A Case Study of "Flipping" Technical Communication Lectures in a Chemical Engineering Laboratory Course

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Introduction

Course Overview

- **Course:** ChE 360 Laboratory, 4 credits
- **Instructional team:** 1 technical, 2 technical communication, 3 graduate student instructors
- **Enrollment:** 54 students
- **Weekly Schedule:** One 4-hour laboratory, two 50-minute lectures (1 technical communication, 1 technical)
- **Lecture Delivery:** All via PowerPoint slides (before flip)

Motivation for Project

- Students typically received first exposure to technical communication content in lecture.
- Assignments and grades were mostly team-based.
- Students received little individual writing feedback.
- Technical Communication instructors sought to:
  - increase student engagement
  - provide individual feedback to students
  - explore effectiveness of a flipped classroom, including pre-recorded, short videos

Research Questions (RQ)

- **RQ1:** What are student perceptions of their communication skills before and after course?
- **RQ2:** Did student performance on homework assignments increase throughout the semester?
- **RQ3:** How are course evaluation scores affected with flipped classroom approach?

Design of Flipped Classroom

Schedule of Pre-Work and In-Class Activity

Flipped #1: (Sept. 11, 2013)	Flipped #2: (Sept. 18, 2013)	Flipped #3: (Sept. 25, 2013)	Flipped #4: (Oct. 2, 2013)	Flipped #5: (Oct. 16, 2013)
Pre-Work: (1) Videos 1, 2 on Calibration Report (2) Pre-Course Survey	Pre-Work: (1) Video 3 on Calibration Report (2) TC HW1 Calibration Report Critique	Pre-Work: (1) Video 1 on Final Report (structure) (2) TC HW2 Final Report Critique (structure)	Pre-Work: (1) Video 2 on Final Report (visuals) (2) TC HW3 Final Report Critique (visuals)	Pre-Work: (1) Video on Standard Operating Procedures (SOP) (2) TC HW4 SOP Critique
In-Class Activity: None	In-Class Activity: Workshop on TC HW1	In-Class Activity: Workshop on TC HW2	In-Class Activity: Workshop on TC HW3	In-Class Activity: Workshop on TC HW4

Pre-Work Activity: Watch video and critique sample document

Students watch video lecture (5 to 12 min.)

Students write memo that critiques sample document (rubric below)
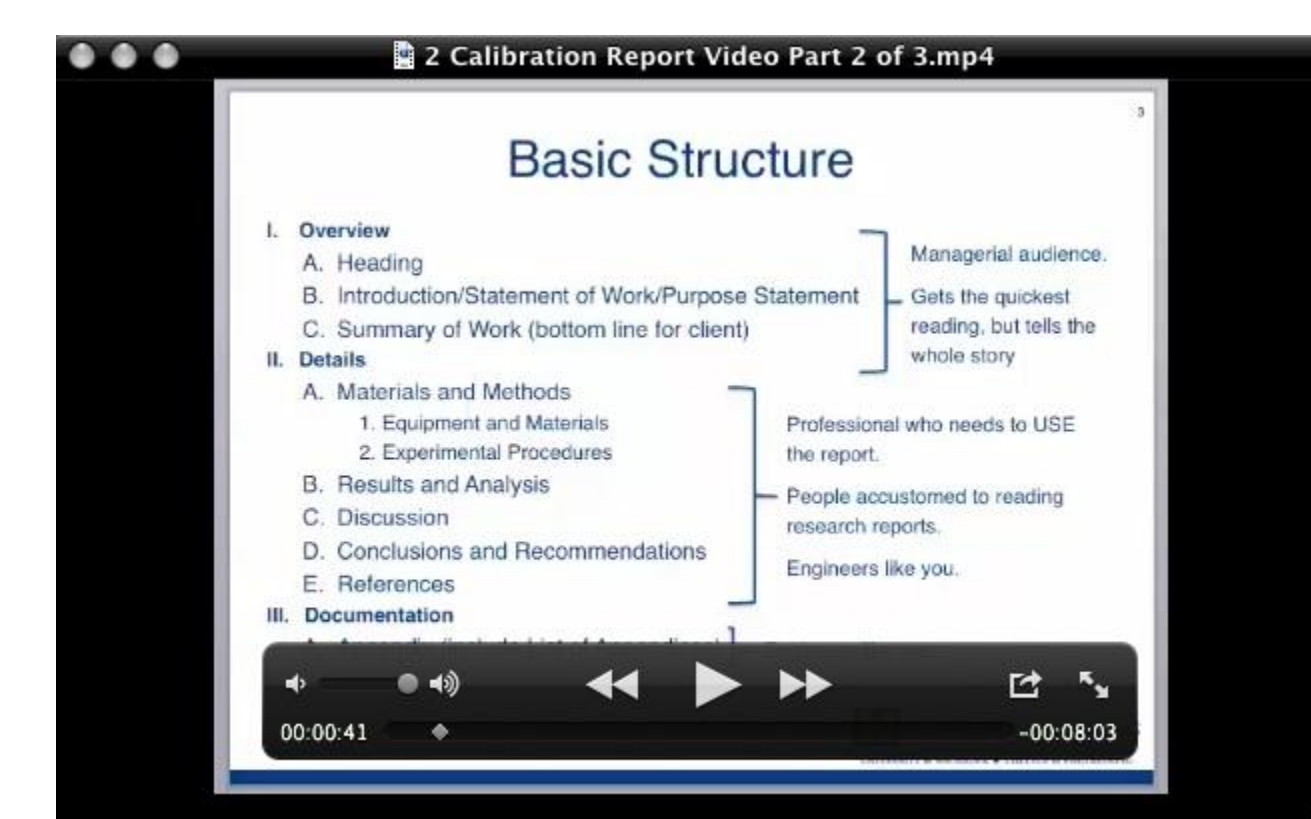
Note: Students also had access to a "feedback" video after TC HW1, 2, and 3 that provided a "talk through" of key elements that should have been included in their individual critiques. Watching these videos was optional.
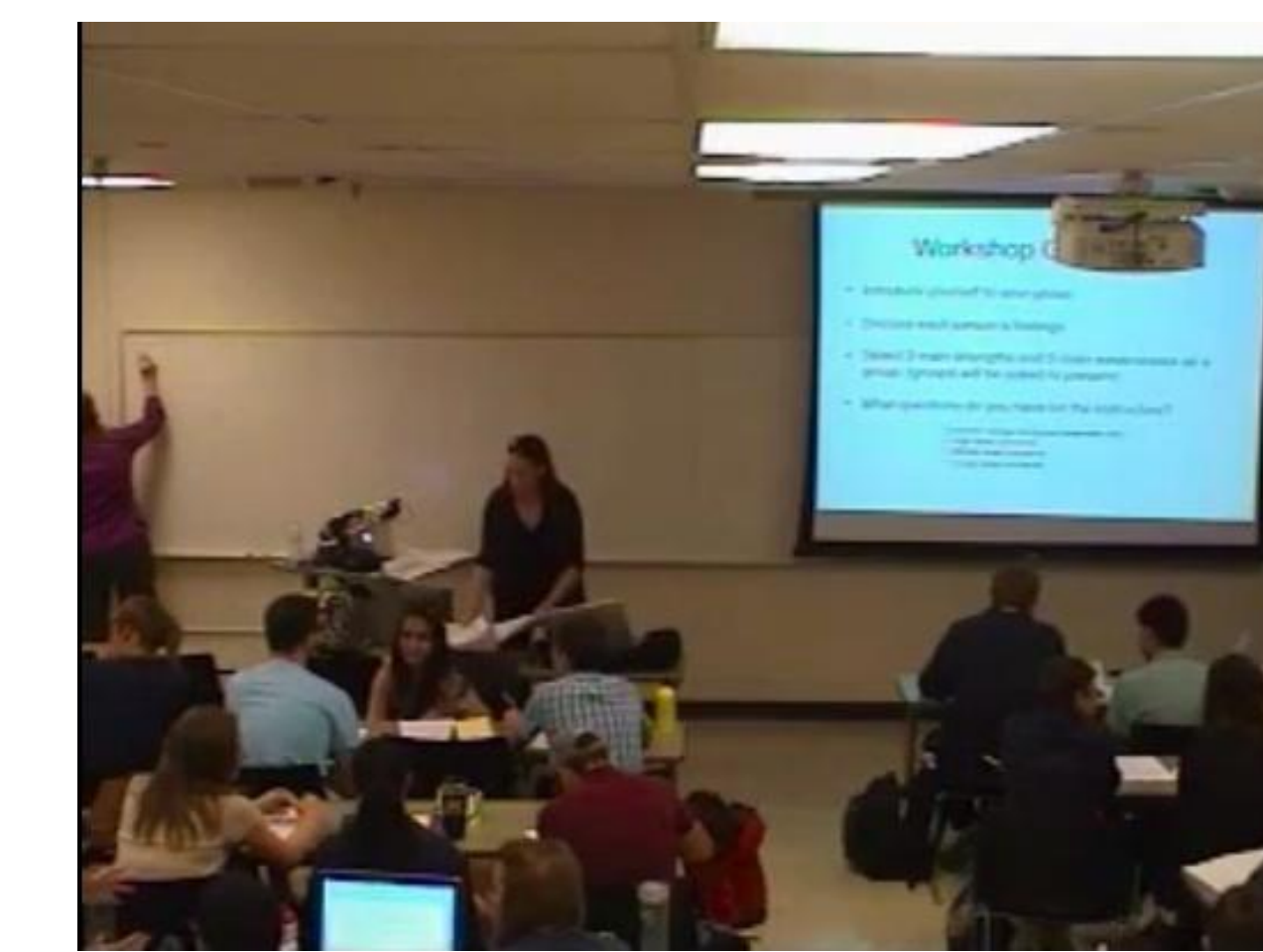
In-Class Activity: Group Work and Presentation

Students are placed into pre-determined groups of 3 or 4 students and given tasks based on TC HW:

- identify top 3 to 5 strengths of certain sections
- identify top 3 to 5 areas to improve certain sections
- revise and rewrite sections

Group members discuss their individual results for 25-30 mins and reach consensus on given tasks
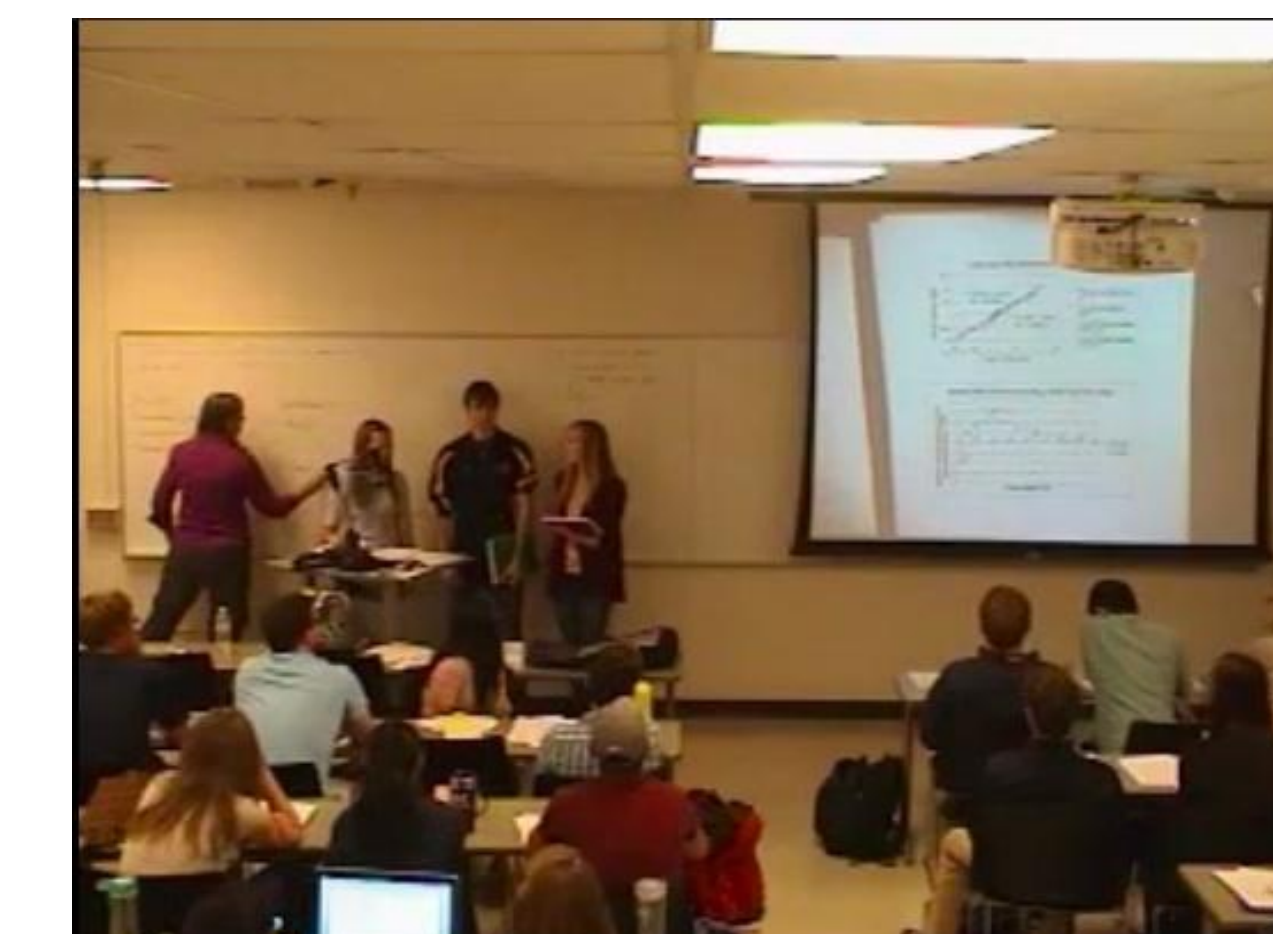
Groups present their joint results (3 to 5 groups per session)

Data Collected

Pre-Course Survey: Online survey with questions regarding their:
- experience in academics and industry
- experience with flipped classrooms
- assessment of strengths and areas for improvement in written and oral communication
- preferred teaching approaches
- expectation of how videos will affect their learning

Midterm Feedback Session: Learning and Teaching Consultant conducts 45-minute discussion with class about student experiences with course and instructors.

Post-Course Survey: Online survey with comparable questions from Pre-Course Survey.

Debriefing Meeting: 15-minute meeting with instructor to discuss their:
- use of the video content
- time spent on each TC HW assignment
- grades on TC HW assignments
- use of comments on previously graded TC HW
- major concerns or feedback with course

Course Evaluation Scores: Scores from Fall 2013 and previous semesters (Fall '12, Winter '13) regarding student ratings of the excellence of the course and instructor, and desire to take course.

Course Performance: Scores from TC HW1, 2, 3, and 4 and overall technical communication score.

Course Online Resources Usage: Measure of whether student accessed and downloaded the technical communication resources (e.g., videos, lecture slides, grading rubrics).

Initial Results

RQ1: Students seem to perceive an improvement in written communication skills after completing the course (n=36)
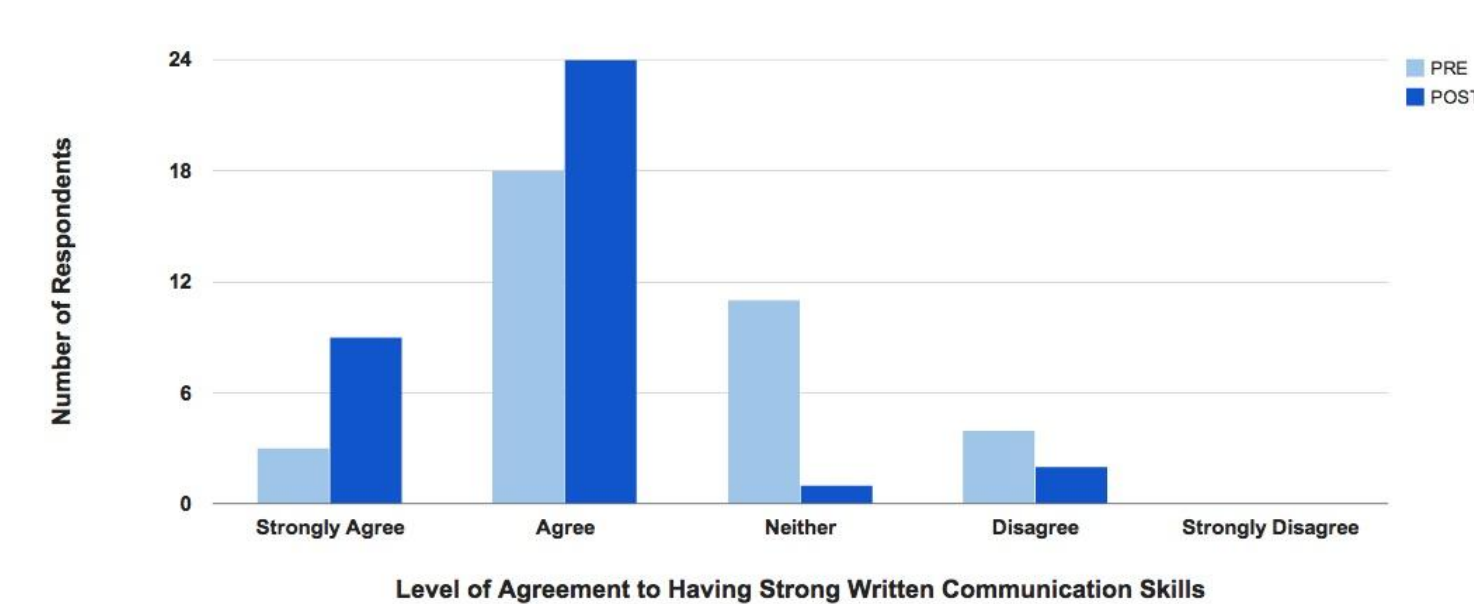
**RQ2:** Avg. TC HW performance increased (n=54)

TC HW1 85.5% TC HW2 86.3% TC HW3 88.8% TC HW4 90.6%
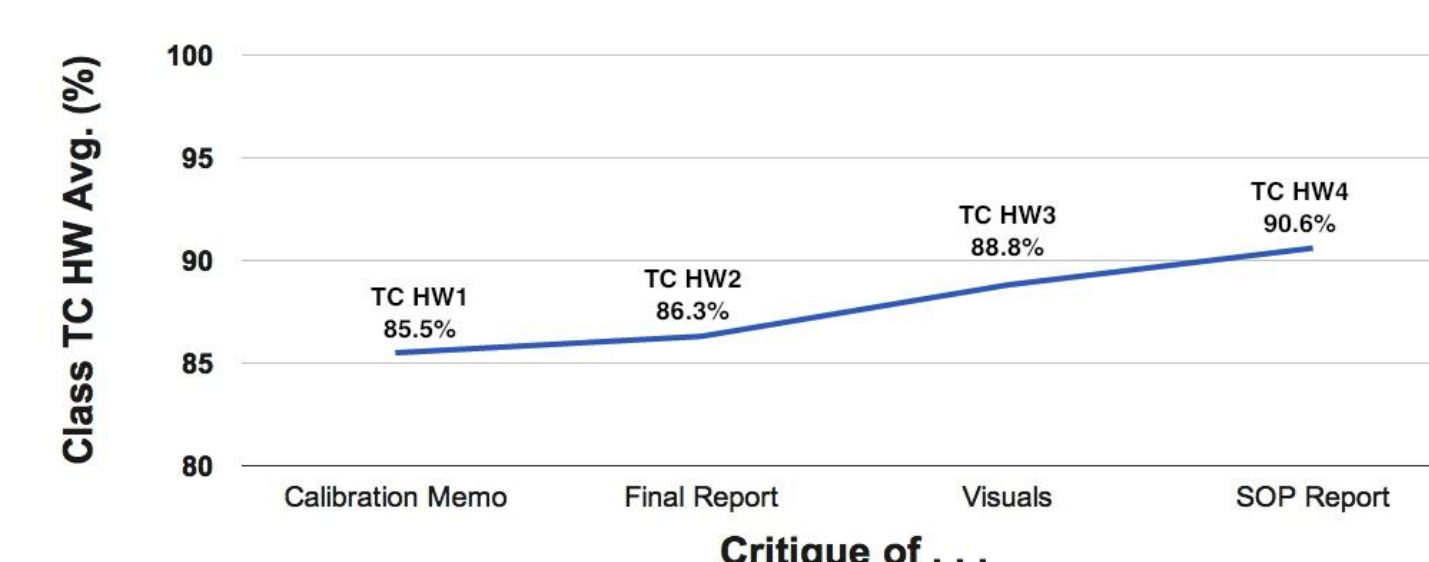
RQ3: Course evaluation scores increased for "excellent instructor" with flipped classroom

Semester	Response %	A	B	C
Fall 2013 (with flipped classroom)	25.9 (14/54)	3.88	4.63	3.33
Winter 2013	43.0 (31/72)	4.07	4.35	3.75
Fall 2012	37.5 (21/56)	4.00	4.55	3.88

A: Overall, this was an excellent course. B: Overall, the instructor was an excellent instructor. C: I had a strong desire to take this course.

Communication experiences from academics or industry may affect course grade

Design Reports 5%, Proposals 4%, SOPs 9%, Articles 9%, Memos 13%, Lab Reports 16%, Orals 21%, Email 23%
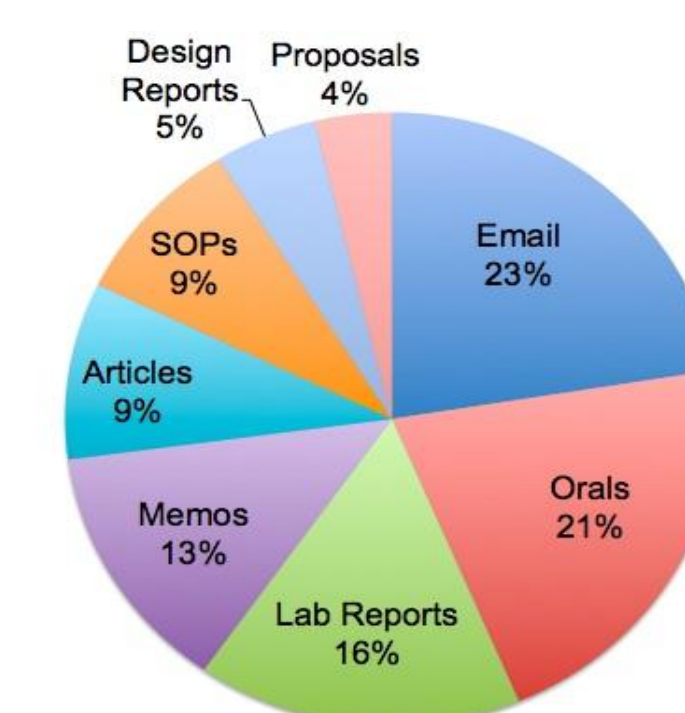
Students have most experience with email and oral communication and least with proposals and design reports.

Engin 100: Taking Engin 100 resulted in higher average TC course grades:
- took (n=47, 91.5%)
- did not take (n=7, 87.3%)

Internships: Having more than one internship resulted in slightly higher average TC course grades:
- 2 or 3 (n=15, 92.8%)
- 0 or 1 (n=39, 90.6%)

Students desire to improve oral communication skills

Desired Areas to Improve	%
Delivering oral presentations	72%
Understanding and practicing conventions for genres (reports, SOPs, proposals)	29%
General writing skills (organization, clarity, concision, coherence)	20%
Time management	4%

Amount of time spent on homework does not seem to affect grade
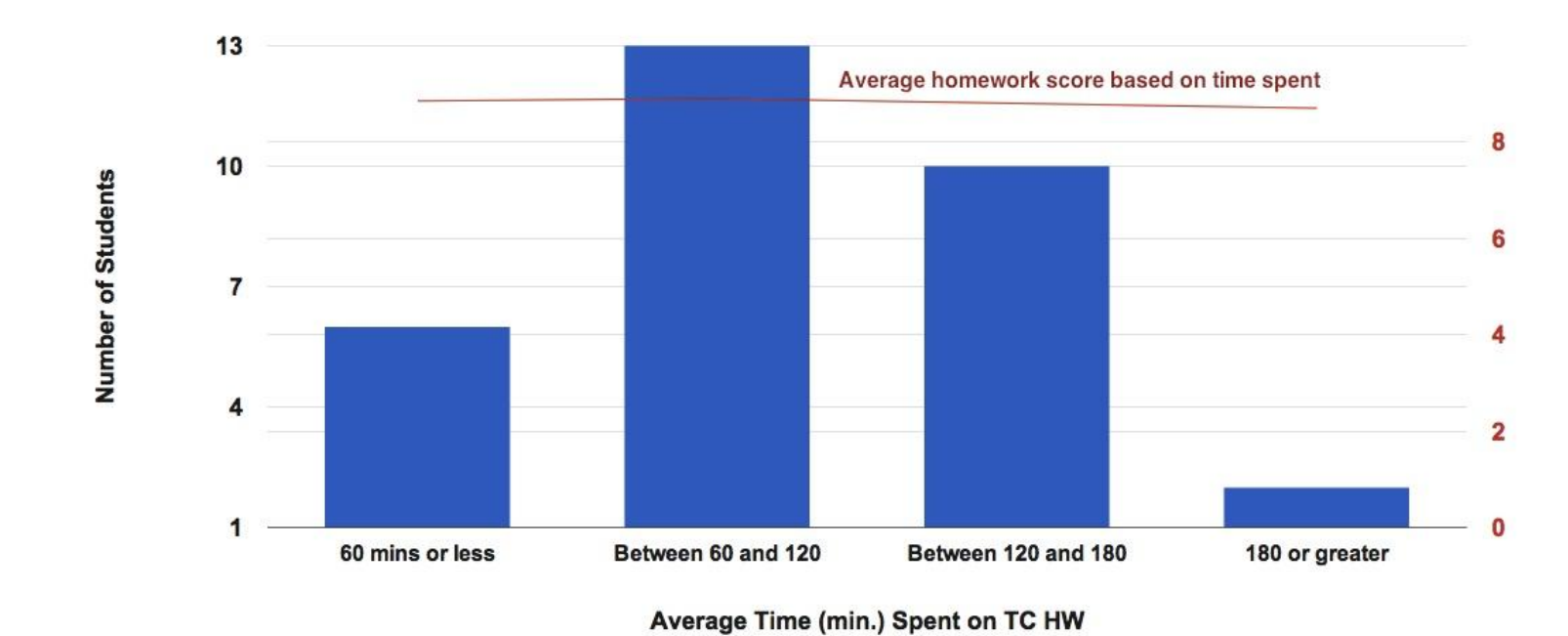
Conclusions

- **Low responses to course evaluation limit conclusions**, but do show higher instructor approval and no significant changes in class approval despite the lowest score in class history on "I had a strong desire to take this class".

- **Potential undesired negative effect not related to "flipped" approach.** Repetitious nature of homework assignments seemed to be associated with some, possibly unwarranted, negative connotations for the flipped approach.

- **Students wrote an average of 10 more individual pages** with flipped approach versus past semesters and also met individually with class instructors more than past semesters.

- **Creating more engagement in the writing process and genre awareness** via the critique memo assignments created moderate positive gains in student perception and performance.

- **Future modifications include more variation in assignments and in-class activities** to address student concerns over repetitive assignments. Also plan to generate more non-video reference materials to address a perceived lack of positive direction.

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