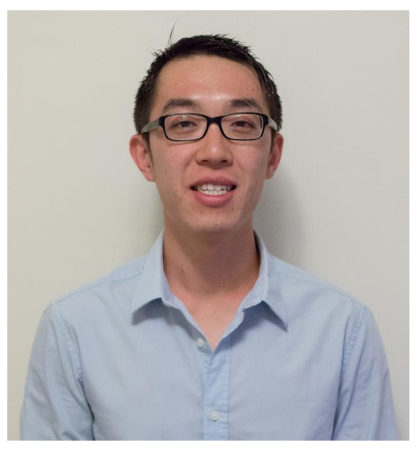

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TEACHING & LEARNING SUMMIT 2016

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Flipping Undergraduate Robotics and Creating Interactive Online Content

- **Goals**: Increase active learning to supplement traditional lectures
- Multi-media exposure to content before attending lectures
- Classroom activities based on student feedback of pre-assignments
- Create online robotics curriculum available to the public

Flipped Robotics Course Design

- Robot Kinematics and Dynamics (16-384) previously taught via traditional lectures and "paper and pencil" homework.
- In fall 2014, students watched pre-recorded lecture videos before class and provided feedback to instructor.
- Freed up classroom time for instructor to actively engage with students on concepts that most needed reinforcement.
- For fall 2016, videos are now part of a full online curriculum on the Open Learning Initiative (OLI) platform.
- Contains interactive exercises and specialized feedback for both students and instructor to make better use of classroom time.
- Will eventually be public to support instructors and self-learners globally.

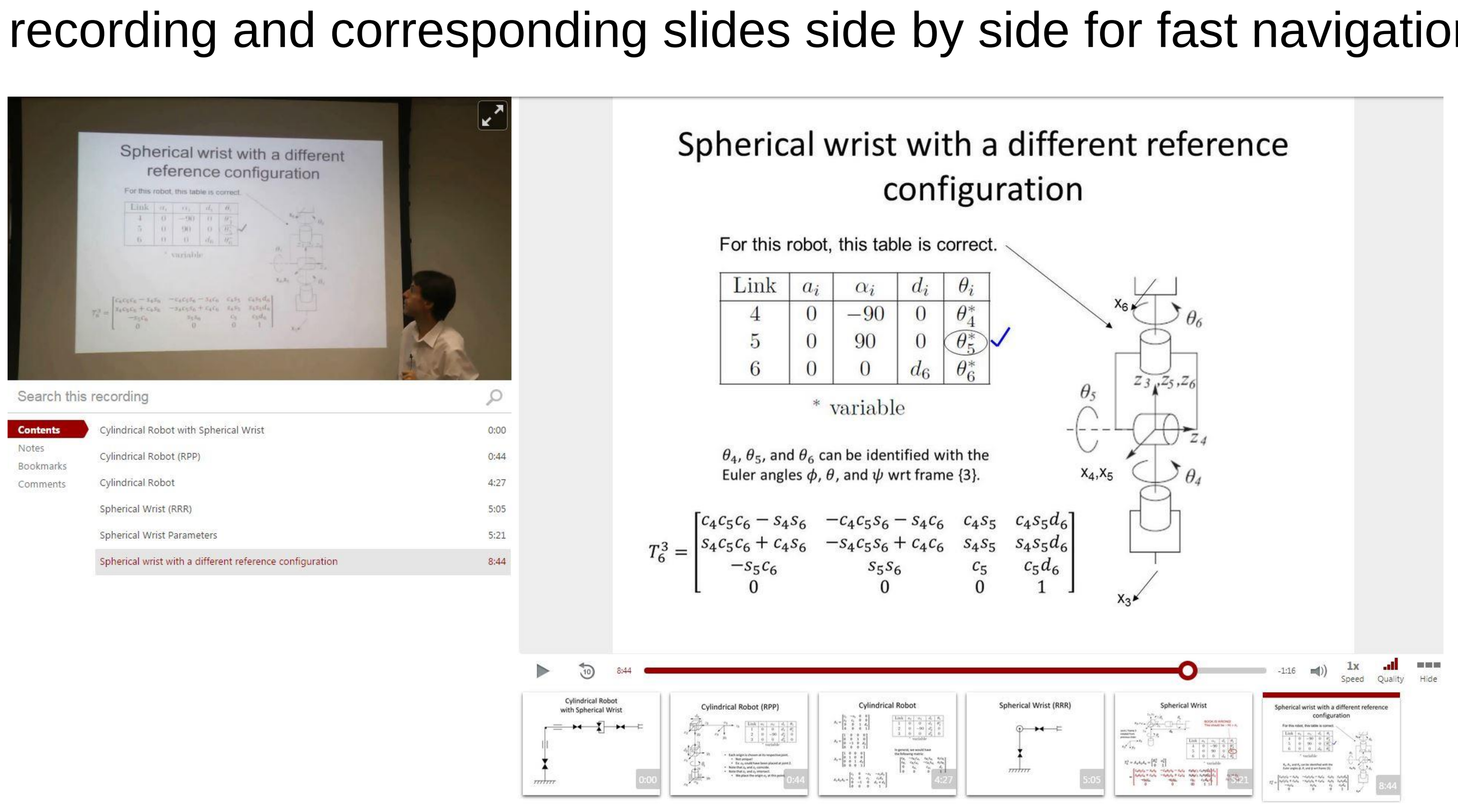
Findings and Lessons Learned

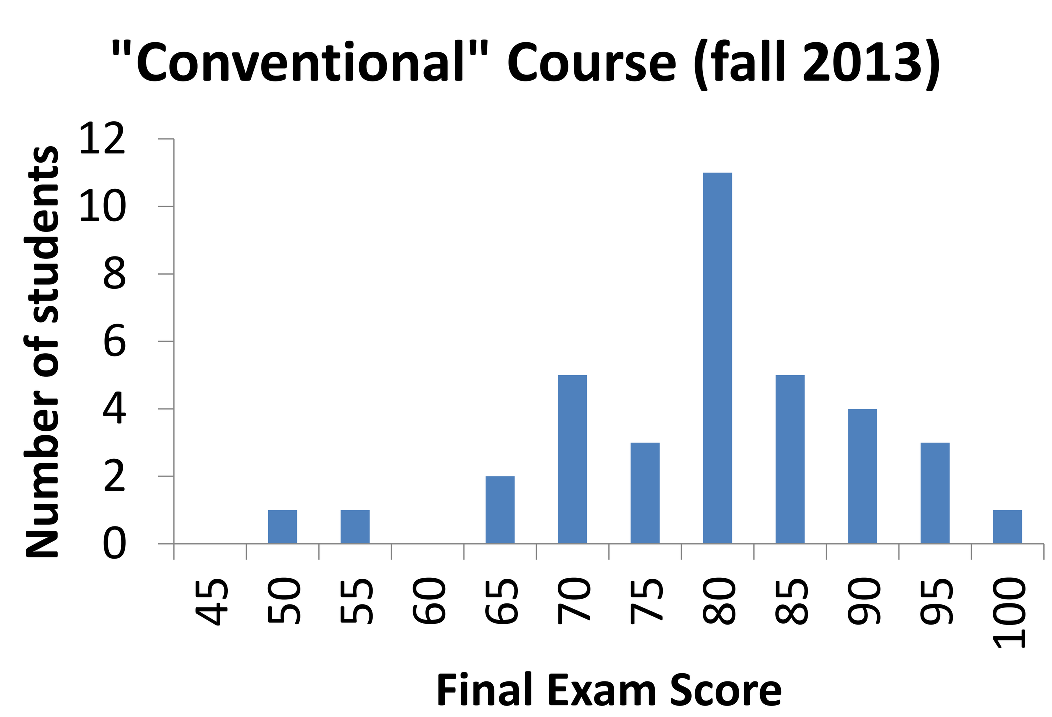
- Hit traditionally lacking learning methods: active, peer-based, and problem-based (as opposed to concepts only).
- Students reacted favorably to flexibility of lecture videos to control pace of learning, take notes, and review on their own schedule.
- Some performance improvement observed on final exam grades compared to previous semesters.
- Sizeable minority of students still preferred traditional teaching method.
- Videos and online content require constant maintenance and refinement based on student feedback and performance statistics.
- Course development workload comparable to creating a new course from scratch despite already having traditional format materials.

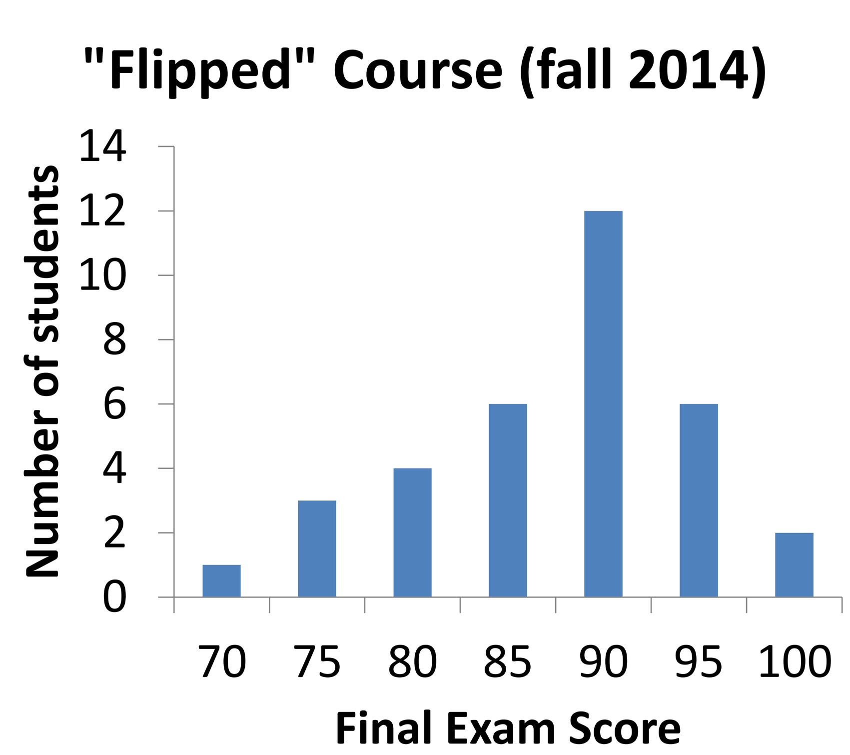
Implementation and Evaluation

Classroom activity (below) vs. Type of learning addressed (right)	Active	Peer-based	Problem-based
Submitting short questions after watching videos	✓		
Fast-paced interactive lecture and review session in teams	✓	✓	
Solving assigned homework problem in teams	✓	✓	✓
Individual oral presentation of homework solution	✓		✓

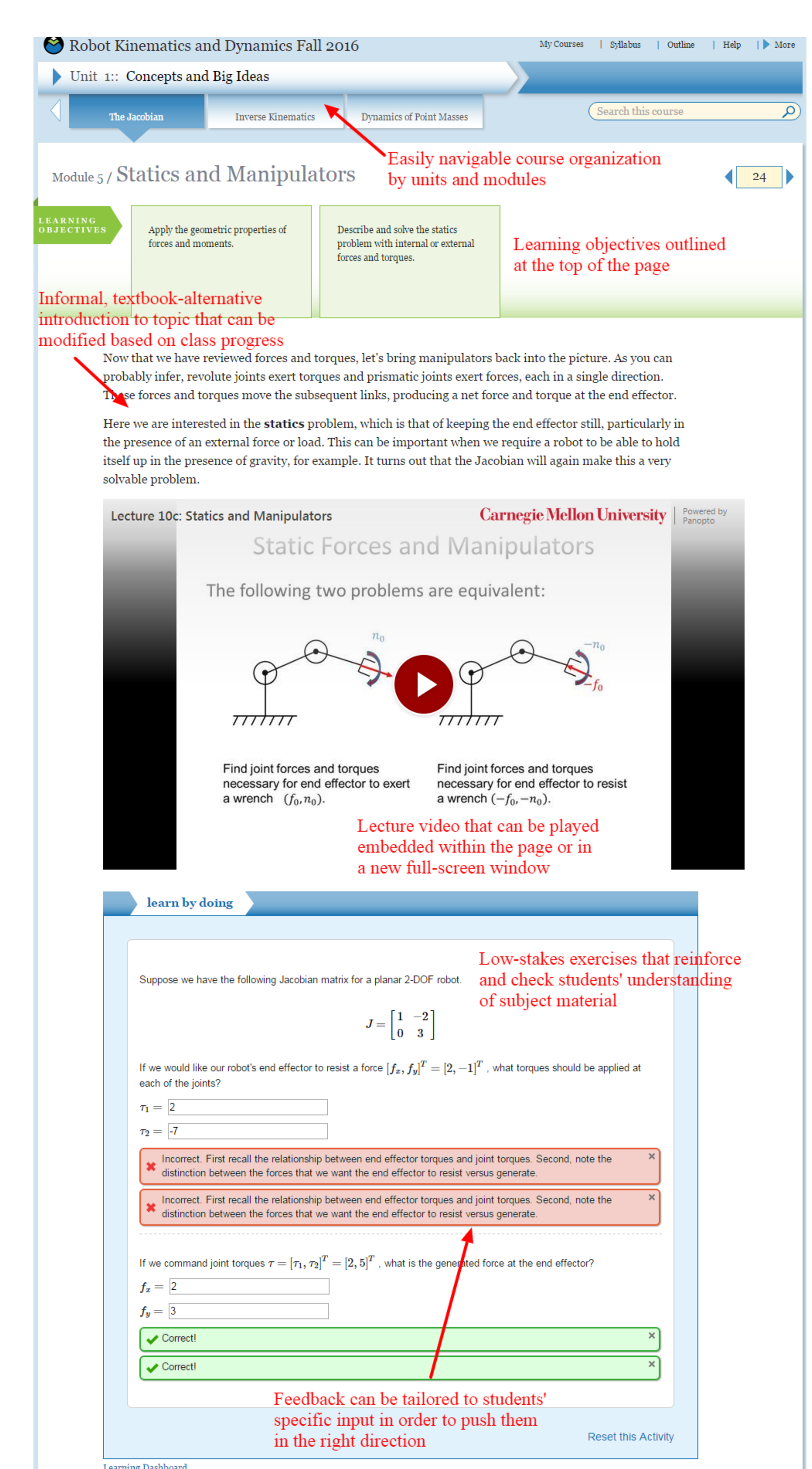
Above: Summary of "flipped classroom" activities from Fall 2014.
Below: Screenshot of lecture video player Panopto, with video recording and corresponding slides side by side for fast navigation.







Comparison of grades from identical final exams in two course offerings. Improvement in average and individual question performance was observed.



Screenshot of online OLI curriculum currently being tested for Fall 2016.

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