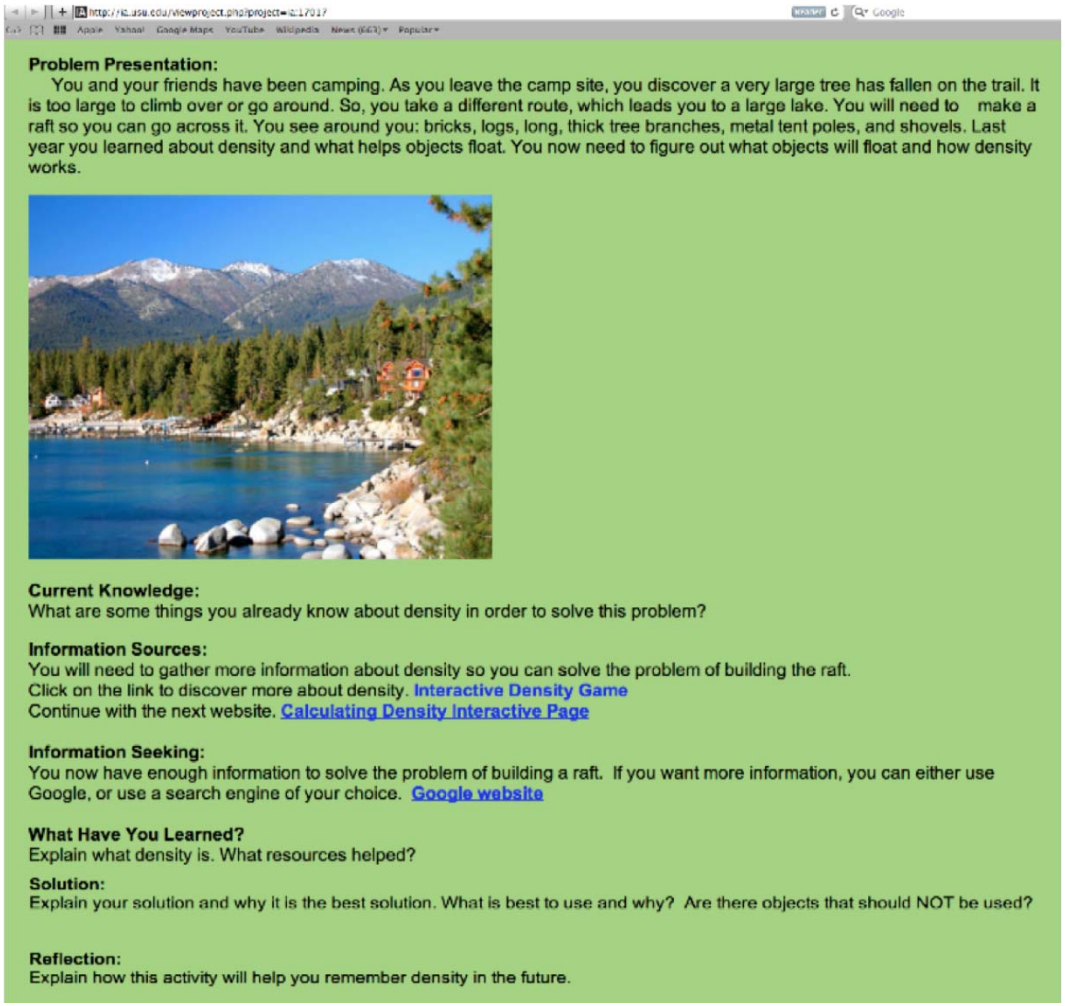
Intended contributions

- Comparison of two PD designs
  - tech-only (self-chosen pedagogy)
  - tech+pbl
- Add to the PD literature base
- Answer call to examine impacts across teacher and student levels
- Statistical methods (GEE) for nested data
  - (Finkelstein, Chun-Wei, & Ravitz, 2011; Scott, 2012)

Literature Review

- TPCK
  - theory of teacher knowledge
  - measurement
- learning by design
  - prescription for increasing TPCK
  - NOT Learning By Design™
- Problem Based Learning

Technology context: IA.usu.edu



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. You will need to make a raft so you can go across it. 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 solve this problem?

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. **Calculating Density Interactive Page**

Information Seeking:
You now have enough information to solve the problem of building a raft. If you want more information, you can either use Google, or use a search engine of your choice. **Google website**

What Have You Learned?
Explain what density is. What resources helped?

Solution:
Explain your solution and why it is the best solution. What is best to use and why? Are there objects that should NOT be used?

Reflection:
Explain how this activity will help you remember density in the future.

- Search
- Localize
- Publish

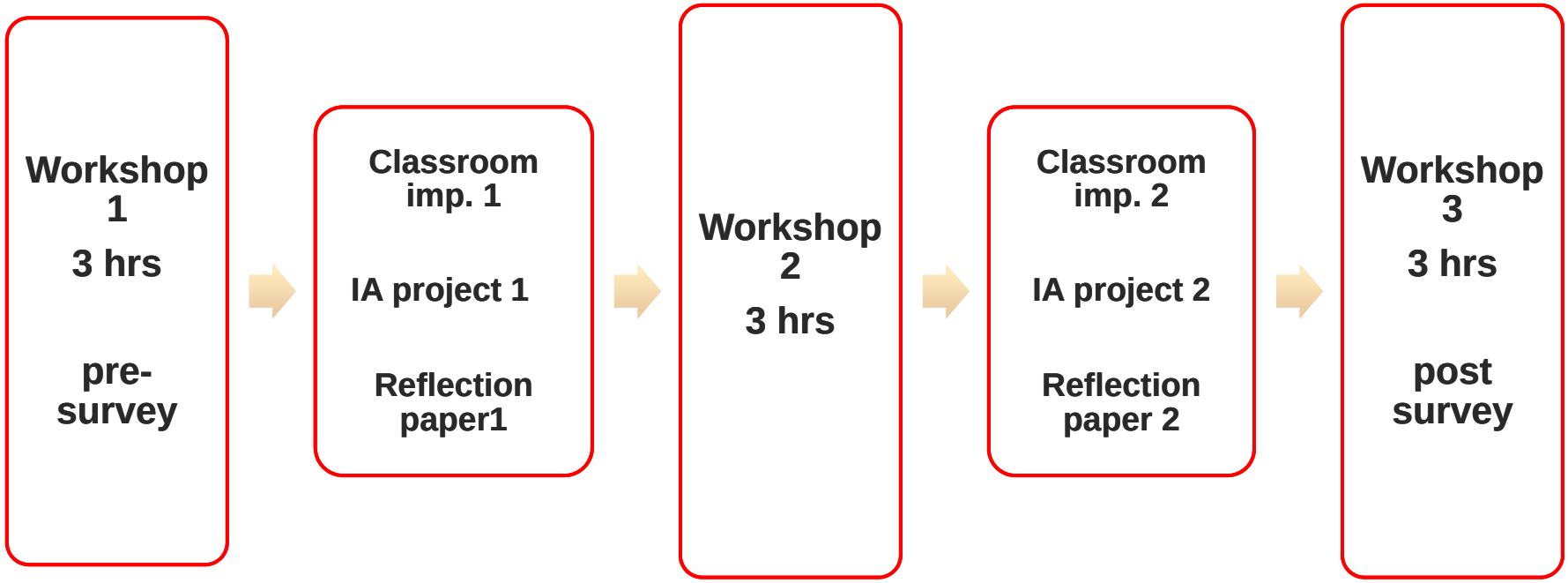
- 7,100 users
- 70k resources
- 16k projects

Research Questions

1) What is the **impact** of the two PD designs on teachers' **knowledge**?
2) What is the **impact** of the two PD designs on **design choices** made by teachers in their IA projects?
3) What combination of **teacher** variables and **student** variables significantly **predict student outcomes**?

PD Designs

1) Both used PBL*
2) 9 hours over 3 months



Participants

- Teacher
  - Math and science teachers (N = 36)
  - Non-equivalent control groups (scheduling preference)
- Students
  - Junior high (grades 7-9)
  - N = 1247

Data Sources

- Teacher Survey (self-report) (α = .88; .78-.97)
  - knowledge TK, PCK, TPCK, PBL, Search
    - (Becker, 2000; Archambault & Barnett, 2010; Archambault & Crippen, 2009; Robertshaw, et al., 2010)
- Teacher Projects
  - PBL alignment Rubric
  - 3 independent scores (ICC = .86)
    - (Walker & Shelton, 2008; Walker et al., 2010)

Data Sources

- Student questionnaire (self-report), pre-post gains x2
  - Behavior (α = .77-.81)
  - Knowledge
  - Attitude
- CFA 3 factors
  - .68
  - >= .85

Results: Impact on teachers

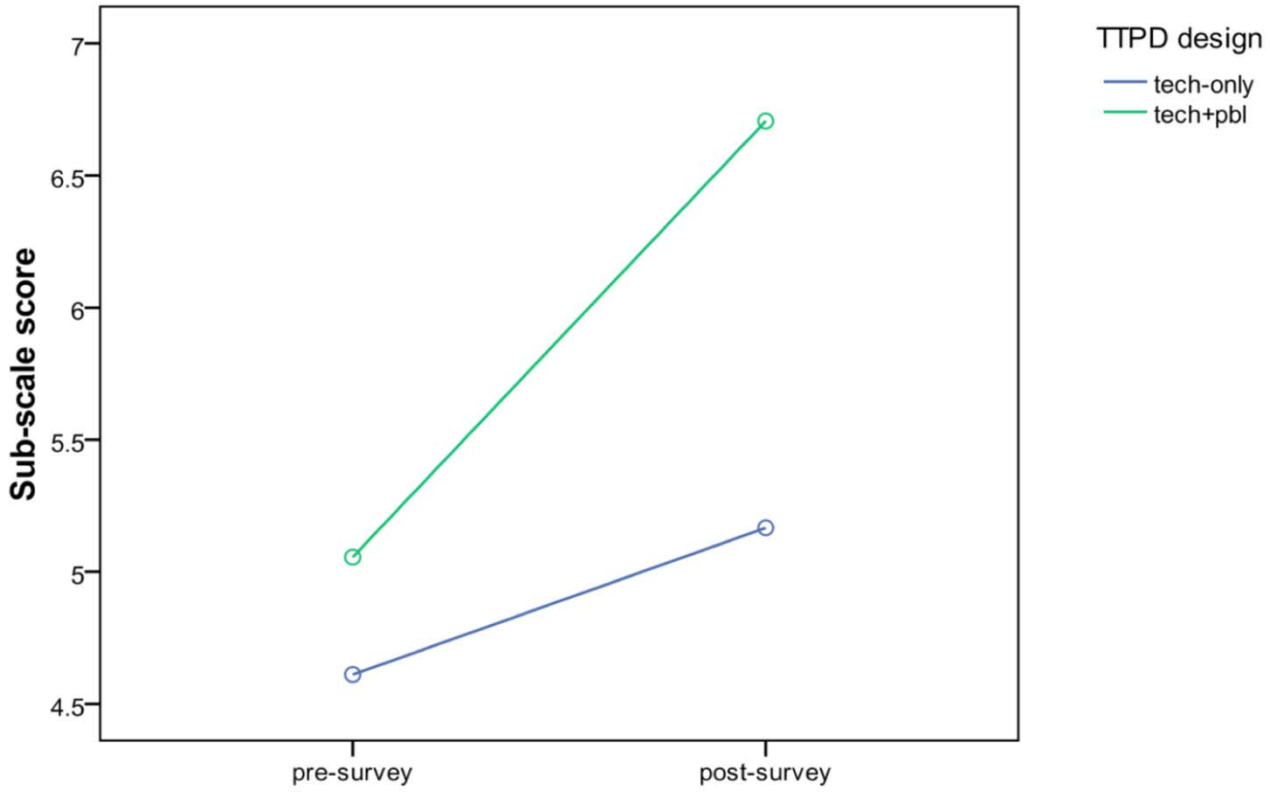
- Factorial RM ANOVA (time x PD design)
- Consistent main effect for time

Sub-scale	Pre-survey *M*	Pre-survey *SD*	Post-survey *M*	Post-survey *SD*	*F*(1,34)	$\eta 2$
PCK (0-16)	11.58	2.66	12.98	2.43	6.58*	0.16
TPCK (0-24)	12.97	4.54	19.09	2.99	50.71**	0.60
PBL (0-8)	4.83	1.84	5.94	1.72	10.12*	0.22
TK (0-12)	5.22	3.94	7.35	2.74	17.55**	0.34
Search (0-12)	6.92	2.47	10.10	1.91	60.08**	0.64

($\eta 2$ .1/.25/.4)

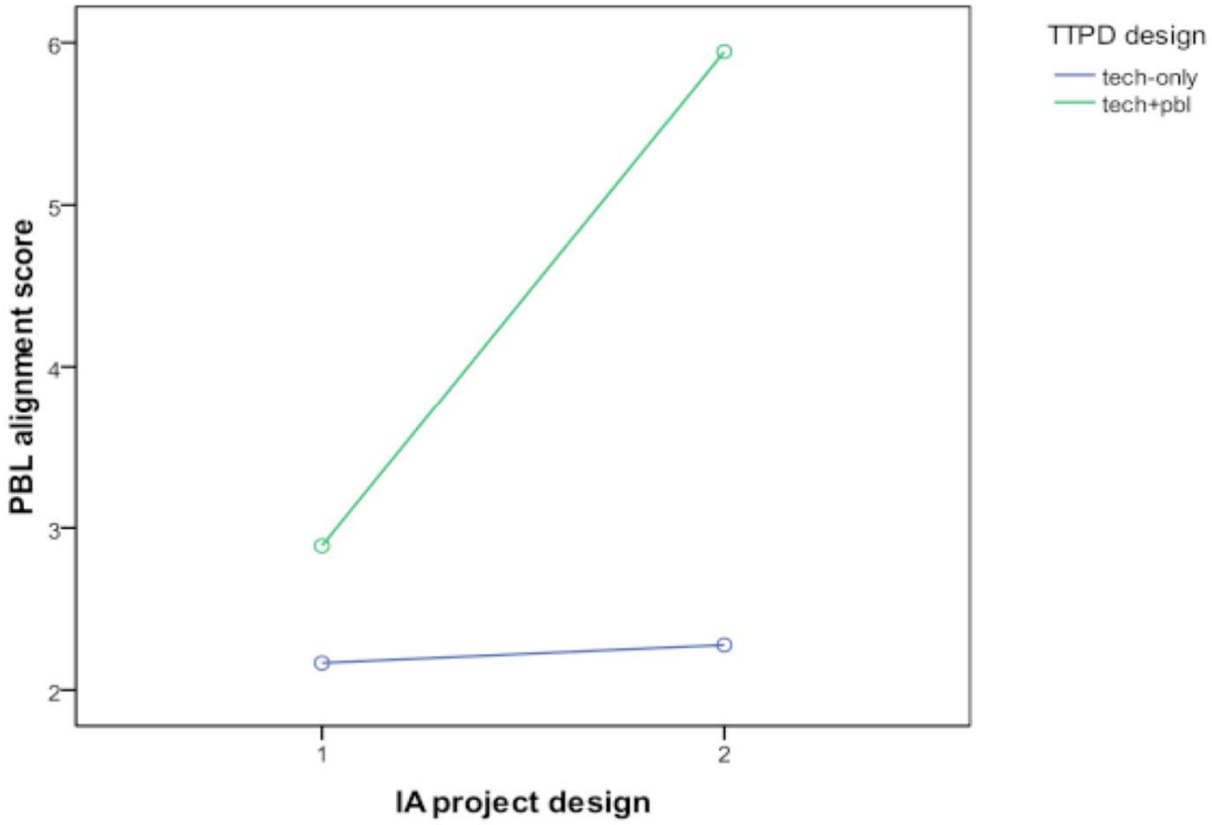
Results: Impact on teachers

- $F(1, 34) = 4.79$, $p<.05$



Results: Impact on teacher **practice**

- *F(1,34)=4.55, p< .05*



Results: Impact on student knowledge

	Final model		
	Estimate	SE	*p*-Value
Intercept	-.79	1.09	.47
PD design	.01	.32	.99
Classroom implementation	**.48**	**.18**	**.01**
PBL alignment score	.06	.05	.19
# of teacher IA logins	.01	.01	.08
# of student visits to the IA projects	-.01	.01	.18
Teaching experiences	-.02	.02	.39
Grade	.12	.13	.35
QIC score		4675.04	

Results: Impact on student knowledge (post-estimation)

Classroom implementation	Final model		
	LS Means	95% CI	z
Tech-only PD (N=544)			
Classroom implementation 1 (N=264)	.86	(.44, 1.29)	1.67 ns
Classroom implementation 2 (N=280)	1.35	(.96, 1.75)	
Tech+pbl PD (N=703)			
Classroom implementation 1 (N=345)	.86	(.48, 1.24)	2.25*
Classroom implementation 2 (N=358)	1.44	(1.11, 1.78)	
Total (N=1,247)			
Classroom implementation 1 (N=609)	.86	(.56,1.16)	2.56*
Classroom implementation 2 (N=638)	1.40	(1.11, 1.69)	

Conclusions

- Teachers
  - Uniform gains support TPACK claims
  - **Aligned** gains in **self-reported** PBL knowledge and **rated** PBL use

Conclusions

- Students
  - tech+pbl teachers had gains in all three student outcomes
  - tech-only teachers had gains only in student attitudes
  - May not align with learning by design

Conclusions

- Limitations
  - Variation in magnitudes (main effect for time vs interaction effects)
  - Self report data (teachers mixed, students all self-report)
- Future Work
  - PBL alignment rubric – sources of variance
  - Alternative pedagogical approaches

Questions?

- andy.walker@usu.edu
- happy to share slides/paper