A Tale of Two 1st year Biology courses - The BioFlex Approach
Collaborative and Evidence-Based Approaches Towards Improving Student Learning and Experiences

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INTRODUCTION

What is BioFlex?

Learning- and Learner-centered course transformation pilot of two large-enrolment and multi-section 1st year Biology courses (BIOL 112 and BIOL 121) – which unified the teaching methodologies among the different sections of the courses within the "BioFlex Learning Path" framework.
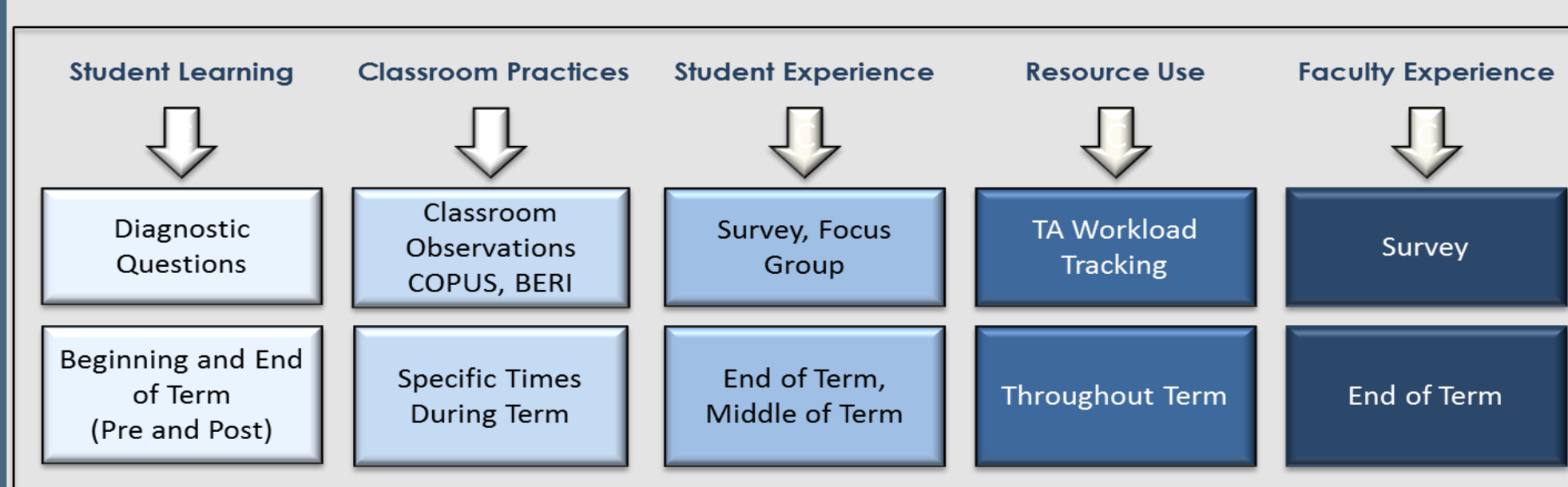

The Learning Path

- **Pre-Class** Prepare for Class
- **In-Class** Activities and discussions
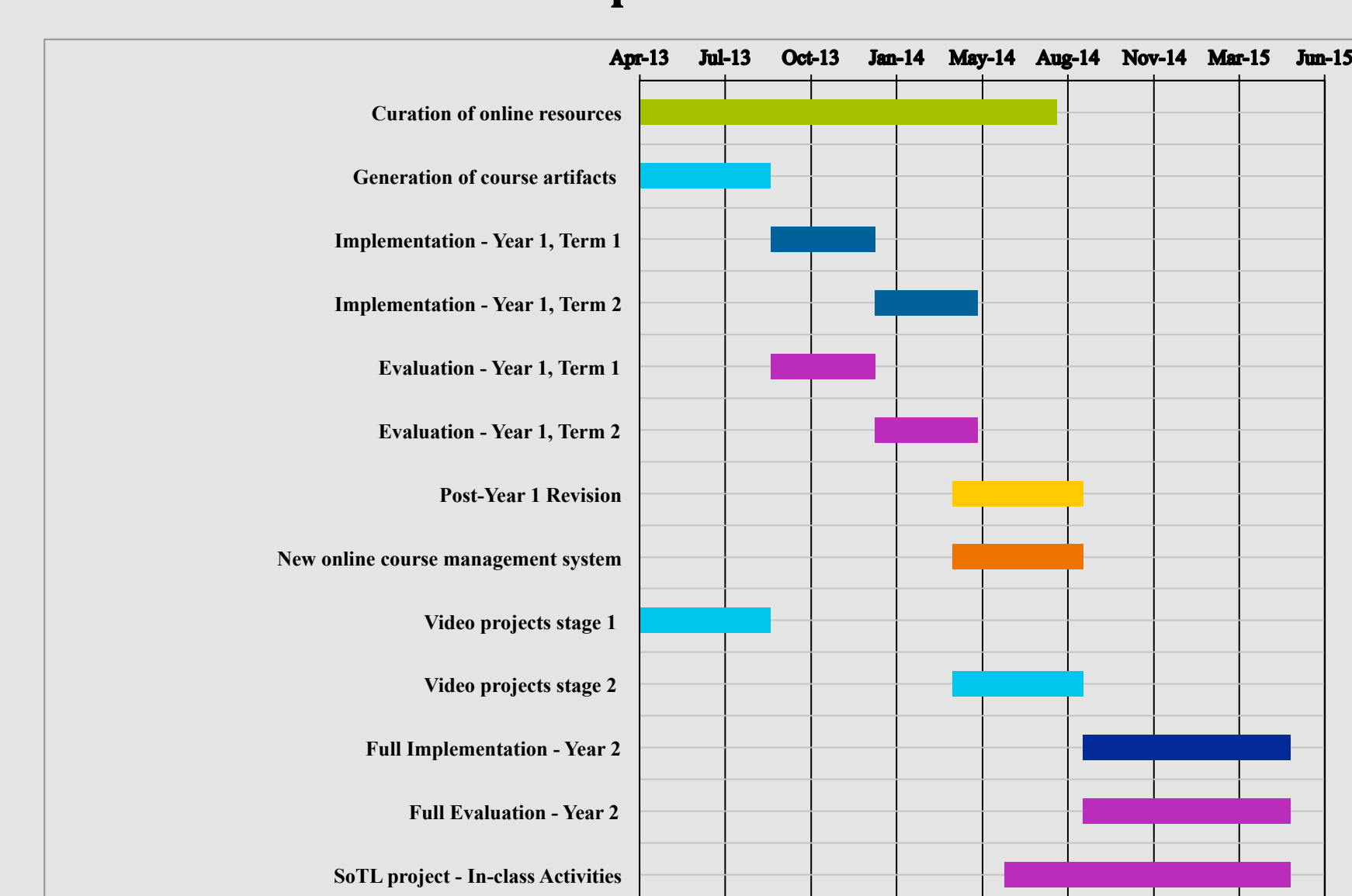- **Post-Class** Solidify Learning with practice

Questions we asked:

- What do the learning- and learner-centered course transformations look like?
- What is the effect of such course transformations on:
  - student learning?
  - student perception of their learning experiences?
  - Faculty experiences?
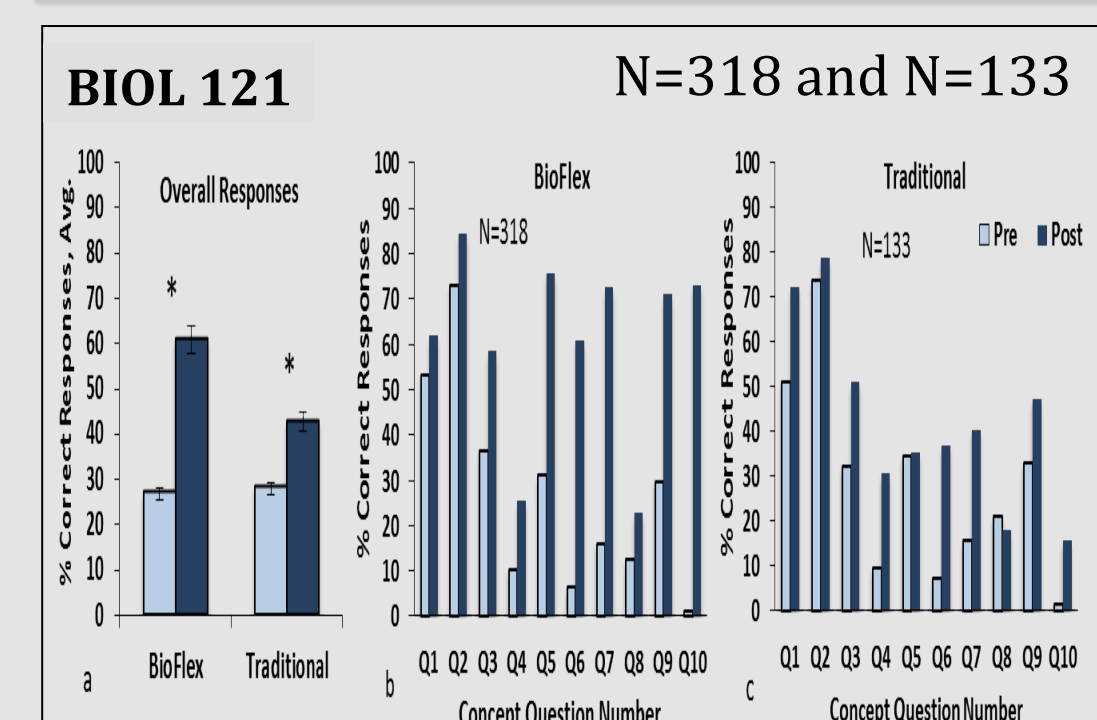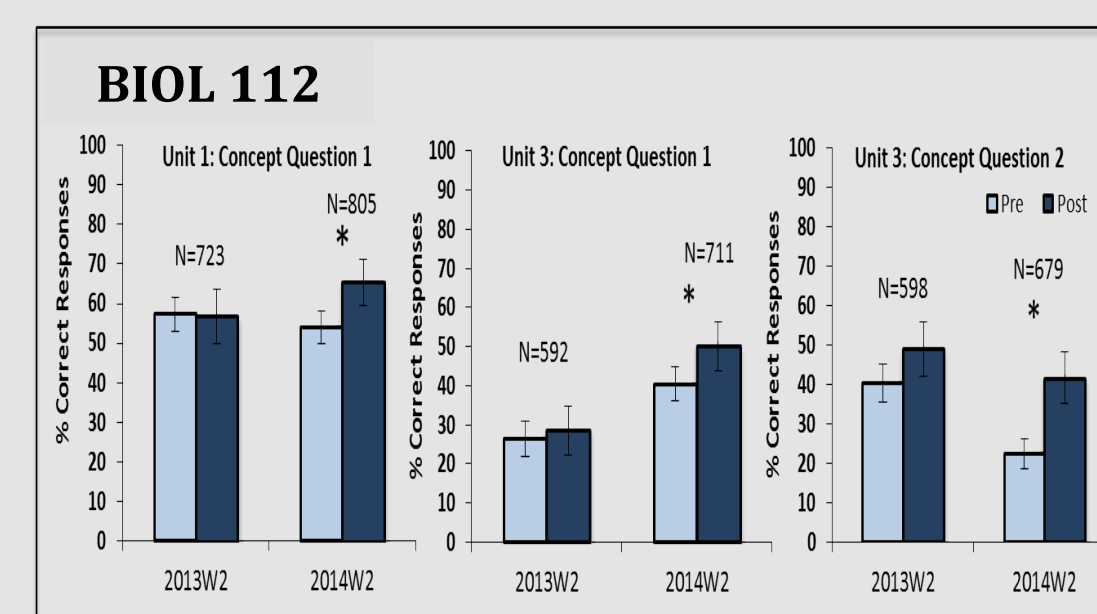
Project Assessment Strategies: What we documented

Student Learning	Classroom Practices	Student Experience	Resource Use	Faculty Experience
Diagnostic Questions	Classroom Observations COPUS, BERI	Survey, Focus Group	TA Workload Tracking	Survey
Beginning and End of Term (Pre and Post)	Specific Times During Term	End of Term, Middle of Term	Throughout Term	End of Term

BioFlex Implementation Schedule

RESULTS

Assessment Results from Diagnostic Questions
Pre- and post-test matched responses to select concept diagnostic questions

BIOL 112

- Pre- and post-test performance in year one helped inform our practice and interventions in year two.
- Revised intervention activities resulted in significant increases in year two.

BIOL 121 — N=318 and N=133

A comparison between BioFlex sections and traditionally taught section in BIOL 121:
- No significant difference in the overall student performance on the pre-test.
- Significant better performance on the post-tests in the transformed (BioFlex) sections.

* indicates statistical significance at $p<0.05$. Error bars indicate 95% confidence interval.

A comparison of student performance in the courses between pre- and during/post-BioFlex pilot.

The comparison revealed interesting and encouraging shifts in student final grades - The mean course grade significantly increased in both BIOL 112 (69.9% to 74.0%) and BIOL 121 (67.5% to 74.4%)
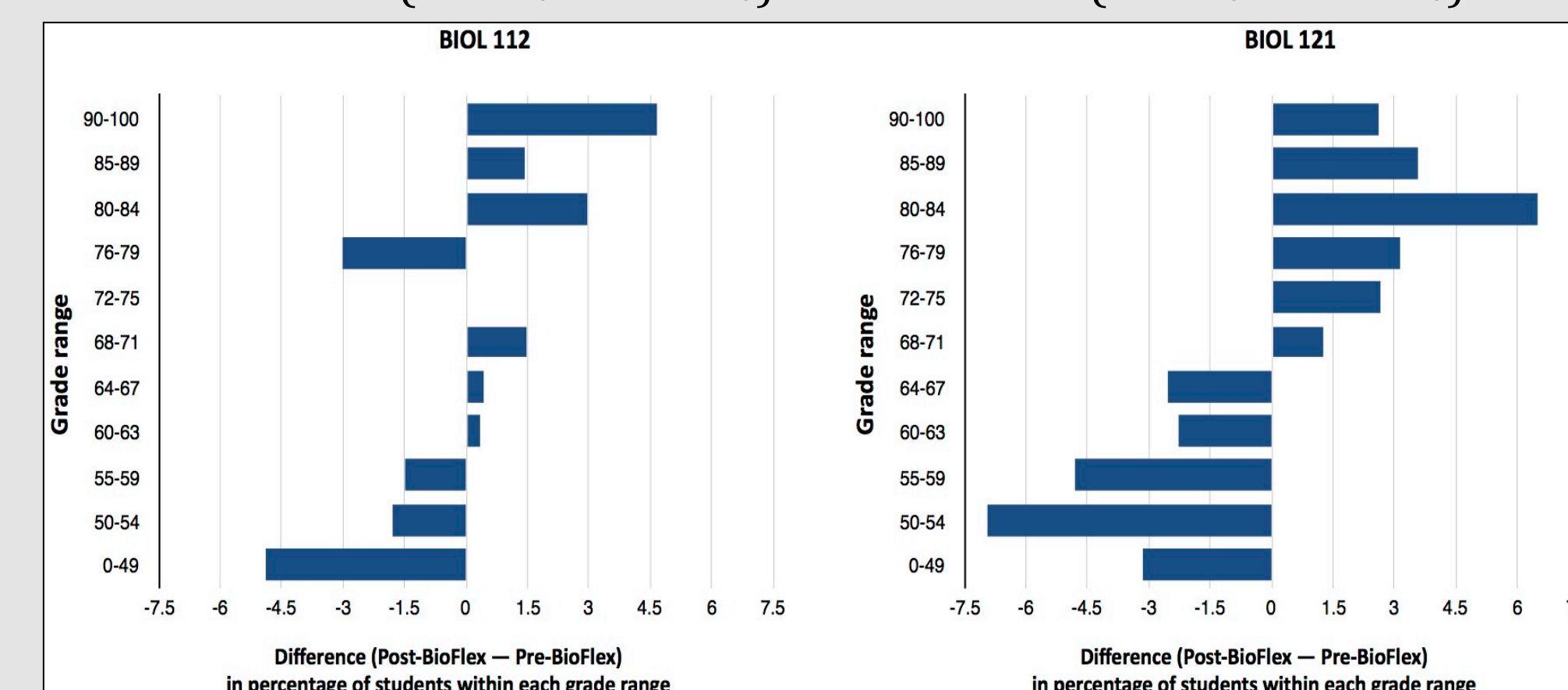
Grade shifts in BIOL 112
- reduction in the proportion of grades below 60% and 76-79%.
- increase in grades in the 68-71% and 80-100% ranges.

Grades shifts in BIOL 121
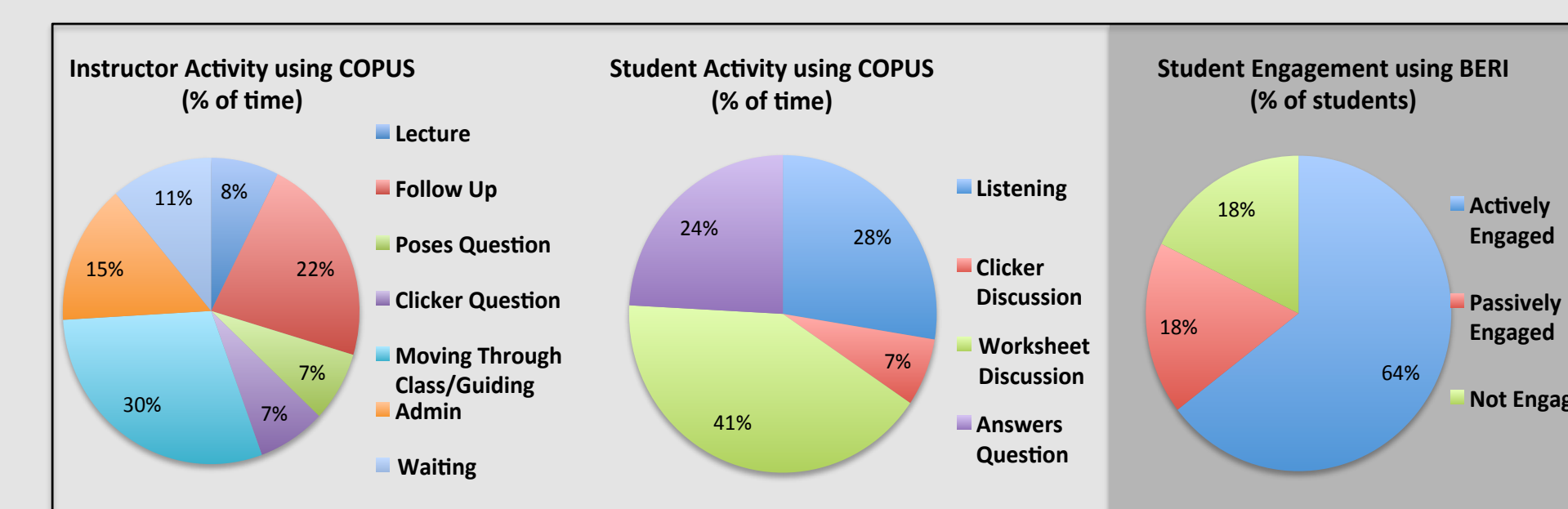- reduction in the proportion of grades below 68%
- increase in grades above 68%.

Do these shifts reflect more or better learning?
- Cannot say, since both courses have changed substantially, particularly in their structure.
- However, the shifts suggest that the new versions of the courses are a better match for our population of students, allowing a larger fraction of them to be successful.
- Arguably, this should also relate to a more positive student experience.

Classroom Observations using COPUS[2] and BERI[1]
What do our transformed classrooms look like?

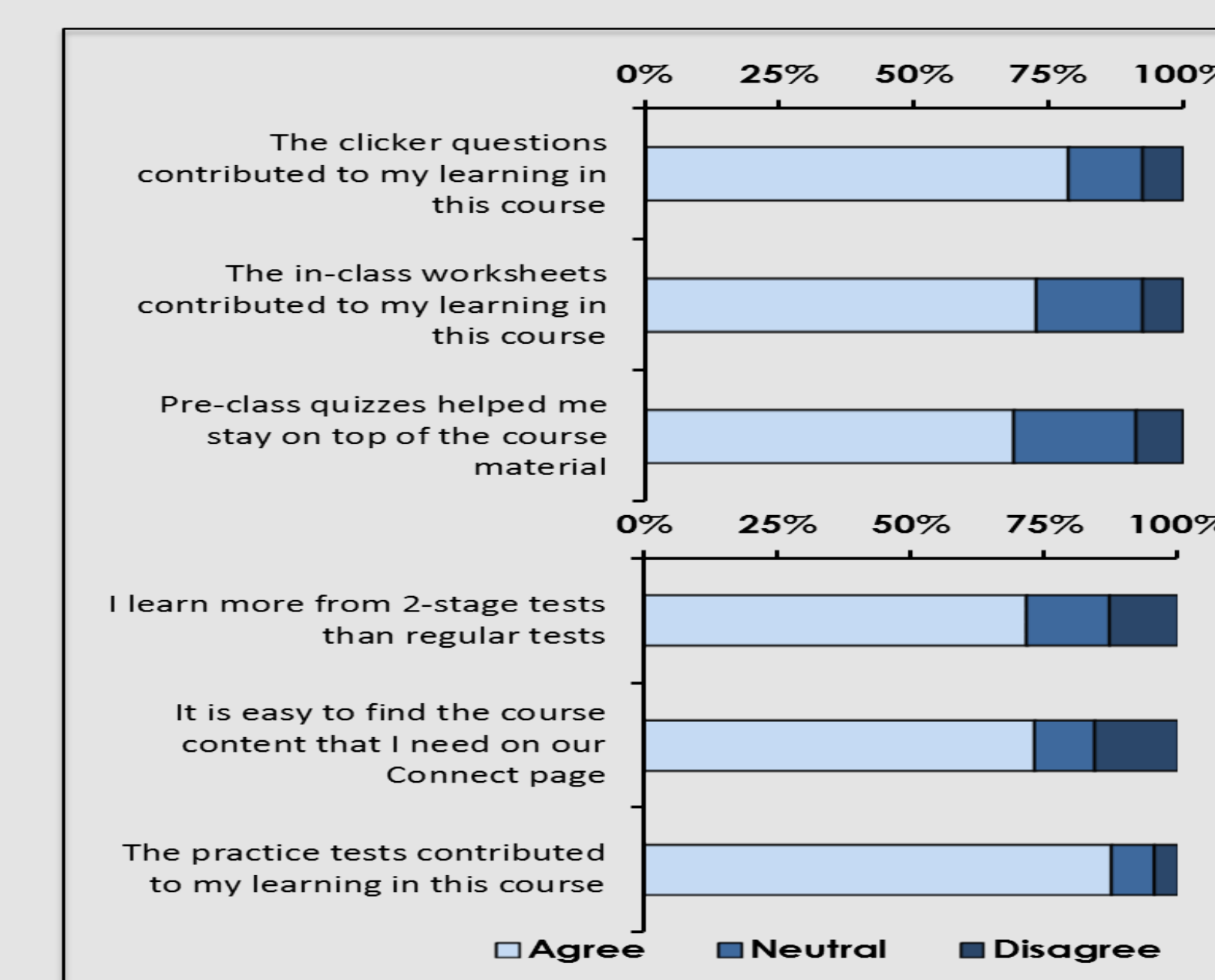Summary of data collected during one lecture using the COPUS and BERI tools

Instructor Activity using COPUS (% of time); Student Activity using COPUS (% of time); Student Engagement using BERI (% of students)

COPUS: Classroom Observation Protocol for Undergraduate STEM

BERI: Behavioural Engagement Related to Instruction

Most Students are engaged in their learning during most of the class time.

Student Experiences
Survey and Focus Group Data

A subset of questions from the Students Experiences Survey

- The clicker questions contributed to my learning in this course
- The in-class worksheets contributed to my learning in this course
- Pre-class quizzes helped me stay on top of the course material
- I learn more from 2-stage tests than regular tests
- It is easy to find the course content that I need on our Connect page
- The practice tests contributed to my learning in this course

Legend: Agree | Neutral | Disagree

A subset of topics from Student Focus Groups - 2014W1

Topic	Focus Group Feedback
Student Background	Students found instruction and evaluation very different from their high school experience.
The Flipped Classroom	Responses to activities varied.
	Some prefer traditional lecture or balance of activity vs. lecture
	Others found activities useful: "I love in-class activities... They are so helpful!"
Targeted Readings and Pre-class Activities	Saw the value in pre-reading and found really helpful
	Students prefer to have all pre-readings in advance for the entire term.
In-class Activities and clicker questions	Provides instant feedback and useful for studying exams.
	Get to know your classmates and promotes engagement and discussion.
Other Learning Resources	Found online discussion boards / help desks more useful as they can receive immediate response and feedback.

Faculty Experiences
Quotes from End of term Survey

Faculty reported a substantial workload increase. However, irrespective of rank and stream, they also emphasized that the experience was well worth their effort and time.

A quote from a Research Professor

"The shift in emphasis of BIOL 112 to a more active learning approach over the last 2-3 years has made the course more fun to teach, and has enhanced the learning experience of the students. Given the time constraints of a busy research program, it would not have been possible for me to make this shift by myself. The support of the BioFlex team, including teaching faculty and postdoctoral fellows, was essential in allowing me to introduce new active learning course material and teaching approaches into my section without having to sacrifice time required to run my research group."

A quote from a new lecturer

"I strongly benefitted from collaborating with (and just listening to) more experienced instructors and how they approach designing activities, how to assess student learning, and how to conduct scholarly evaluation of their practice. I firmly believe that working in the BioFlex team expedited my skills and knowledge as a developing reflective practitioner of evidence-based instruction in the Life Sciences."

CONCLUSIONS

- Enhanced student performances were observed as a result of the course transformations.
- Active Learning approaches in the classroom were valued and perceived as more beneficial to learning and the learning experiences both by students and faculty.
- Collaboration was key to the success of the BioFlex both on student learning and student-learning experiences.
- The project's outcome was much more than a collection of course content - it was also a model for large-team, cross-campus collaboration.

The BioFlex Team

Left to right:
Karen Smith, Sunita Chowrira, Shona Ellis, Gülnur Birol, Gillian Gerhard, Pam Kalas

Megan Barker, Ehleen Hinze, Marcia Graves, Carl Douglas, Carol Pollock, Greg Bole, Martha Mullally

James Cooke, Wayne Goodey, Erica Jeffery, Lisa McDonnell, Brett Couch, Laura Wegener-Parfrey

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1. Lane, E. and Harris, H. (2015). A new tool for measuring student behavioral engagement in large university classes. *J College Sci Teaching, 44(6)*, 83-91.
2. Smith, M., Jones, F., Gilbert, S., and Wieman, C. (2013). The Classroom Observation Protocol for Undergraduate STEM (COPUS): A new instrument to characterize university STEM classroom practices. *CBE-Life Sci Educ, 12(4)*, 618-627.