

# Use of MOOCs in the Inverted Classroom Model

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# Inverted Classroom

- Also known as flipped classroom
- Course material is delivered through resources such as online videos and textbooks.
- Students study course material *before* attending lecture.
- During lecture, students do in-class exercises with the support of the instructor (and possibly TAs).



# Two Studies

- **Study 1:** Compare fall 2012 to winter 2013 offerings
  - Very different populations: fall students mostly intend to major in CS, winter students mostly taking it as a requirement or out of personal interest
  - Study focused on student experience
- **Study 2:** Compare fall 2012 to fall 2013 offerings
  - Same populations
  - Study focused on student outcomes

# CSC108H Introduction to Programming

- Students
  - Mostly 1st year students, but also 2nd-4th year.
  - Majority are Computer Science students, but many non-CS too.
- Typical lecture section sizes of ~200 students
  - Three to five sections in both Fall and Winter terms
- Typical lab section sizes of 30 students
- **Traditional:** 3 lecture hours, 2 lab hours per week
- **Inverted:** 3 lecture hours, labs replaced by a new online tool

# Our Inverted Offering

- **Before lecture:** students prepared by watching videos
  - Videos also used for two MOOCs; featured Jen and Paul
  - Mostly screencasts of “live” programming with voice over
  - Credit for attempting quizzes embedded in videos; 0.5% per week
- **During lecture:** students worked on exercises
  - Exercises provided on worksheets; many worked on paper
  - Students worked solo or in pairs
  - Worksheets were not collected; attendance not for credit either
  - Instructor plus 1 TA per 100 students enrolled
- **After lecture:** students did an online exercise
  - A series of programming problems

# Evaluation

- Pre- and post-course surveys
  - Completed on paper during lecture
  - Administered by a faculty member who was not teaching this term
- Survey 2:
  - 1236 completed pre-course survey
  - 485 completed post-course survey
- Questions related to demographics, interest in pursuing a CS program, interest in CS1, enthusiasm for CS1, difficulty of CS1, time spent on CS1, and more.
- Weekly lecture attendance counts; enrolment tracked
- Standard university course evaluations collected

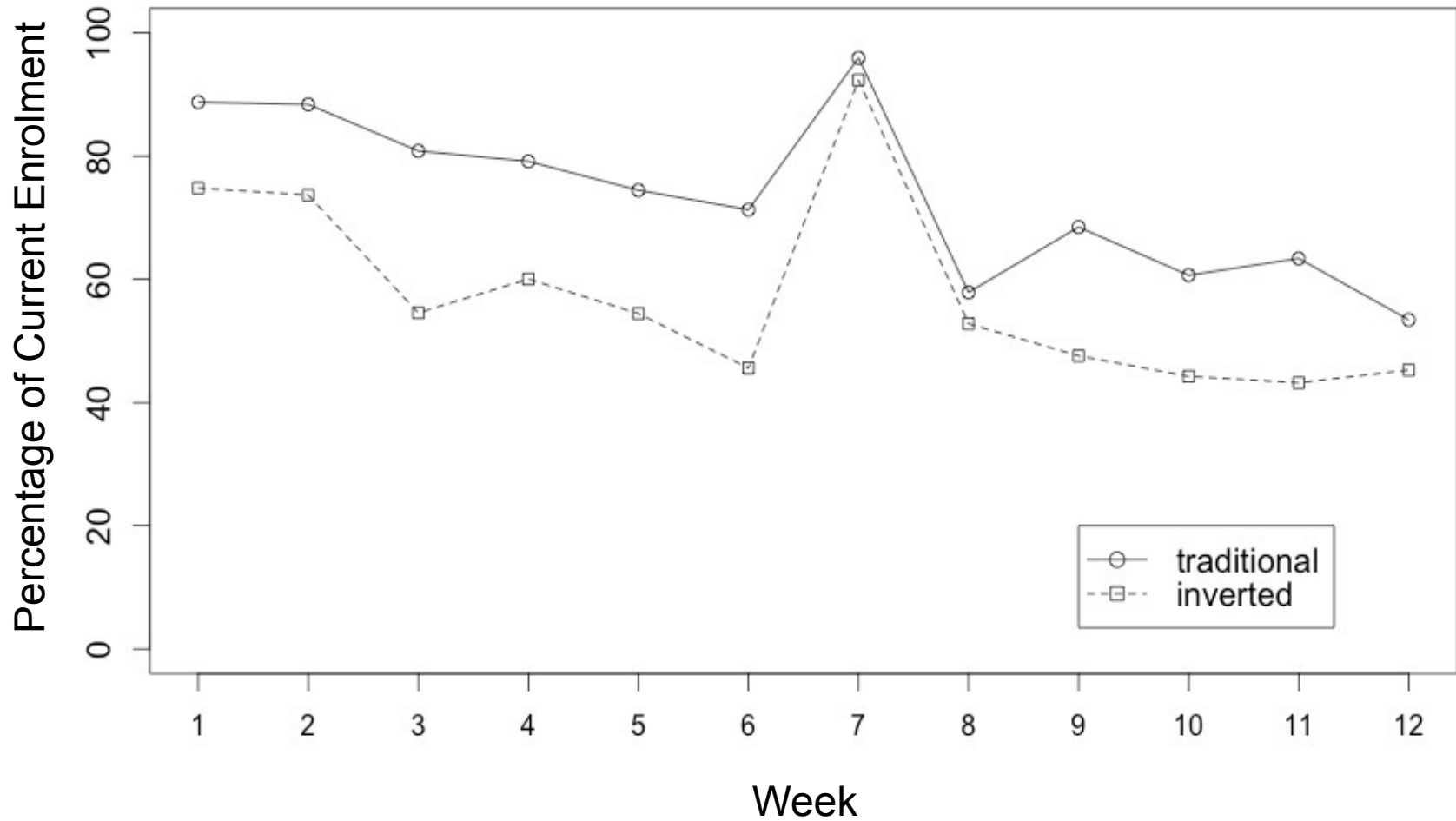
# Results

# Student population

- Just under 50% had prior programming experience in each term
- Roughly 50% females and males



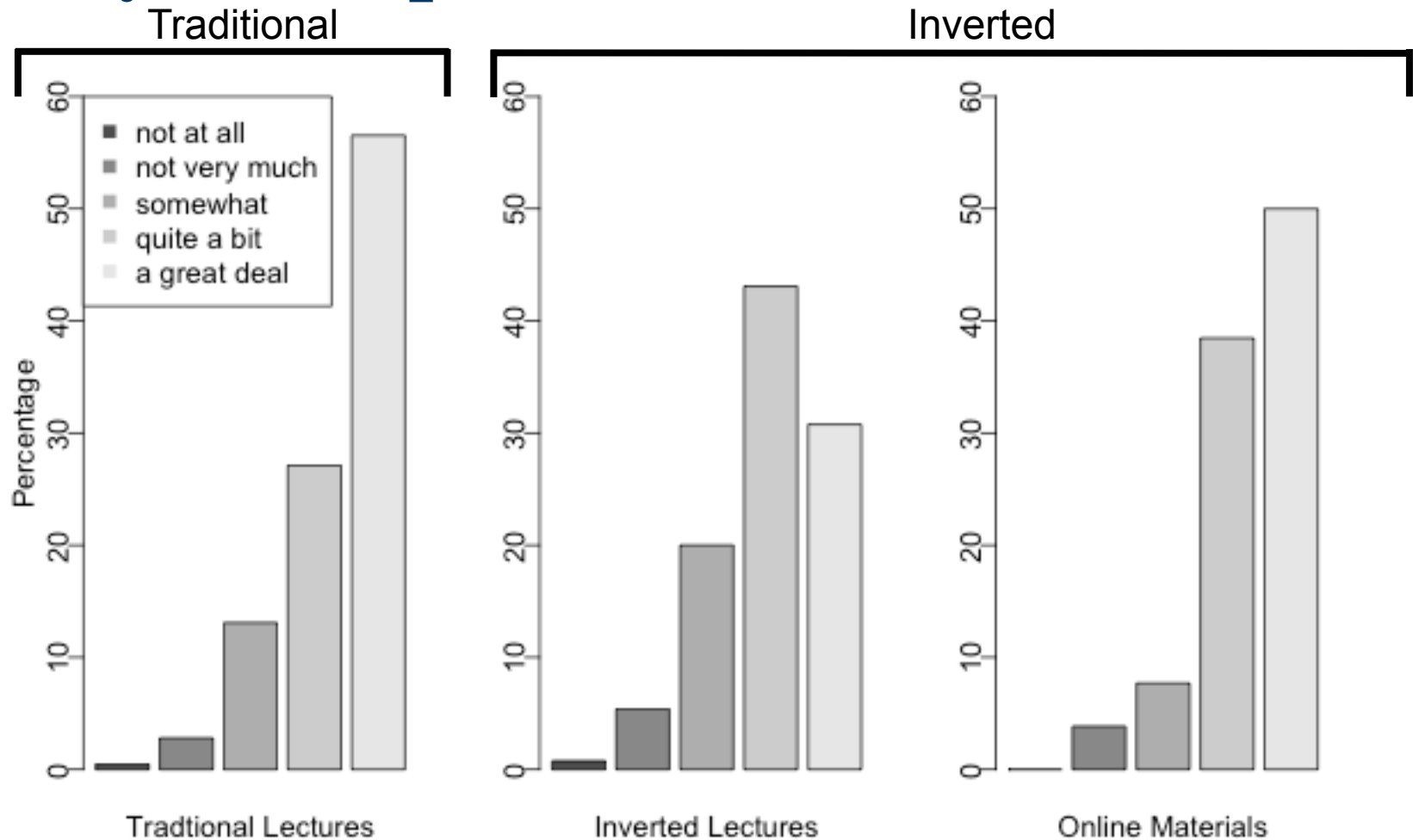
# Study 1: Low Lecture Attendance



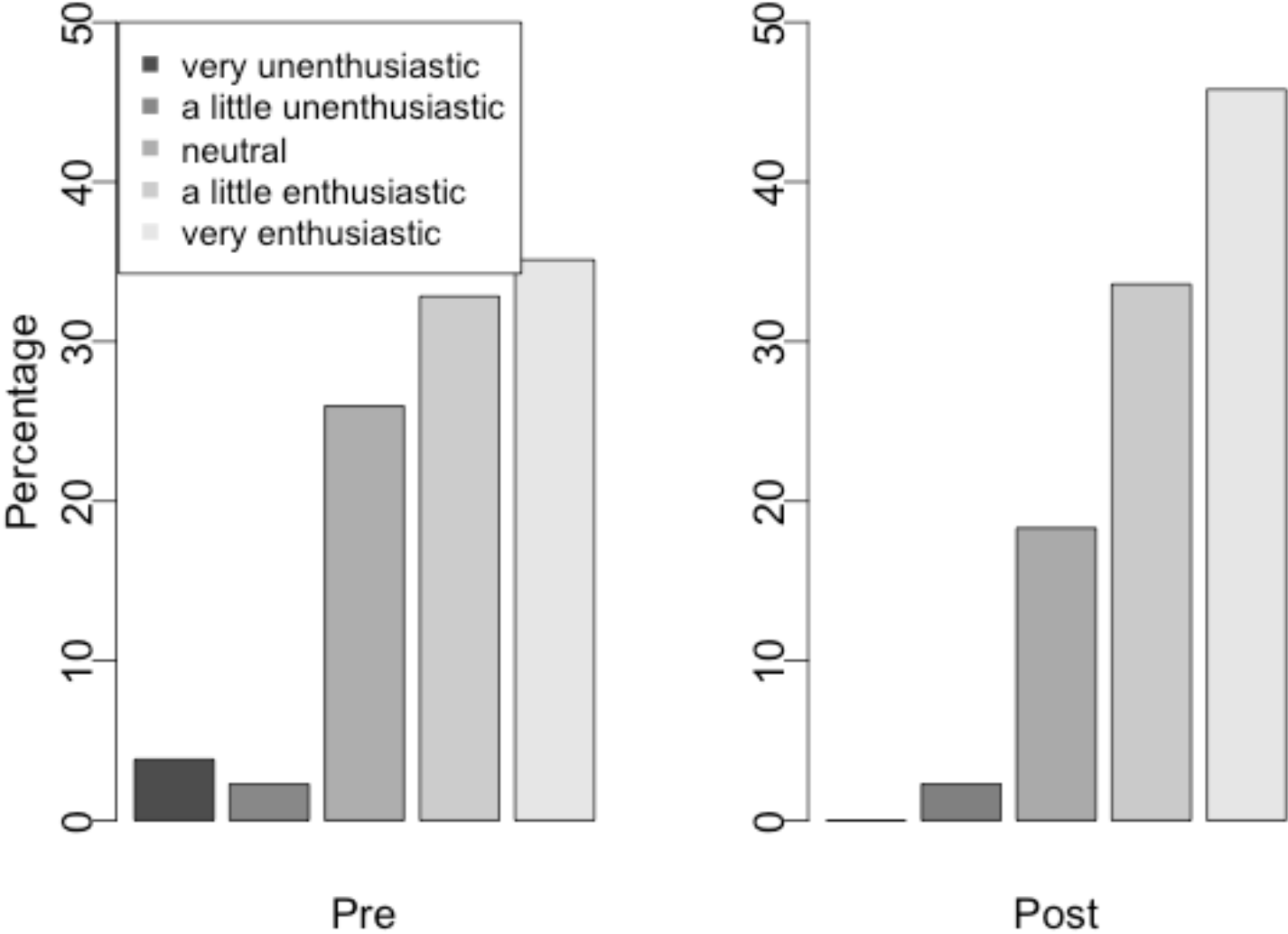
# Study 2: attendance rates on the day of the post-course survey

	Gender		Prior Experience		English-language Proficiency	
	F	M	Beg	Non-beg	Fully	Not Fully
Trad	50%	42%	44%	46%	52%	33%
Inv	47%	43%	41%	47%	50%	37%

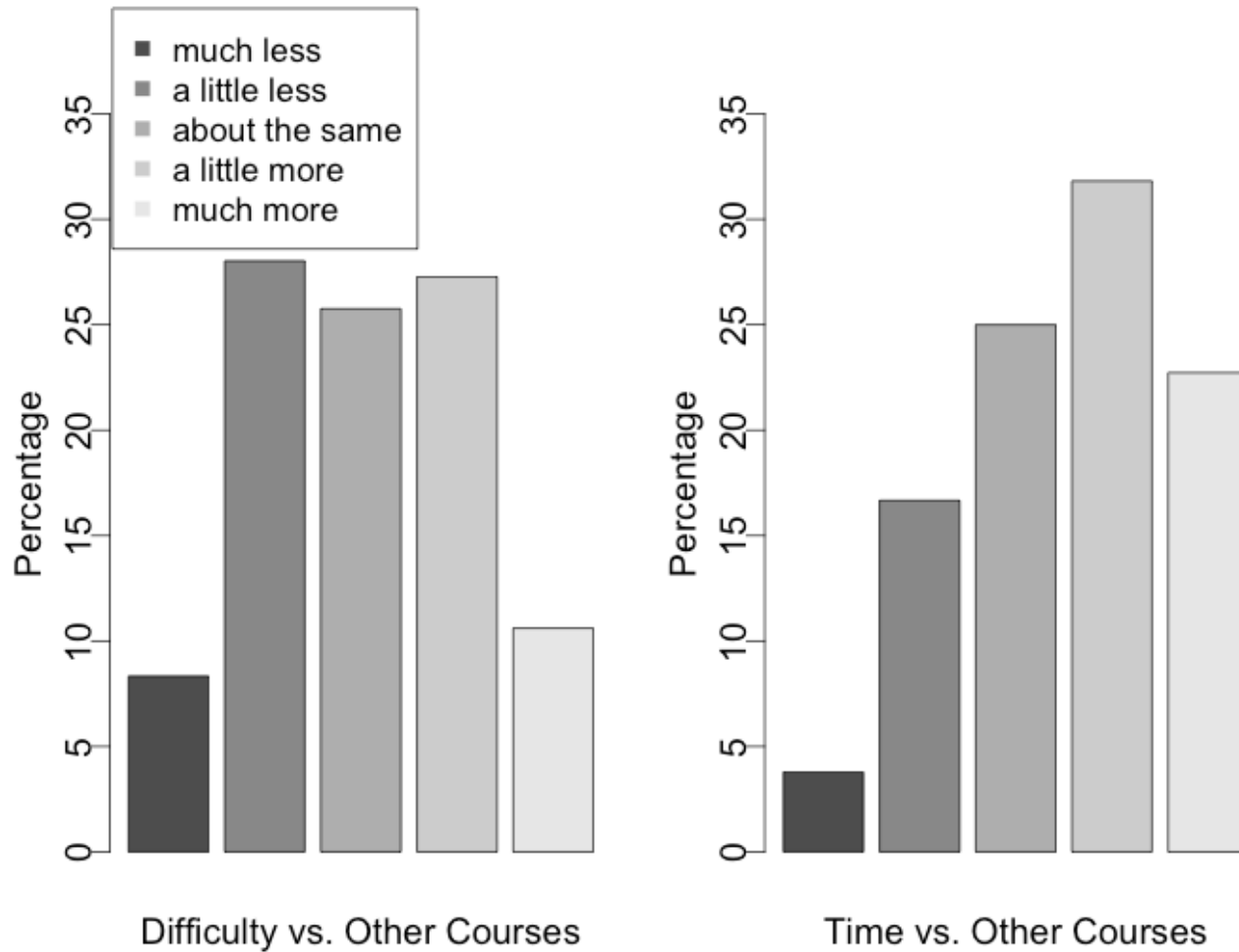
# Study 1: Helpfulness



# Study 1: Enthusiasm Increased



# Study 1: same difficulty, more time



# Study 1: Difficulty, Time by Subgroup

- We explored whether the explanatory variables (gender, commute time, proficiency with English, prior programming experience, etc.) correlated with difficulty or time.
- Surprisingly, women found the course more difficult and more time consuming than men.
- More surprisingly, prior programming experience was not correlated with difficulty or time spent on the inverted course.

# Study 2: Helpfulness, Difficulty, Workload

- Helpfulness results are the same
- Traditional and inverted drop rates the same
- Time spent the same
- Inverted rated slightly more difficult than traditional
- English proficiency seems to have no influence on these!

# Study 2: Exam Grades

- **Exam Grades: yay!**
  - Inverted exam independently rated at least as hard as traditional
  - Despite this, inverted exam grades 8% higher than traditional (74.3% vs. 66.2%)
- Hypothesis: in-class exercises *on paper* were valuable test preparation



# Lessons Learned

# Resources

- Video preparation took ~600 hours
- Development of in-class exercises took ~130 hours
- Development of online exercises took ~50 hours
- We can reuse most of these
- Extra TA support was required to facilitate in-class exercises
  - We replaced most weekly two hour labs with online exercises and a TA Drop-in Help Centre.
  - This allows us to teach using the same TA resources as the traditional offering.

# Lecture Delivery

- We begin each lecture with a short worked example
  - Introduced material in the style the students would see on the in-class exercises
  - Didn't repeat material from the video lectures, but set the stage for students
  - Otherwise students often had difficulty getting started
- Lecture preparation is for credit
- Lecture attendance (in-class exercises) is not for credit
  - Lecture attendance is low
  - We are strongly considering requiring attendance (clickers, quizzes, some other mechanism)

# Next Steps: inverted is so passé

- **Fall 2014:** 4 inverted sections *plus a fully online section!*
  - Hosting the video lectures locally
  - Same assignments and online exercises, shared final exam
  - Online section won't have a midterm
  - Online section will have additional online support (dedicated TAs, online office hours, extra help)
  - Lots of concerns to address (possibly higher drop rate, students falling behind, students needing individual attention)
- **Someday:** a self-paced version of the course
- (No, we're not getting rid of inverted.)

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