Successes and Challenges in Transitioning to Large Enrollment NEXUS/Physics IPLS Labs

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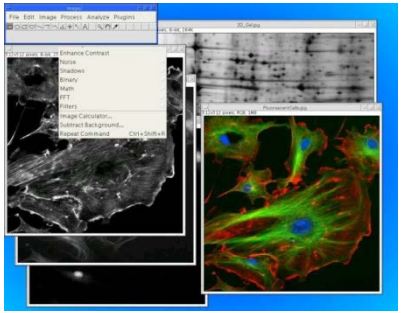
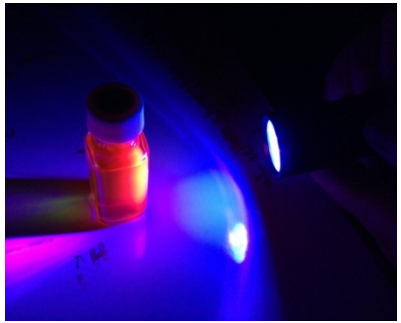
Outline

- NEXUS/Physics Labs in Brief
- Challenges of Transition to Large N
- Adaptations to Accommodate Large N
- Research Questions and Data Collection
- Student Perception at Large N
- Acculturation of TAs—training and retention
- Simple Lesson Learned
  - Recommendation for YOU

NEXUS/Physics Labs in Brief

- Reformed from Traditional IP Labs:
  - Shifted Physics Content
  - Shifted Pedagogy
  - High-Tech Equipment
  - Modern Analysis Tools





#1: Promoting… Interdisciplinary Thinking

Goal: Helping students to appreciate how physical measurements and analyses help us understand biological phenomena

— quantification yields biological insight!

#2: Promoting…
Authentic Scientific Practice

Goal: Helping students ***acquire and perceive*** the skills, problem-solving approaches, and patterns of behavior demonstrated by professional scientists, above and beyond content knowledge.

Authentic Scientific Practice

- Includes:
  - Modeling systems and interactions
  - Experimental design/Protocol development
  - Uncertainty (“error”) analysis
  - Group work strategies
  - Communication and presentation skills
  - Critical assessment of scientific argumentation
  - Trouble-shooting equipment and analyses
  - Persistence and re-design in the face of difficulties

Gott *et al.* (1999) | **NRC *Bio 2010* (2003)** | **AAMC/HHMI *SFFP* (2009)**

AAAS *Vision & Change* (2011) | Zwickl *et al.* (2013) | Moore *et al.* (2014)

Challenges of Transition to Large N

- Currently: 8th offering of 1st Sem & 7th of 2nd Sem at Large N
- New Staffing
  - 8 Profs and 54 TAs to date –Train? Acculturate? Support?
- Change in Student Population
  - Diverse backgrounds and preparation—Support motivation and persistence?
- Logistics of 12 sections per week in on-sequence course
  - 6 Lab Technicians—Training?
  - Use of rooms/equipment; Room reset

Seek uniformity of delivery without losing authenticity

Seek unified educational vision across diverse instructors

Adaptations to Accommodate Large N

- Professors: Apprenticeship/Mentoring
- Weekly common trainings
  - Epistemology; Intentional and Reflective
- LAs… until the money dried up (IE $$)
- Shifting majority of TA time to student contact (rec, labs, course center, helping) over grading ***

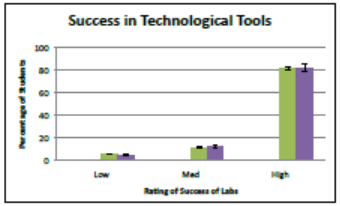
Research Questions & Data Collection

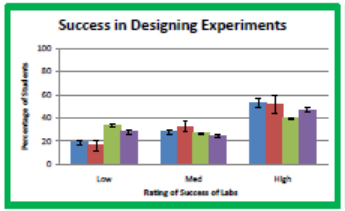
- Previously, we asked: (Both are YES!)
  - Can we transition successfully to large N?
  - Can we establish stability at large N?
- NOW, we ask:
  - Can we understand how variations in instructional staffing impact student perception of the success of the lab curriculum?
  - What implications do our findings have for the broader physics education community?
- Data:
  - ~1600 Ss in 1st Sem; ~1400 in 2nd Sem
  - **Pre/Post Surveys**, Lab Reports, Video of Labs, Individual Pre/Post Interviews

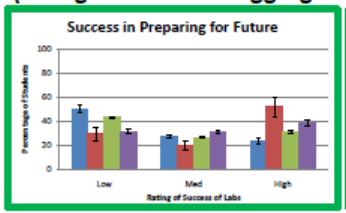
54 TAs to date; 13 TAs with >1 Sem in our Course

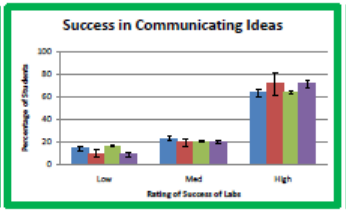
	1st Sem Course	2nd Sem Course
Ss Taught by ALL TAs	~ 1600	~ 1400
Ss Taught by EXP TAs	375	290
Ss of EXP TAs as %	23%	20%

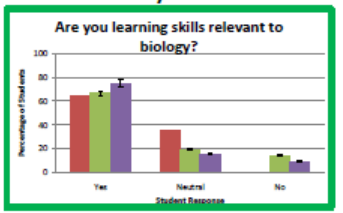
- Of the 54 TAs:
- 17 were considered "Experienced" by the Physics Department (having taught both recitations and labs for other courses previously) and an additional 10 had taught either recitations or labs previously.
- **THERE is NO advantage to having experience with a prior, non-IPLS course (all effect sizes ~0.1 or less).**
- **Only prior experience within this IPLS course impacts student perception of the success of the labs.**
- **Here is the 1st Semester Data (though the overall aggregate and 2nd semester data are similar in trends):**



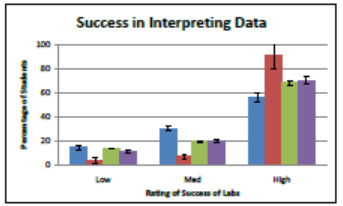


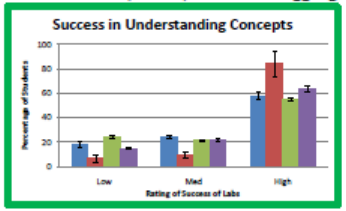


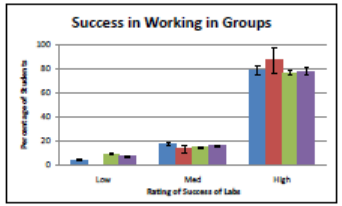


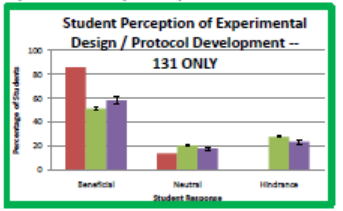


ISLE (N = 187) NEXUS '12-'13 (N = 31) NEXUS Aggregate New TA (N~1170) NEXUS Aggregate Experienced TA (N~320)









These effect sizes are small at best (0.2-0.3), but repeatable across filters.

Acculturation of TAs—training and retention…. Focus on Pedagogy…

- What do we do & Why do we do it that way…
- Frustration & Motivation
- Interest/Engagement/Motivation/Self-efficacy—Affect Cluster
- Epistemology & Epistemic Tools
- Recognize Ss expertise—co-create knowledge!

Acculturation of TAs—training and retention…. AT the training…

- Reflection, w/ Metacognition Activities
- New Physics Content Overview
- TAs engage in task
- Trainer interrupts regularly
- For Labs:
  - Introduce equipment/technology
  - “Bumps” as a FEATURE, not an obstacle
  - Authentic Scientific Practice—subverting expectations
  - Showcase actual student data

Acculturation of TAs—training and retention…. Before/After…

- Before the training:
  - Student, TA, and Tech guides provided
- After the training:
  - Reminders from training
  - Encourage TAs to synthesize on their own before teaching

Acculturation of TAs—training and retention…. Support while Teaching….

- Double-up TAs
- Have NEW TAs act as “Helper” prior to their own first section

RESULTS:

- 75-80% report “Rewarding”
- Teach it again? 70% say YES!
- Gained benefit for self/own learning? 75% say YES!

Simple Lesson Learned

- What can WE do to help sustain high quality learning environments for our students?
- Recommendation for YOU:
  - **RETAIN your TAs and Instructional Faculty**
  - IE is expensive; costly in time and money
  - Student perception data for “Experienced” TAs is measurably better than NEW TAs, especially for Experimental Design & Interdisciplinarity Clusters… But WHY?? The training!

References (kmoore17@umd.edu)

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