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Recruiting and Data Sharing in a Study of Flipped College Calculus

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WestEd

Objectives

First in the World: Promoting Active Learning Strategies Through the Flipped Classroom Model is a project funded by the U.S. Department of Education. It partners San José State University, California State University, Los Angeles, and California Polytechnic, Pomona with the nonprofit educational agency WestEd. The project is developing and studying the impact of workshops and professional Flipped Learning Communities (FLCs) offered to science, technology, engineering, and mathematic (STEM) faculty in support of "flipping" instruction. One goal of the project is to complete a randomized controlled trial study to examine what works, for whom, under what conditions in first semester college calculus.

Perspective

There are many ways to "flip" a course. In "flipped" teaching and learning the grounding idea is to switch the traditional uses of in- and out-of-class learning time. In a flipped course, students spend time on activities with lower cognitive demand (e.g., information gathering and review, basic skill building) outside of class. This *individual space* effort occurs before and after students attend class meetings. The focus in *group space* (i.e., class meetings) is more complex and higher cognitive demand activity, with students doing cooperative or collaborative tasks that leverage the immediate availability of the instructor as expert consultant and guide (e.g., group-worthy tasks, inquiry-based learning, team-based tasks, labs). Clear from the current research is that such an approach may result in better outcomes for students, both in terms of achievement and quality of learning experience (Deslauriers, Schelew, & Wieman, 2011; Hake, 1998; Laursen, Hassi, Kogan, & Weston, 2014; Lord & Camacho, 2007; Maciejewski, 2016; Prince, 2004; Ruppert, 2003; Walczyk & Ramsey, 2003). However, there never has been a rigorous test of the effectiveness of flipped instruction for improving learning in college calculus in the United States.

Though considered the gold standard for U.S. research funding, randomized controlled trials (RCTs) in authentic educational research settings are problematic. Such studies depend on "balancing research ambition against operational reality" (Gueron, 2002, p. 19) in recruiting of teachers and/or students to a study and in obtaining data, particularly personally identifiable data. While some candid reporting on recruitment in K-12 settings has been offered (e.g., Gueron, 2002; Roschelle, et al., 2016), little has been shared openly about the stumbles and struggles encountered when researchers attempt to implement idealized designs in the wilds of U.S. colleges and universities. One recent addition to the literature has offered insight into what can support success in recruiting and retention of post-secondary students (Terrell & Bugler, 2018). The work reported here is focused on recruiting and retention of post-secondary instructors in an RCT.

Methods

The Plan

The flipped calculus study is an RCT across first semester calculus classes at the three large state universities in the project. When funded, the original design of the study was vetted and approved by the U. S. Department of Education's First in the World evaluation staff, who relied on standards asserted by the then-current version of the What Works Clearinghouse handbook (WWC, 2014). Guided by initial power analyses, the design called for 20 instructors to participate for two semesters, each teaching two sections of calculus each semester, with about 25 students per section (i.e., a total of about 2,000 students across the two semesters). Each semester, instructors would be their own comparisons (i.e., teach one section flipped and one as usual). Each faculty member would have pre- and in-semester professional support for flipping one class section. The project would collect data both semesters, though it was acknowledged that the project-designed professional supports for instructors to learn to "Do the Flip!" were being (re)designed throughout the first semester of the study.

The Reality

In any given semester, a total of 20 to 25 sections of Calculus I exist across the three universities. So, virtually all calculus instructors would have to participate. At the same time, math department chairs are constrained by many conditions, including the realities of academic freedom and faculty union rules about making assignments to teach calculus. Thus, we could not ensure that participating instructors would be assigned two sections for two semesters in a row. Involving one or more additional universities was beyond the funding available. As a result, prior to recruiting, the design was revised to have a "Plan B" for those cases where instructors were interested in participating but were assigned just one section of calculus. The revised plan, also vetted and approved based on WWC (2014) standards, led to the design shown in Figure 1. Group 1 includes those eligible in the original design and Group 2 represents Plan B, for those teaching just one section of calculus in a semester.

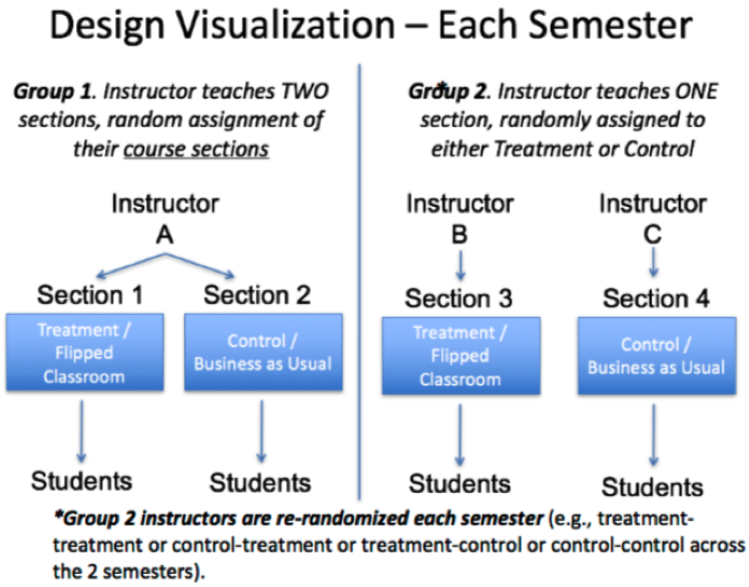

Figure 1. Original (Group 1) and additional option (Group 2) for participation.

Compounding the challenges of recruitment was the fact that one of the three colleges was delayed in a planned move to the semester system. Hence, their faculty could not participate at the same time as faculty at the other two colleges. Most calculus courses at the three sites are taught by conditional faculty (e.g., non-tenure track or adjunct instructors). As of this writing, the calculus study is in its first semester at the two colleges ready for it. Of the 10 instructors originally recruited, 2 were reassigned before randomization of sections, 1 dropped before randomization of sections, and 7 are active participants. Reporting on communication with the local leaders of the professional development for faculty and on retention of instructors in the study are the topics of a planned, future, report.

Data Sources and Data Collection

Data sources include a calculus readiness pre-test and a calculus concepts post-test to be completed by students in all class sections, regular teaching logs by instructors, surveys completed by instructors about their mathematics instructional experiences before and during each semester of the study, an end-of-term survey by students about their experiences in their calculus course, and anonymized transcript data from each college's Institutional Research office about student preparation, course grades, subsequent course-taking and course success, and demographics.

Results (to date)

Administrators

We found that more often than not, STEM leaders in the universities had limited familiarity with the institutional review board (IRB) role in conducting such a study and the protections offered to participating faculty as human subjects in research. To avoid having faculty being "voluntold" to participate in it - a violation of IRB and union rules – we engaged in some teachable moments with administrators. We have needed active and regular consulting with department chair and a local leader (e.g., a dean) at each site to negotiate teaching assignments and processes for recruitment of faculty as well as implementation of classroom data collection. Communication has included in-person meetings, short presentations by project research staff at faculty meetings to give information and answer questions about the study, and the creation of a 4-page "Administrator's Guide" to the study. The guide became a written document for several reasons. One reason was the turnover in administrators over the course of the first year in the project, so a written Administrator's Guide was a handy reference for the next new person in the job. The guide was also created to address the strong negative reactions to the study design by some administrators (chairs and deans), who were sure no instructor would agree to be in Group 1. The guide, as revised in response to feedback from project leaders and local administrators, has been a worthwhile investment in time as a reference document for talking with local administrators.

Instructors

One unanticipated challenge of data collection was that the vendor of the online calculus readiness pre-test changed their policies and required that researchers obtain anonymized student data from instructors (the vendor would not provide it to researchers directly). Thus, supports for instructors in order to supply score data were needed. In addition to creating an

Instructor Guide with timeline of study activities and answers to frequently asked questions, we created a three-page illustrated step by step guide for download, anonymizing, and uploading score data. These guides, along with links to surveys and logs are organized in a personalized Instructor Participant Dashboard (see Figure 2). We asked each instructor for a preferred mechanism for communication (email, phone/voice mail, text message). Since the study started (January 2018), instructors have received regular reminders to visit their participant dashboard to complete study tasks.

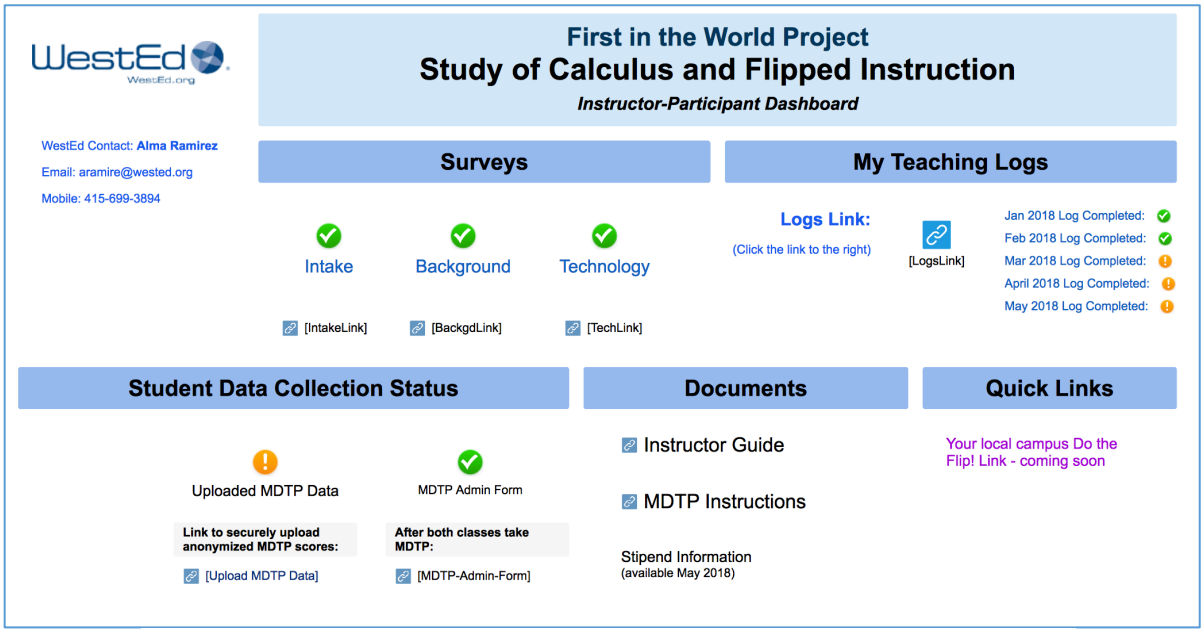

Figure 2. Screenshot of personalized dashboard for instructors

Institutional Research Offices

Another challenge is acquiring, cleaning, and matching of anonymized data for hundreds of students across three colleges. From lessons learned on other projects, we met early with staff at each of the three Institutional Research offices to plan a test of the data sharing process. As of this writing we await test spreadsheets from partner colleges.

Significance

In the poster we will share results to date in recruiting of instructor participants, data gathering, and testing for data exchange. Tools and tips for establishing clear communication (e.g., the Administrator and Instructor Guides, FAQs, and format for meeting with local college leaders) can provide foundation for others attempting to work in the public university educational research space.

Acknowledgments

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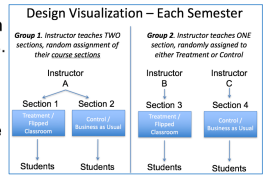
Flipped Classroom Study

Design

What: Flipped Instruction. In a "flipped" classroom the grounding idea is to switch the traditional uses of in- and out-of-class time. Students spend individual learning time on lecture-type information and basic skill building outside of class. Group learning is the focus of class time, with students doing cooperative or collaborative activities that leverage the immediate availability of instructor as expert consultant and guide (e.g., group work, team-based tasks, labs).
Where: San José State University, Cal State Los Angeles, Cal Poly Pomona.
When: Spring '18, Fall '18, Spring '19
Who: Instructors of Calculus 1, their students, WestEd. Eligible instructors are full- or part-time, teach first semester calculus.
How: Randomized controlled trial with instructor as own control where possible (see Figure at right).



Tool: Equity in Math Education

In a TODOS/NCSM position statement, there are three necessary conditions to establish just and equitable mathematical education for all learners:

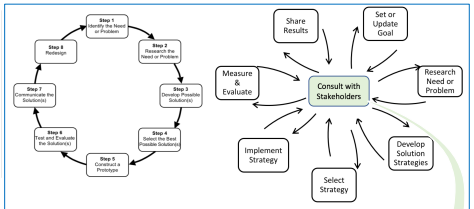
1. **acknowledge** that an unjust social system exists.
2. take **action** to eliminate inequities and to establish effective policies, procedures, and practices that ensure just and equitable learning opportunities for all,
3. be **accountable** by measuring progress so changes are made and sustained.

Challenging Question:

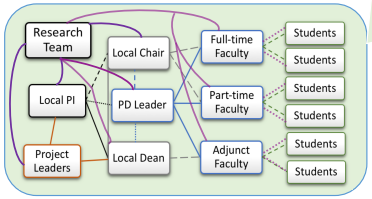
1. In what ways might design assumptions promote inequity and/or equity for participants (e.g., faculty, students)?

Recruitment and Retention of Faculty

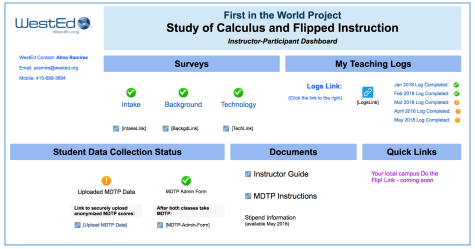
Tool: Relationships



Example: Identify and Manage Equitable Communication with/among Stakeholders



Tool: Personalized Dashboard



Additional Challenging Questions:

2. What does it mean for recruitment and retention to take action that addresses inequity?
3. How do we know it when we see it (i.e., measure progress)?
4. How do we include stakeholders?

What More? What's Next?

Responses, alternatives, and extensions to the challenging questions.

Study Design

Recruiting & Retention

Other Ideas, Questions?

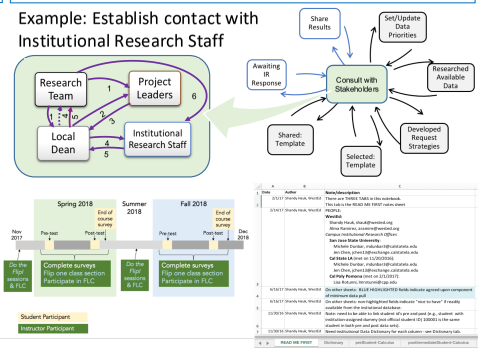
Data Sharing

Data Sharing

Tool: Illustrated Guide and Follow-up

Tool: Orientation and Data Template

Example: Establish contact with Institutional Research Staff



Another Challenging Question:

5. In what ways does the work in this session acknowledge, act, and hold us accountable for reducing inequity? What is the evidence of it, for you?

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