

Notes From A Capsized Classroom

Experiences With a Hybrid Teaching Model Combining Traditional and Inverted Lectures in Introductory Computer Science Courses

Brian Harrington, Mohamed Moustafa, Marzieh Ahmadzdeh, Jingyiran Li, Nick Cheng

Department of Computer and Mathematical Sciences, University of Toronto Scarborough



UNIVERSITY OF
TORONTO
SCARBOROUGH

Abstract

The benefits of inverted lectures are well documented, including improved retention and a focus on active, student-directed learning. However, the prospect of converting a course to flipped classroom can be daunting, both for the amount of time required to develop on-line resources, and for the prospect of relying on students to adequately prepare outside of class time. Many instructors may feel that they would like to adopt inverted lectures in their classroom, but are not prepared to commit to a complete conversion of their course. Over the course of three offerings of an intro CS course, we were able to develop a model which is relatively easy to adopt, requires much less intense preparation than converting fully to inverted lectures, and appears to have been positively received (after some initial difficulties) by the students. This also provides an interesting opportunity to study student survey responses in order to determine which types of students prefer inverted lectures over the traditional model, while there is no obvious trend with respect to grades, we did find a preference for traditional lectures among international students, as well as a very strong preference for inverted lectures among female students.

Main Objectives

1. Develop a lecture format that retained some of the benefits of the flipped classroom whilst maintaining a lower barrier to entry
2. Keep as much of the in-class experience 'in-the-room' as possible
3. Provide a teaching model that is not overly paternalistic and is easy to implement with little to no change to course design or logistics

Semi-Inverted Model

- Course initially consisted of 3 hours of lecture per week
- Two of those hours were kept as 'traditional' style lecture time, and the remaining one hour was inverted
- First version of the model focused on presenting live coding or tracing questions during the inverted lecture, and instructing students to work through them
- Questions were taken up at the end of the inverted lecture
- Second version of the model replaced this with worksheets consisting of 2-3 questions. Students were instructed to work together to answer the questions and later submit them for grading
- The second version did not provide answers to worksheets

Results

- Students were asked to pick their top three (of a total of seven) course components that they found most beneficial to their learning experience, and rank them
- Rankings were given weighted scores where the highest rank was given a score of 3, the second highest a score of 2, and the third highest a score of 1
- Cumulative totals for each component were then computed, and compared as a percentage of total marks allocated.
- Data was compared to the 2015-2016 version of the survey (as seen in Figure 1) where lectures were always a popular course element, second only to weekly exercises
- Inverted lecture immediately became the most popular component, beating out both traditional lectures and exercises
- Points allocated to inverted lectures appear to have come from those previously allocated to readings, whose score dropped drastically between the two offerings of the course, despite the readings being kept constant

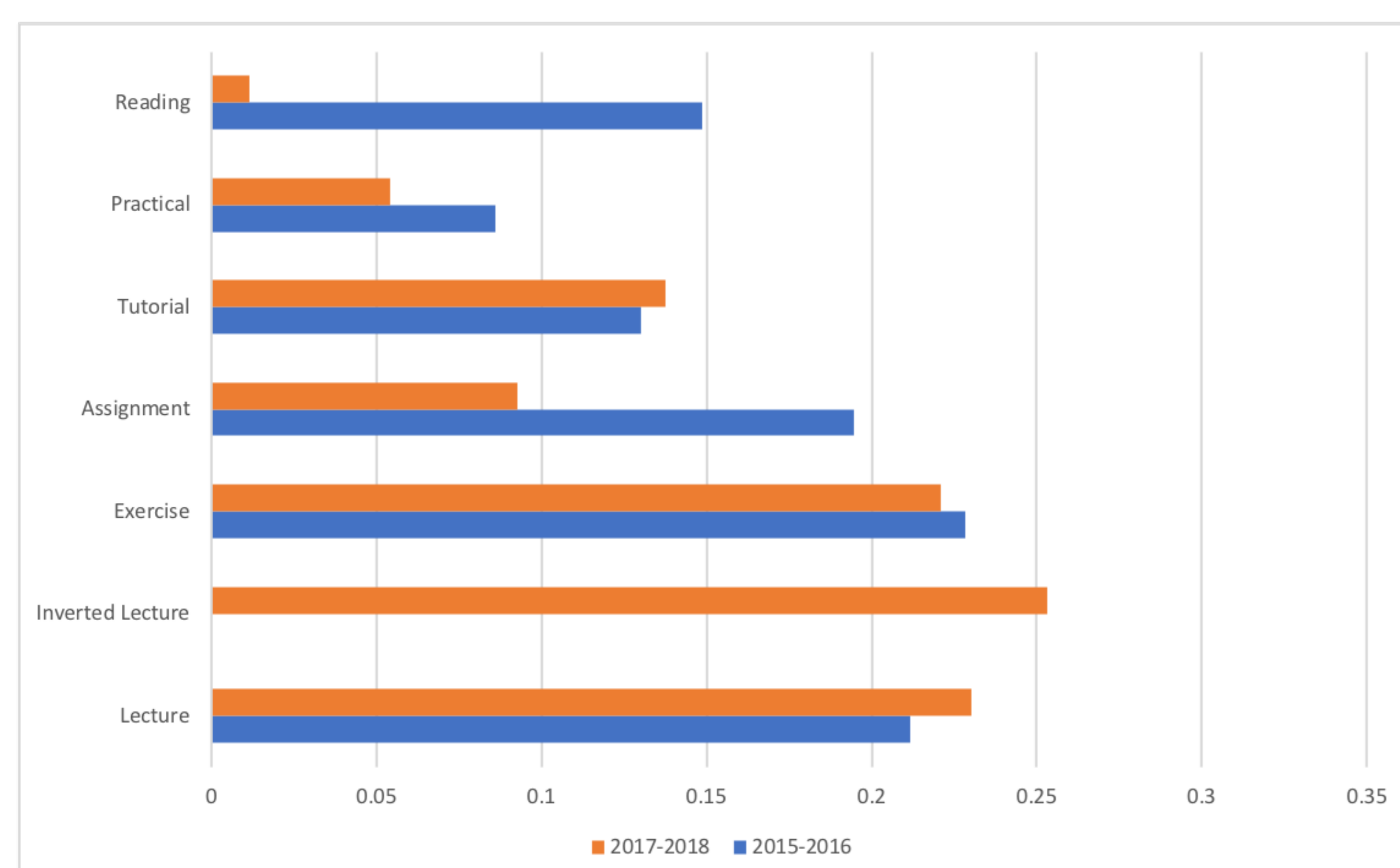


Figure 1: Students survey results compared with traditional offering

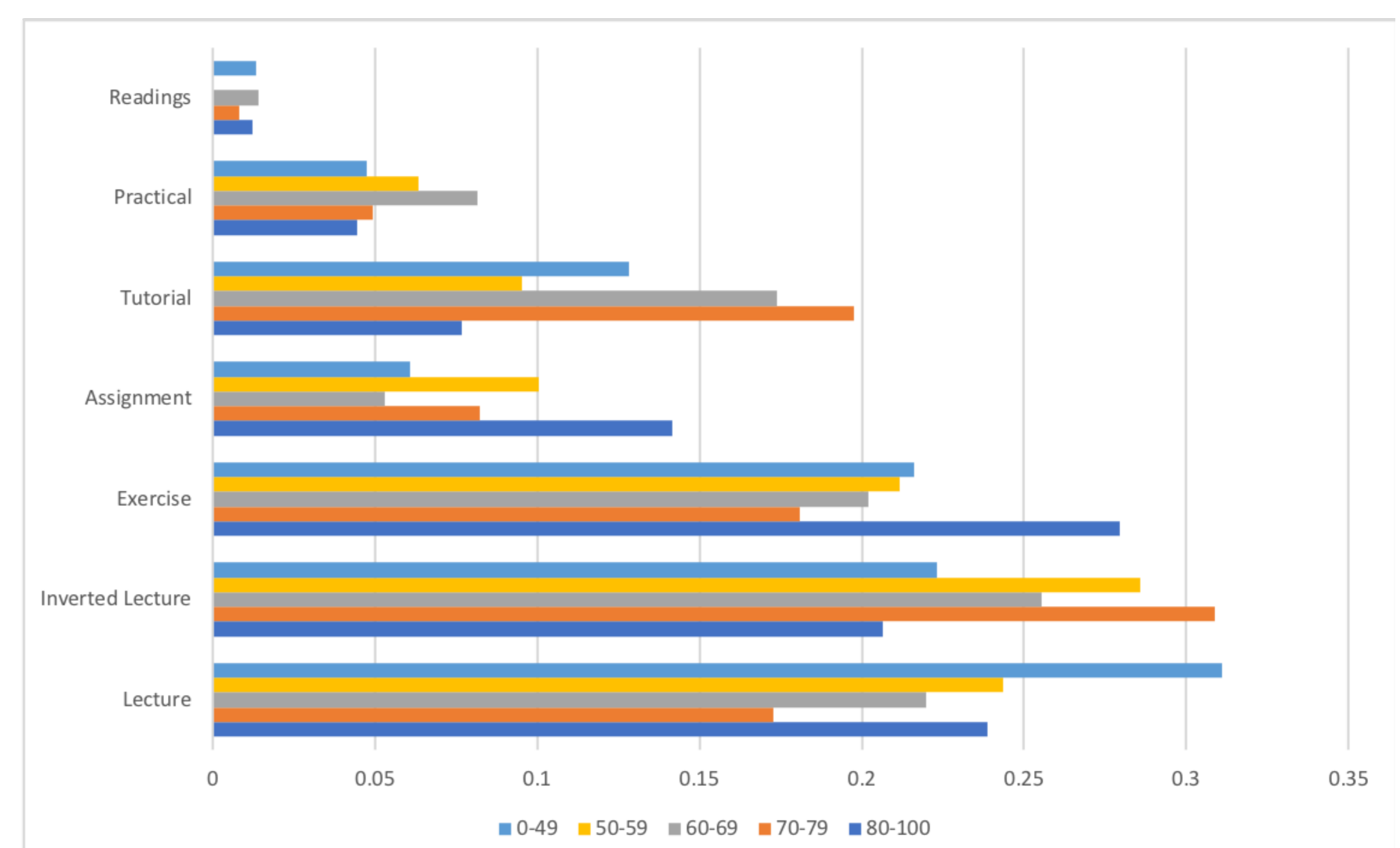


Figure 2: Students survey results by final grade

- Further analysis was done to see if distributions changed for various sub-groups
- Inverted lecture appears to be least popular with students at the lower and higher end of the grade spectrum (those with final grades below 50 or above 80)
- Inverted lecture was most popular with those in the middle of the spectrum. An opposite effect was observed for the traditional lecture
- When data was separated by international and domestic students, it appears that domestic students preferred the inverted lecture more than their international counterparts
- The difference between the two groups was found to not be statistically significant when performing a Pearson's chi-squared test with Yates' continuity correction ($\chi^2 = 0.061719$, $df = 1$, $p = 0.8038$)
- Grouping the data by gender found that the traditional lecture was ranked more highly by males, whereas inverted lecture was ranked much more highly by females
- 62.3% of female students had inverted lecture as one of their top three components, compared to only 42.9% of males
- Running a Pearson's chi-squared test with Yates' continuity correction based on the number of students putting inverted lecture in their top three components showed that there was in fact a statistically significant difference ($\chi^2 = 5.8551$, $df = 1$, $p = 0.01553$)

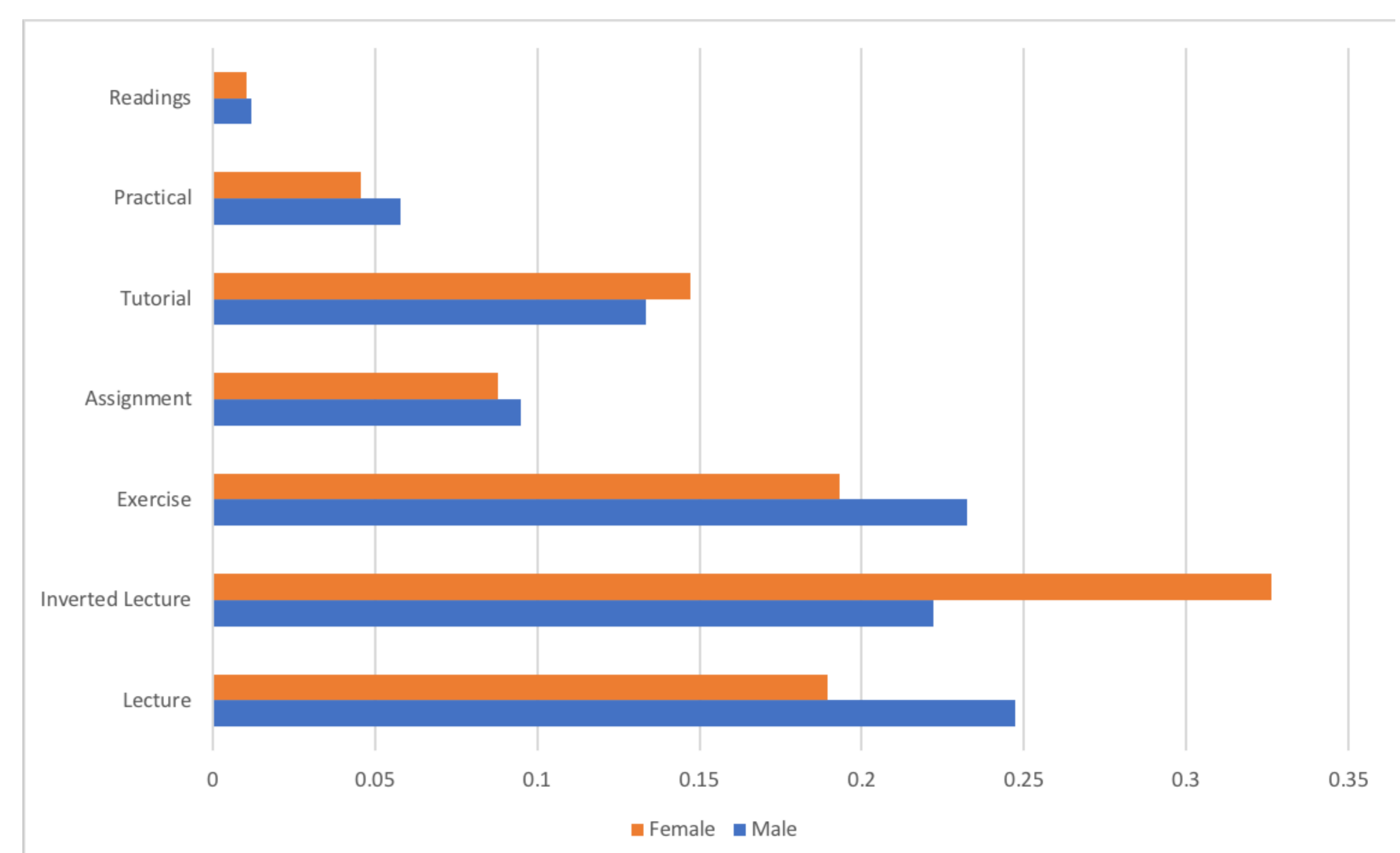


Figure 3: Male vs female students survey results

Conclusions

- Results show that we succeeded in developing a teaching model that supports our goals and was liked by students
- Interesting evidence was discovered that international students may prefer traditional lectures to inverted
- Female students strongly and statistically significantly preferred the inverted lectures more than their male counterparts
- Semi-inverted model required no significant changes to course design or logistics

Acknowledgements

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