

Student Perception of NEXUS/Physics IPLS Labs—TA Retention Implications

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The NEXUS/Physics Lab Curriculum Project:

For information about the motivation for these labs, our vision for a new IPLS lab curriculum, and discussions of curriculum content, see our article and supplement in the AJP Special Issue:

K. Moore, J. Giannini, & W. Losert, *Toward better physics labs for future biologists*, *Am. J. Phys.*, v. 82, n. 5, pp. 387-393 (May 2014)

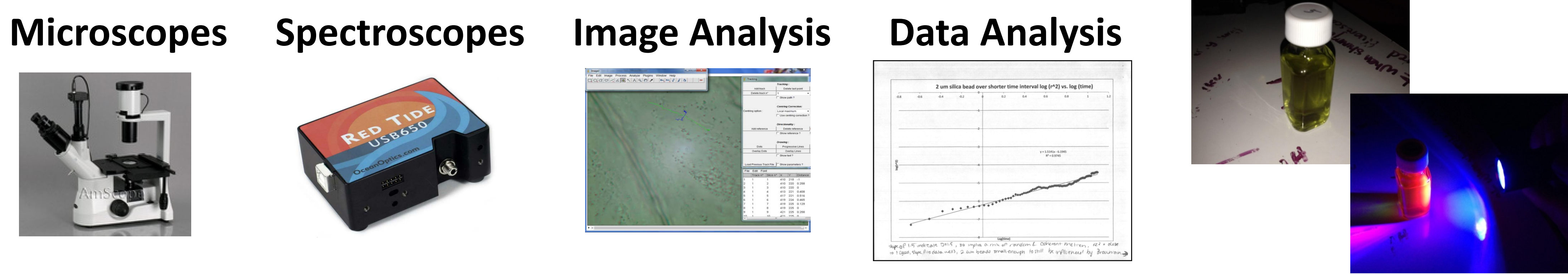
What we did (the short version):

1. We **changed the content** in order to focus on physics applicable at biological scales (esp. micro- and nanoscale) and in authentic biological contexts. **(Physics Concepts)**
2. We **chose a lab format** to promote coarse-grained lab skills (e.g. sense-making, experimental design, epistemological focus). **(Pedagogical Approach)**
3. We **chose high-tech equipment and modern analysis tools** to promote fine-grained lab skills (useful to professional biologists). **(Technological Tools)**

These three aspects are often in tension.

Our Challenge: Having achieved stability, can we understand how variations in instructional staffing impact student perception of the success of the lab curriculum? What implications does our analysis support for implementation in the broader physics education community?

Lab Equipment: High-Tech Equipment with Modern Analysis Software

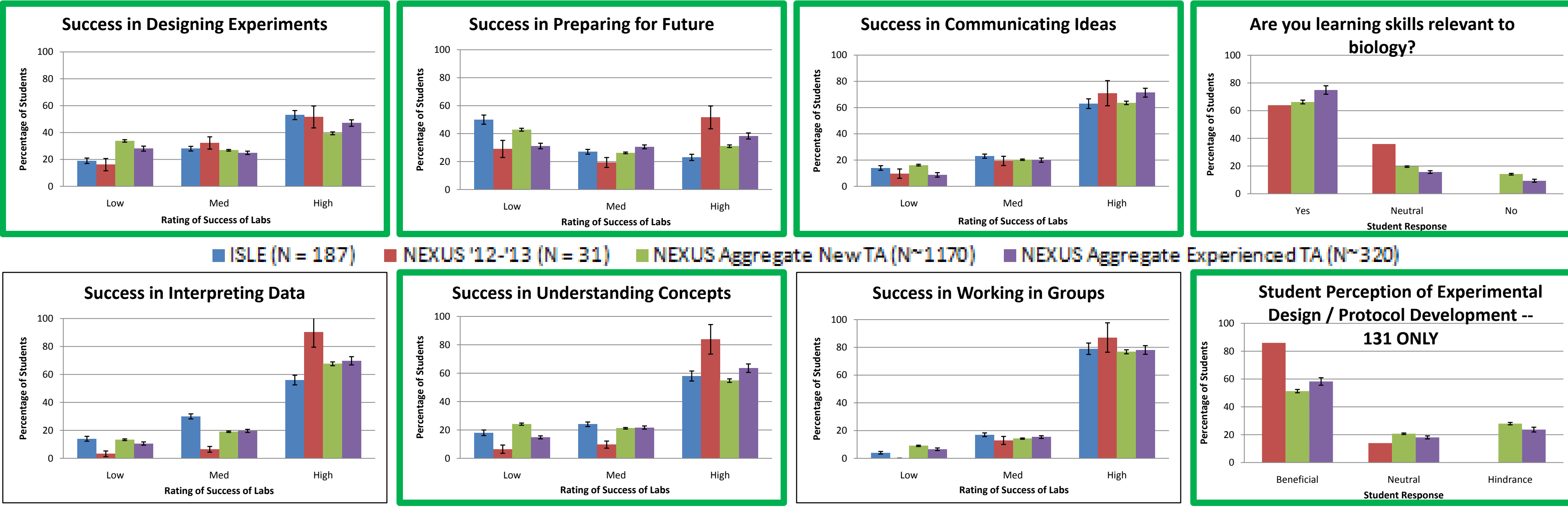


In the 15 semesters of Large Enrollment (N~200 per course per semester) offerings, we have had numerous changes in the instructional and operational staffing. Let us begin by examining the effect of NEW vs. EXPERIENCED TAs...

Thus far we have had:

- 8 different lecturers/professors
- 1633 Students complete the 1st Semester course
- 1457 Students complete the 2nd Semester course
- 54 TAs (some undergrad TAs) – Avg. of 5 TAs/course/sem (ranging from 3.5-7)
- 38 LAs (undergrad Learning Assistants, split between Physics and Bio majors) – Avg. of 3 LAs/course/sem (0-12)
- 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):

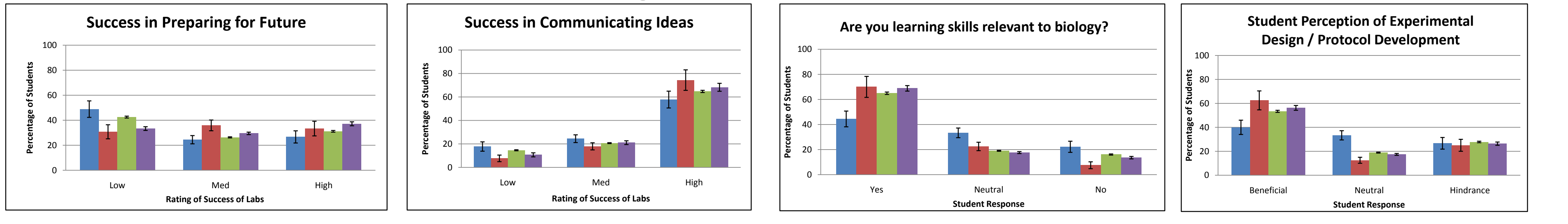
These student surveys have a 90% to 97% response rate....



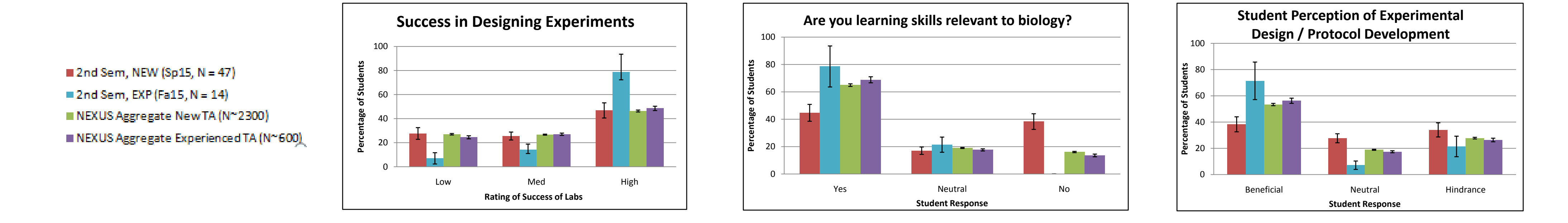
These effect sizes are small at best (0.2-0.3), but repeatable across filters.

Student perception of curriculum success for individual TAs shows great variation from semester to semester, but the general trend is an increase in perceived success from the first (New) to the repeated (Experienced) semester.

CASE 1—1st Semester TA—Poor initial performance, but increase in every category with small (0.2) to medium (0.6) gains... 1st Sem, NEW (Fa14, N = 45) 1st Sem, EXP (Sp15, N = 39) NEXUS Aggregate New TA (N~2300) NEXUS Aggregate Experienced TA (N~600)



CASE 2—2nd Semester TA—Excellent growth in 2/3 of the categories, showing medium (0.6) to very large (>1.0) gains, including affect measures... [“I am capable of understanding physics” (e.s. +0.98) and “I can usually figure out how to solve a physics problem” (e.s. +0.67).]



The categories most impacted in student perception of the lab curriculum success, when shifting from New to Experienced TAs, are in the “Experimental Design/Protocol Development” and the “Interdisciplinarity” clusters. This result is supported by the survey information taken from the TAs in their own words...

At the end of our 4th year of Large Enrollment offerings, the TA pool is finally large enough to survey with guaranteed anonymity... Of the 54 TAs sent the survey, 28 responded, roughly evenly split between TAs who taught only one semester with us and TAs who taught two or more semesters... (TAs work an average of 1.7 +/- 1.0 semester with us.)

In response to a “Please rank how often you found yourself thinking about the following ideas when working with the students in the labs”:

- **NEW TAs** spend time in lab thinking about: 1) the new lab contexts, then 2) the new technology, and the 3) the new pedagogy; with *very little time spent thinking about the interdisciplinarity* and the new physics content.
- **EXPERIENCED TAs**, in contrast, think about all five of these things regularly, but rank them as: **1) the interdisciplinarity**, 2) the new physics content, 3) the pedagogy, 4) the new technology, and 5) the new lab contexts.

In response to an open-ended prompt, “What do you think are the qualities or characteristics that make a “good” TA?,” the TAs and LAs surveyed gave the following responses (repeatable across sub-groups)...

- PATIENCE (50%) Preparedness (25%)
- Relatability/Accessibility (25%) Humility (18%) Kindness/Compassion (13%)

Curricular materials available: <http://www.nexusphysics.umd.edu> ; “NEXUS/Physics Labs, 2013-2014”

REFERENCES

[1] E. Etkina & S. Murthy, *Design Labs: Students’ Expectations and Reality*, *AIP Conf. Proc.*, v. 818, p. 97 ff (2006)

ACKNOWLEDGMENTS

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