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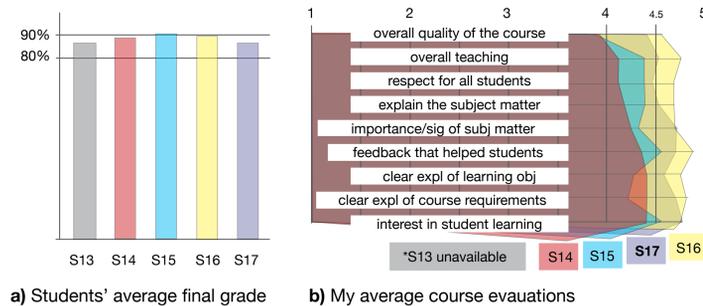
# Learning from our teaching by reflecting on iterative pedagogical changes

I describe a low-effort, high-insight strategy for instructors to learn from their own teaching efforts across semesters

## Existing measures of pedagogical innovation don't capture disciplinary insights

Many instructors at all levels teach the same course multiple times over a series of years. And intuitively, the instructor's teaching innovations through this time can dramatically affect how students perform and how instructors think they've done. So how do we know if we've gotten better as teachers over time? How can instructors track their own pedagogical innovations and the effects that those have for students? Unfortunately, naive measures of tracking pedagogical innovations don't capture disciplinary insights:

**Fig. 1** - Two naive strategies for tracking pedagogical innovation don't work well. Across 5 spring semesters in which I taught the same course (76-101, Interpretation and Argument), **a)** Students' average final grade simply hovers from 85% to 90%. **b)** Students' course evaluations generally improve (although see S17), but at a high level that is difficult to interpret disciplinarily.



## A simple system for tracking our changes

We need a 1) sustainable 2) tracking system 3) that sparks disciplinary reflection on our teaching and 4) encourages us to continue iterating. I used a two-part system (**Fig 2**). In my case, I used students' final argumentative STEM paper as the disciplinary measure of student learning.

|     | 1. Record pedagogical innovation(s) since prior collection   | 2. Retain disciplinary measure of student learning |
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| S13 | NA   | Author A's final essay (median-scoring in section) |
| S14 | 1. Provide colorful handout I designed that explained the flow of the essay by using a heist movie as an analogy<br>2. Enumerate available methods for data collection: interview, survey, experiment, corpus, or case study.  | Author B's final essay (median-scoring in section) |
| S15 | 1. Provide students with a "methods packet":<br>• pros and cons of using each method of collecting data<br>• a scholarly reference for each method to guide data collection<br>• an example of student work that used each method<br>2. Provide handout on five ways to use sources (roughly following Bizup's BEAM heuristic), require students to use some of each type<br>3. Provide instruction on writing each section of the paper | Author C's final essay (median-scoring in section) |
| S16 | 1. Updated methods packet<br>• better student samples<br>• split up into multiple documents, for better focusing<br>2. Instruction on writing the analysis section specifically  | Author D's final essay (median-scoring in section) |
| S17 | 1. Updated methods packet<br>• better student samples<br>2. In-class activity to practice analyzing data<br>3. Preparatory assignment on reading and using unfamiliar secondary research   | Author E's final essay (median-scoring in section) |

**Fig. 2** - An adaptable recording system for tracking pedagogical changes and their effects. Column 1 records each year's pedagogical changes, in my case focused on helping students make stronger research writing moves (a discourse-oriented approach to teaching research writing [Hyland]). These changes would have been overwhelming to make all at once. Column 2 shows that I retained one final essay from each semester (with students' permission) to analyze it using disciplinary concepts (see next section). The temptation would be to retain more, but a disciplinarily useful measure should be rich and therefore also selective. Keeping the median-scoring essay, rather than the highest-performing, is a good way to find the "same" student across semesters.

## Comparing student learning across semesters reveals teaching improvement

By retaining only the median-performing student essay, I am able to do a deeper comparative analysis. In the following points of interest, I find dramatic improvement in my teaching over time, from Author A's paper to Author E's paper:

- **length** doubles
- data collection becomes rigorous (i.e. paper explains how it followed an academically recognized **research method**)
- **analytic claims** become more detailed, sophisticated, measured, and supported by data
- analysis is undertaken through the use of an **interpretive lens**
- **visuals** increase in number and become more targeted (i.e. less of a data dump)

Broadly, then, in tandem with pedagogical innovations that I made over several years, the average student finished the course increasingly able to write a developed, insightful, and generically appropriate research essay.

## Students also improve in creating a research gap

To see this improvement in action, **Fig. 3** zooms in on how Authors A-E handle the delicate STEM writing move of creating a research gap (Swales, Walsh). Creating a research gap shows a writer's understanding of their audience and their own contribution; it is thus a good disciplinary marker of the learning effects of both my broad and targeted pedagogical changes.

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| <p><b>Author A (S13)</b><br/>The study of different leadership styles throughout history can lead to some very valuable and interesting conclusions about how leaders should act today. Traditionally, men have held almost all leadership positions. It is only recently that women have been able to lead outside the household. This is a particularly fascinating point of study because it is so new, and we can see firsthand how these changes are taking place and the effects they're having on leadership. In this paper, I will...</p> <p>Author A simply asserts a gendered history of leadership, and unclearly assumes that this creates a "point of study."</p> | <p><b>Author B (S14)</b><br/>Most people in the past, defined a robot as what is written in Oxford Dictionaries: "[definition]" (Oxford Dictionaries). Even today, many people still abide by this definition – in their minds, robots are simply machines that help humans achieve their day-to-day goals. This used to be an unquestionable notion. However, during the last fifty years, technology has been growing at a rate so exponentially astounding that we may be in a "period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed" (Kurzweil, 7). The robots we humans create are now getting to be more and more similar to us – to the point that there is now some societal controversy if intelligent robots should even be considered to be human.</p> <p>Author B appeals to the dictionary and to an author read in the course to create tension</p> | <p><b>Author C (S15)</b><br/>Many scholars have examined the extent to which self-positioning and socio-economic division influence people's behavior in peacemaking. Authors like Saul D. Alinsky argue that people within different economic and political divisions act differently according to their respective goals; however, little discussion has been made regarding the effect of gender division on political behavior. The separation between male and female has been crucial ever-present. As suggested by Libby Copeland's "Why Do Women Vote Differently than Men", the two genders' different genetic character and role in history have shaped their different approaches to politics (2). Throughout history, it can be seen how women activists make significant impact on a movement.</p> <p>Author C concretely explains one course-read scholarly position to create a gap, but then inadvertently refutes that gap when drawing in a new author</p> | <p><b>Author D (S16)</b><br/>Many philosophers are divided between the belief that rationality is an emotional capacity (Bentham) and the belief that rationality is a logical capacity (Descartes). As a result of their definitions of rationality, each side likewise assumes that the development of rationality is a development of their beliefs' respective capacities. Yet, both fail to see how interwoven the development of emotional and logical capacities are. Unable to separate one from the other, the development of these capacities are most prominent and most connected during the phenomenon of play, leading modern play culture researchers to ask these same questions as these philosophers. So, I ask...</p> <p>Author D deftly compares and contrasts two course-read positions, then pivots unconvincingly to frame the essay as contributing to the purported research area of play culture</p> | <p><b>Author E (S17)</b><br/>Many researchers have studied human-robot interactions, and how our observation of a robot's capabilities affects the moral status we attribute to them. Vasant Srinivasan studied this idea in his investigation of the effectiveness of different robot politeness strategies for soliciting help from people. [...]</p> <p>In another approach to understanding the effect of our perception of a robot's capabilities on the way we interact with it, Kate Darling studied the relationship between the degree of anthropomorphic framing of robots in certain narratives and the empathy one displays towards them. [...]</p> <p>Although understanding interpersonal skills in humans and human-robot interactions informs us about how robots should communicate and interface with humans and other robots, a consideration of how they will act when presented with situations wherein even we struggle to make decisions is crucial if human-robot coexistence is to be realized. Thus, I ask...</p> <p>Author E unites two new readings from the same academic field, with complex (but relatively clear) cohesive links and a significant but unexaggerated goal</p> |
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**Fig. 3** - Each year's average student creates a stronger research gap. In particular, my pedagogical innovation in S17 of using a preparatory assignment on reading/using unfamiliar secondary research seems to pay off in Author E's detailed explanation of how two new (i.e. not part of the main course readings) articles create a gap for their project.