A comparison of paired teaching models in large-scale introductory physics courses

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Introduction

Paired teaching is an arrangement in which two faculty are collaboratively responsible for all aspects of teaching a course. By pairing an instructor experienced in research-based instructional strategies (RBIS; the "expert") with an instructor with little or no experience in RBIS (the "novice"), paired teaching can be used to promote the adoption of RBIS [1].

Goal: What factors make for effective professional development in teaching via paired teaching?

Method

We focus on four novice instructors: A, B, C, and D.

Post-course interviews were analyzed for:
1. The relevant "input" factors that characterize paired teaching arrangements.
2. The novice instructors learning about teaching.
3. Specific connections between the input factors and faculty outcomes.

Evidence for learning comes in different forms.
Strong evidence of learning: The transfer of teaching techniques to an antagonistic scenario (i.e. a course for which there exists barriers to using RBIS).
Moderate evidence of learning: The use of RBIS while teaching the same course again individually or a development in professed attitudes towards RBIS.
Weak evidence of learning: Using RBIS while pair-teaching—the existing course structure means that novice instructors are very likely to teach in a reformed style while pair-teaching.

1. Input factors in paired teaching

Novice instructor	A	B	C	D
Course (year)	I (2013)	I (2014)	I (2015)	II (2015)
Context*	First-year large-scale calculus based physics course using active learning techniques. Multiple sections and instructors. Structure and materials established.			
Novice prior experience*	<1 year teaching. No experience with RBIS.	< 5 years teaching. Some previous exposure to RBIS.	10 years teaching at all levels. Some previous exposure to RBIS.	10 years teaching at all levels. Some previous exposure to RBIS.
Approach of novice*	Intention to learn "tried and tested" methods.	Saw paired teaching as an "apprenticeship."	Sought feedback from expert, but "most of the things weren't new."	Focused on in-class product and not professional development.
Expert instructor	Instructor Y, teaching stream tenured, 20 years teaching experience, 10 years PER experience.			Instructor Z, teaching stream tenure-track, 20 years teaching experience, 10 years PER experience.
Relationship*	"Incredibly friendly."	"… I do like them as [a person]."	"It was very collegial."	"… we all got along."
Teaching assignment sequence*	Taught course I individually in next two years.	Taught both course I and other similar courses in subsequent year.	Taught upper division course III at the same time as pair-teaching. Will teach course I individually and course III next year.	Will teach course II individually next year.
Support*	No science education specialist (SES) support.		SES provided feedback from classroom observations and student interviews.	

*Evidence for effects of factor on learning about teaching given below

2. Novice instructors learning about teaching

A	B	C	D
• Continued use of RBIS in teaching course I. • Interest in research basis: "I didn't really expect to be that interested in the why of the questions." • "Vital" to their development as an instructor. • Developed overall confidence in teaching. • Discussed specific teaching skills (i.e. lecture preparation, crowd management, and the ability to adapt) and a higher level approach to teaching (the importance of active learning).	• Continued use of RBIS in next courses. • Active in PER group; has undertaken projects with expert instructor Y. • "Apprenticeship" was important for their development as an instructor. • Discussed specific teaching skills, including the need for adaptation.	• Plan to transfer: "For the upper level class... I will try to see if I can develop guided worksheets." • Plan to teach course I "exactly the same." • Positive and reflective about the use of RBIs. "I can't be argumentative about the use of classical lecture versus more interactive class [sic]." • Discussed specific teaching skills, including pacing and adaptation. • When in charge, taught in the same overall style as expert instructor Y.	• Some changing perspective in "thinking a little bit more like a student as opposed to just thinking like a lecturer." • Some reservations about the lack of content covered. • Conflated adding active learning techniques with removing challenge: "I'd still like to learn... the blending of slightly more challenging aspects with still this way of being very interactive." • When in charge, taught in the same overall style as expert instructor Z.

FAQ

Do instructors enjoy paired teaching? Yes!
Described as "a lot of fun" and "one of the best teaching experiences I ever had."
Compared to teaching individually, how much time does paired teaching take? Same to less!
Described as "about the same workload as the second time I taught the course, entirely myself" and "a quarter time savings."
Do students like having two instructors? Yes!

Overall, having two instructors in this course was…		
an advantage	neutral	a disadvantage
75%	14%	11%

2015 courses, N = 269

3. Factors that affect outcomes

Approach of novice instructor
Instructors A and B were deliberate about learning about teaching, and took advantage of both observing the expert and receiving feedback from them. In contrast, there was comparatively little evidence of learning for instructor D, who did not focus on professional development.

Teaching assignment sequence
Instructors A and B went on to teach the same (or similar) courses; both instructors continued use of RBIS. Teaching an upper division course at the same time—and being scheduled for it next year—provided instructor C a concrete example to think about transfer.

Novice prior teaching experience
Overall, the relatively less experienced novice instructors (A and B) reported learning more skills than the more experienced novice instructors (C and D).

Course context / structure
The established course structure created a low barrier to using RBIS; instructors C and D taught in a manner consistent with the reformed structure.

Support of SES
The support of the SES was important for instructor C's developing attitude towards in-class activities: they conclude that ``there is no doubt that they [worksheets] improve engagement."

Relationship between instructors
Instructor B observed that "compatibility really makes a big difference when you're doing this kind of work." A positive relationship—which all four of cases had—may be a necessary condition for positive outcomes.

Future work

- Follow A—D: Does it transfer to new situations?
- More pairs, more examples, more data

We thank UBC SESs and PHASER. This extension of CWSEI work is funded by John and Deb Harris, the UBC Faculty of Science, and the UBC Department of Physics and Astronomy.
[1] C. Henderson, A. Beach, and M. Famiano, American Journal of Physics **77**, 274 (2009).

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