Board 367: Repairing the Reputation of the Teaching Profession

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Repairing the Reputation of the Teaching Profession

Abstract

Background: This paper presents an example of the progress made in a five-year NSF IUSE-funded project on repairing the reputation of the teaching profession to address teacher shortages in STEM disciplines. This paper focuses on an undergraduate student-facing presentation developed by Get the Facts Out (GFO) used for teacher recruitment with the goal of examining the effectiveness of the presentation at impacting students' perceptions of teaching. The presentation was designed to address common misconceptions about the teaching profession that were preventing many students from exploring teaching as a career path.

Methods/Assessment: In 2021 and 2022, GFO conducted effectiveness studies on the presentation in a first-year chemistry course at Colorado School of Mines (Mines) using pre, post, and delayed-post Perceptions of Teaching as a Profession (PTaP) surveys with control (2021 n=103; 2022 n=163) and treatment groups (2021 n=210; 2022 n=380). For each year, we ran paired t-tests and determined Cohen's D effect sizes in R on pre/post, post/delayed, and pre/delayed data sets for both groups.

Outcomes: Across both years, the post-test and delayed post-test results for the treatment group showed that many student perceptions of the teaching profession became significantly more positive (pre/post $p<0.001$) and remained more positive throughout the semester (pre/delayed and post/delayed $p<0.001$), regardless of their plans to pursue teaching. "Medium" and "large" effect sizes showed the practical significance of these results. After viewing one presentation, student agreement to the statement "*I want to become a grade 7-12 teacher.*" increased.

Implications: Results indicate that using GFO resources can increase student interest in and perceptions of grade 7-12 teaching as a career. Future work includes analyzing the repeated 2023 effectiveness study and growing the network of faculty who share these resources to encourage more students to explore and join the profession and inspire young minds.

Introduction & Background

State of the Teaching Profession: The Unites States is facing a shortage of qualified middle and high school science, technology, engineering, and mathematics (STEM) teachers in nearly every state [1]. K-12 STEM education forms the foundation for students to enter into post-secondary STEM degree programs and pursue STEM careers [2]. The National Science Foundation recommends improving K-12 STEM education as an area to build the US science and engineering capacity [3].

Although around half of STEM majors indicate some interest in teaching [4], the number of students enrolling in teacher preparation programs has declined since 2012 [5]. In a 2017 survey from the American Physical Society (APS), around 30% of post-secondary STEM students reported that there was a negative perception of middle and high school teaching in their

departments. Students' agreement to the statement "Middle or high school teaching is discussed as a career option in my major department" ranged from less than 10% for computer science majors to over 50% for math majors, with chemistry and physics falling within this range. Students' concerns over teaching included misperceptions related to dealing with students, pay, and control over curriculum [4].

Get the Facts Out (GFO) began in 2015 to address the teacher shortage; GFO is a partnership between APS, the American Chemical Society, the American Mathematics Teacher Educators, and the American Association of Physics Teachers led by Colorado School of Mines (Mines). GFO does research on resources for and perceptions of the teaching profession through studies on the effectiveness of resources and analyses of student and faculty data from over 50 US institutions. GFO shares positive, accurate facts about the teaching profession through research-based, user-tested resources designed to help both faculty and students learn more about the profession. These resources are freely available to the public, providing university faculty and staff with tools to discuss teaching as a career with their students.

GFO Resources: GFO resources are based on data gathered from student interviews and large-scale surveys as part of the development and validation of the Perceptions of Teaching as a Profession (PTaP) survey [6]. This foundational research identified that common misconceptions about the teaching profession were preventing many students from considering teaching as a career path. Data on the profession, including information on retirement systems, survey data on job satisfaction, and salary data, formed the basis for the student-facing presentation focused on in this paper. Data in the presentation were gathered from previous research, national reports, and publicly available information from school districts.

The language and content of the presentation were tested and refined in an iterative process of student and faculty interviews, focus groups, and surveys conducted at several demographically and geographically diverse US institutions [7]. For example, the presentation includes "Did you know…" statements such as, "Did you know…that there are student loan forgiveness programs and scholarships for math and science teachers?" These statements were tested through an initial set of five student interviews followed by an online survey of 150 STEM undergraduate and graduate students and ongoing focus groups with over 60 faculty and 150 students from eight institutions.

The undergraduate student-facing presentation is intended to take 15-30 minutes to present. The presentation is designed to facilitate discussion with students who may or may not be interested in teaching. GFO encourages anyone to use the presentation and customize the data to their local area. The presentation includes slides on teacher life satisfaction, salary, and benefits (e.g., Figure 1). The full student-facing presentation is available at https://getthefactsout.org/.

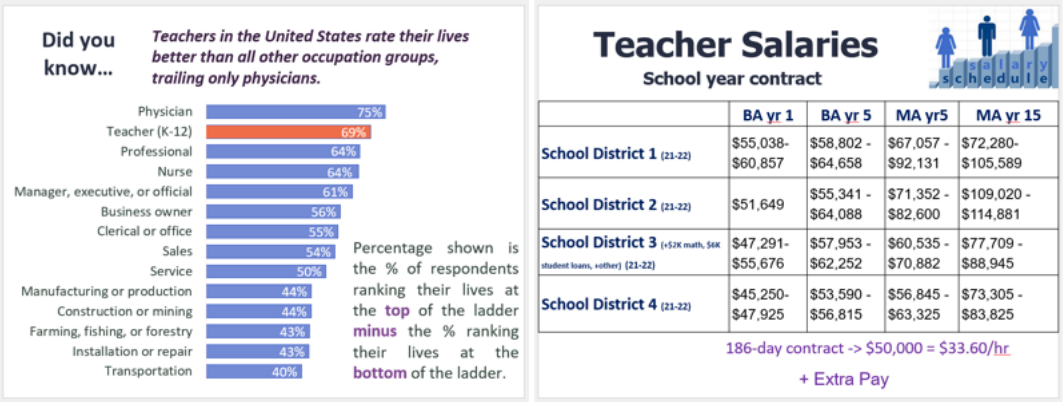

Figure 1. Example slides from the student-facing presentation. Left: Teacher life satisfaction. Right: Teacher salary data.

Research Goals

This paper focuses on the undergraduate student-facing presentation used for teacher recruitment. The goal of the research study is to determine how effective the presentation was at impacting students' perceptions of and knowledge about the teaching profession. The further goals of this paper are to disseminate knowledge and resources to ASEE members and to reach and empower more faculty to feel knowledgeable and able to share information about the teaching profession with students.

Methods

Research Context & Participants: GFO conducted this research in a public R1 institution's first-year chemistry course during Fall 2021 (Year 1) and Fall 2022 (Year 2). We selected this course as the research context because it is required for all incoming Mines students and would provide the widest range of STEM majors. Mines serves approximately 7,400 students in a suburban setting; just over 68% are Male and about 68% are White. Around 83% of undergraduates receive a grant or scholarship, 36% have Federal student loans, and 13% receive need-based financial aid. Students were offered extra credit to participate in the research study.

Survey: We used the previously validated PTaP survey to collect data [6]. The survey consists of 57 Likert scale questions asking students to the degree they agree/disagree with a statement. For example, "*I would be proud to tell people I am a grade 7-12 teacher*" and "*I want to become a grade 7-12 teacher.*" Furthermore, the test also has 3 multiple choice questions and 3 open ended questions, with the entirety of the survey taking on average about 9 minutes to complete.

The survey provides information on students' perceptions of teaching separated into seven empirical categories with two overall groupings (Figure 2).

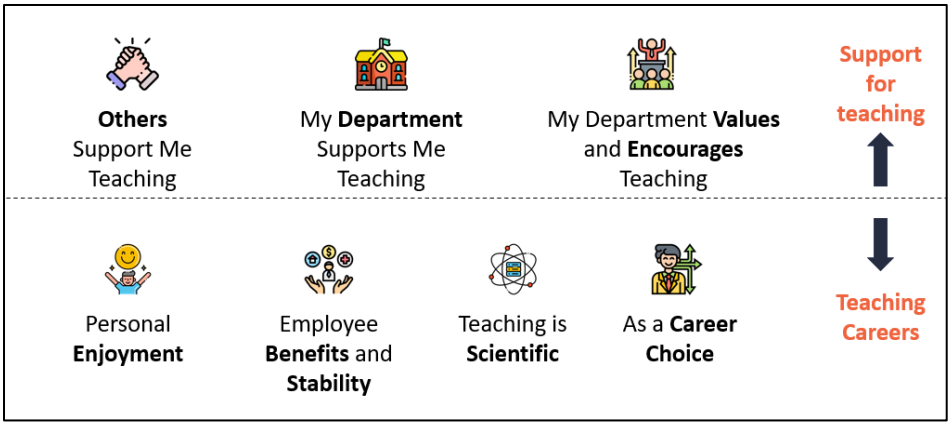

Figure 2. The seven empirical categories of the PTaP survey instrument.

It is important to note that GFO presentations specifically target the categories of "Employee Benefits and Stability" and "As a Career Choice," where the most common teaching misconceptions exist. The presentation was not designed to address the category of "Personal Enjoyment."

Data Collection: Mines obtained IRB approval to conduct this research. Each year, we used SurveyMonkey to collect data from control and treatment groups.

The treatment group consisted of student participants who took an initial PTaP survey, were given the 30-minute student-facing presentation, and then took a second PTaP survey immediately after. The control group, who did not attend a presentation, was also surveyed. Both groups then took another PTaP survey in December, approximately two months later, to assess any long-lasting effects on their perceptions of teaching (Figure 3). In Year 2, students in both groups may have also interacted with GFO posters outside of their labs and classrooms or with slides promoting or advertising teaching as a profession presented by their professors (Figure 4).

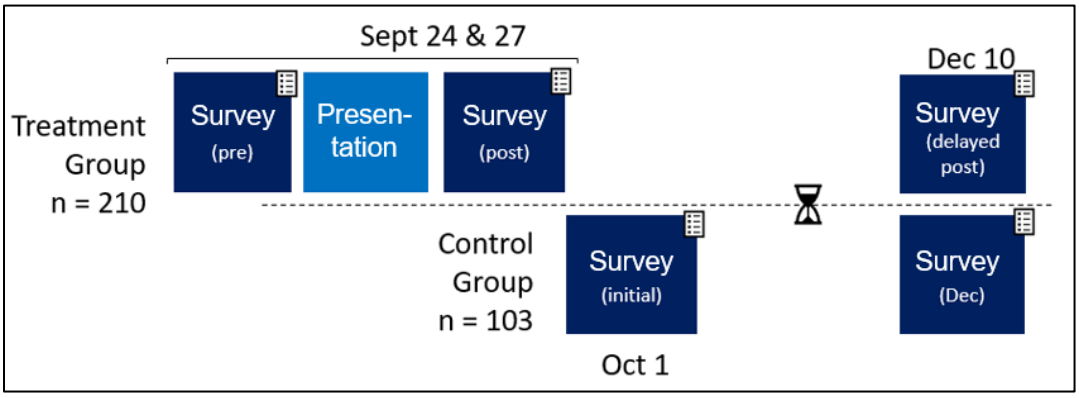

Figure 3. Data collection timeline for Year 1 (2021).

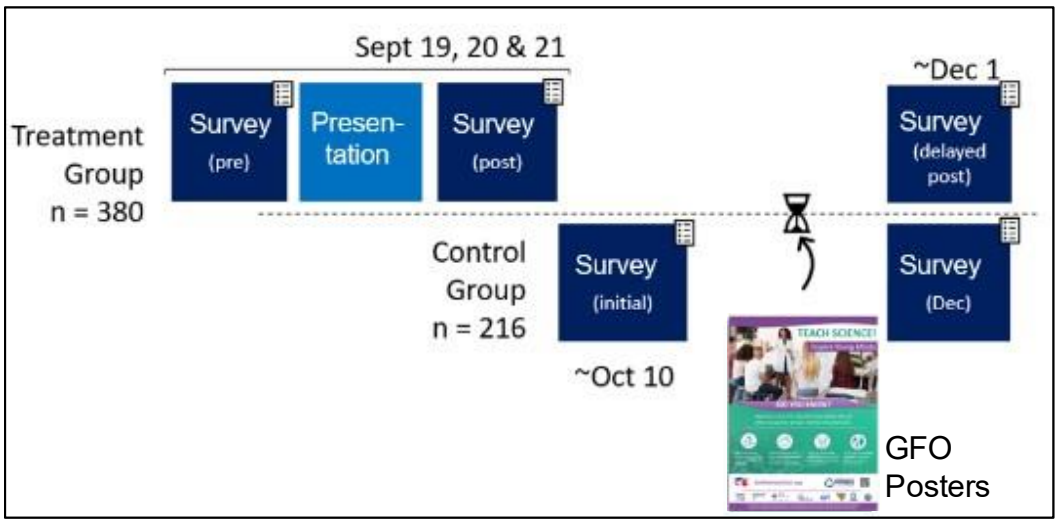

Figure 4. Data collection timeline for Year 2 (2022).

Table 1 shows the number and percent of usable responses from each group for each year; we define a "usable" response to be one where the student completed all surveys distributed to their group across the semester.

Table 1. Number and percent of usable responses from survey distribution.

Year	Group	# Surveys Distributed	# Usable Reponses	% Usable Responses
Year 1	Control	180	103	57.2%
	Treatment	311	210	67.5%
Year 2	Control	269	163	60.6%
	Treatment	480	380	79.2%

Data Analysis: For each year, we ran paired t-tests at $\alpha=0.05$ in R on pre/post, post/delayed, and pre/delayed matched data sets for the control and treatment groups. We also examined the practical significance of the results using Cohen's D effect sizes at the following interpretations: <0.2 "negligible", <0.5 "small", <0.8 "medium", >0.8 "large." We focused on analyzing data within each year and each group because we were only curious about the amount and significance of change of perceptions within each group.

In addition to statistical analyses, we examined each year's treatment group's agreement to the survey statement, "*I want to become a Grade 7-12 teacher*." This survey item directly indicates a student's level of interest in teaching; therefore, tracking the treatment groups' pre- and post-survey responses to it provides insight into students' views of the teaching profession. We focused on only the pre- and post-survey responses to gain insight into the immediate impacts of the presentation on students' perceptions of teaching.

Results

The tables below show the results from paired t-tests at the α =0.05 level and Cohen's D effect sizes for the control and treatment groups for each year. For clarity, values are only preserved to two or three decimal places.

Year 1 results are presented first, followed by Year 2 results. The survey results are broken down by PTaP category and explore student perception changes from "jumps" between the different surveys: pre/post, post/delayed, and pre/delayed. The control group only shows results from the pre/post "jump." Significant p-values are noted with asterisks (*); Cohen's D effect sizes of interest (>0.5 "medium" and >0.8 "large") are noted with daggers (†).

Year 1 (2021): Tables 2 and 3 show statistical analysis results from Year 1 treatment (n=210) and control groups (n=103), respectively.

Table 2. Year 1 (2021) treatment group results from paired t-tests.

Category	**Jump**	**P-value**	**Cohen's D**
Personal Enjoyment	Pre-Post	2.066e-08***	0.28
	Post-Delayed	5.257e-4***	-0.22
	Pre-Delayed	0.204	0.074
As a Career Choice	Pre-Post	2.200e-16***	0.62†
	Post-Delayed	3.950e-05***	-0.28
	Pre-Delayed	1.515e-07***	0.33
Others Support Me Teaching	Pre-Post	2.200e-16***	0.52†
	Post-Delayed	0.0337*	-0.14
	Pre-Delayed	3.920e-07***	0.39
My Department Values and Encourages Teaching	Pre-Post	2.200e-16***	0.86††
	Post-Delayed	0.281	-0.08
	Pre-Delayed	2.200e-16***	0.78†
My Department Supports Me Teaching	Pre-Post	2.200e-16***	0.59†
	Post-Delayed	0.065	-0.13
	Pre-Delayed	1.083e-08***	0.47
Employee Benefits and Stability	Pre-Post	2.200e-16***	2.11††
	Post-Delayed	1.245e-10***	-0.53†
	Pre-Delayed	2.200e-16***	1.37††
Teaching is Scientific	Pre-Post	1.207e-15***	0.55†
	Post-Delayed	3.082e-4***	-0.25
	Pre-Delayed	7.036e-06***	0.31
*p<0.05; **p<0.01; ***p<0.001			
†Cohen's D>0.5 "medium;" ††Cohen's D>0.8 "large"			

Table 3. Year 1 (2021) control group results from paired t-tests.

Category	**Jump**	**P-value**	**Cohen's D**
Personal Enjoyment	Pre-Post	0.091	0.151
As a Career Choice	Pre-Post	0.933	0.007
Others Support Me Teaching	Pre-Post	0.069	0.147
My Department Values and Encourages Teaching	Pre-Post	1.082e-3**	0.334
My Department Supports Me Teaching	Pre-Post	0.038*	0.184
Employee Benefits and Stability	Pre-Post	0.302	0.099
Teaching is Scientific	Pre-Post	0.196	-0.118
*p<0.05; **p<0.01; ***p<0.001			
†Cohen's D>0.5 "medium;" ††Cohen's D>0.8 "large"			

We also collected the treatment group's agreement to the statement, "*I want to become a grade 7-12 teacher*." Figure 5 shows how students' responses changed between pre- and post-surveys.

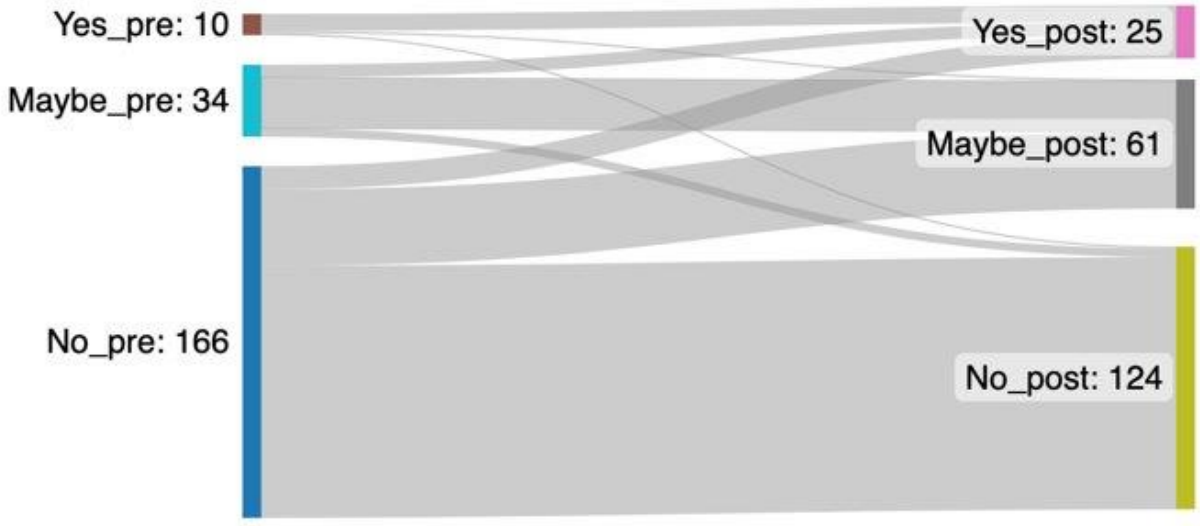

Figure 5. Sankey diagram of Year 1 (2021) treatment group pre- and post-survey agreement to the statement, "I want to become a grade 7-12 teacher."

Year 2 (2022): Tables 4 and 5 show statistical analysis results from Year 2 treatment (n=380) and control groups (n=163), respectively.

Table 4. Year 2 (2022) treatment group results from paired t-tests.

Category	**Jump**	**P-value**	**Cohen's D**
Personal Enjoyment	Pre-Post	2.074e-14***	0.295
	Post-Delayed	2.522e-4***	-0.151
	Pre-Delayed	1.142e-4***	0.159
As a Career Choice	Pre-Post	2.200e-16***	0.712†
	Post-Delayed	4.157e-13***	-0.353
	Pre-Delayed	8.937e-13***	0.342
Others Support Me Teaching	Pre-Post	2.200e-16***	0.446
	Post-Delayed	0.0674	-0.090
	Pre-Delayed	6.775e-12***	0.362
My Department Values and Encourages Teaching	Pre-Post	2.200e-16***	0.674†
	Post-Delayed	9.641e-4***	0.185
	Pre-Delayed	2.200e-16***	0.856††
My Department Supports Me Teaching	Pre-Post	2.200e-16***	0.470
	Post-Delayed	0.394	-0.045
	Pre-Delayed	1.019e-14***	0.436
Employee Benefits and Stability	Pre-Post	2.200e-16***	2.083††
	Post-Delayed	2.200e-16***	-0.595†
	Pre-Delayed	2.200e-16***	1.206††
Teaching is Scientific	Pre-Post	2.200e-16***	0.709†
	Post-Delayed	1.139e-10***	-0.331
	Pre-Delayed	1.667e-10***	0.342
*p<0.05; **p<0.01; ***p<0.001			
†Cohen's D>0.5 "medium;" ††Cohen's D>0.8 "large"			

Table 5. Year 2 (2022) control group results from paired t-tests.

Category	**Jump**	**P-value**	**Cohen's D**
Personal Enjoyment	Pre-Post	0.020*	0.153
As a Career Choice	Pre-Post	0.296	0.079
Others Support Me Teaching	Pre-Post	1.884e-3*	0.177
My Department Values and Encourages Teaching	Pre-Post	9.523e-4***	0.260
My Department Supports Me Teaching	Pre-Post	5.526e-3*	0.231
Employee Benefits and Stability	Pre-Post	2.811e-3*	0.216
Teaching is Scientific	Pre-Post	0.138	0.114
*p<0.05; **p<0.01; ***p<0.001			
†Cohen's D>0.5 "medium;" ††Cohen's D>0.8 "large"			

As in Year 1, we collected the Year 2 treatment group's agreement to the statement, "*I want to become a grade 7-12 teacher."* Figure 7 shows how students' responses changed between pre- and post-surveys.

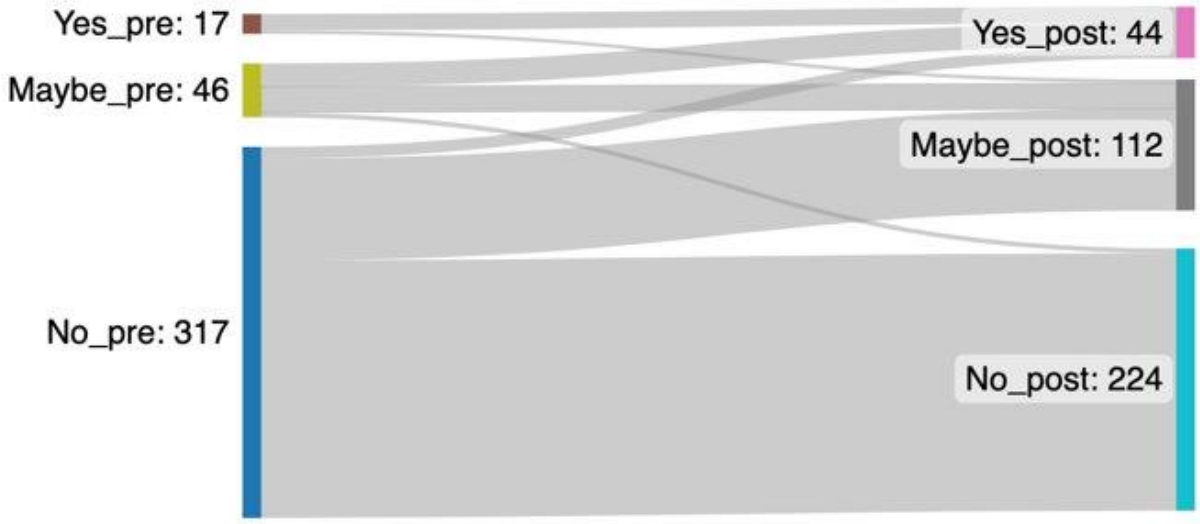

Figure 6. Sankey diagram of Year 2 (2022) treatment group pre- and post-survey agreement to the statement, "I want to become a grade 7-12 teacher."

Discussion

We analyzed PTaP survey responses from treatment and control groups to examine how viewing a student-facing presentation influenced undergraduate students' perceptions of teaching.

The control groups in each year had few significant changes in perceptions in any categories from the PTaP survey ($p<0.05$). None of the results yielded "medium" or "large" effect sizes, showing that even with a significant p-value, the practical implications of the results were limited. Of interest is the Year 2 control group's responses for the category "My Department Values and Encourages Teaching" ($p<0.001$; "small" effect size <0.5). In Year 2, we displayed posters about the teaching profession around campus. It is likely that students in the control group saw these posters around their departments which may have influenced their perceptions of how their department views teaching. Given that APS found 30% of STEM students reported a negative perception of middle and high school teaching in their department [4], this finding is important because suggests that even small interventions like posters may contribute to significant changes in students' perceptions of how their department values teaching. Aside from the potential impact of the posters, the control groups' lack of significant results was expected; the control groups had minimal to no intervention or interaction with GFO materials.

The treatment groups from Year 1 and Year 2 yielded similar results to each other. The post-test and delayed post-test results for the treatment groups showed that many student perceptions of

the teaching profession became significantly more positive (pre/post $p<0.001$) and remained more positive throughout the semester (pre/delayed and post/delayed $p<0.001$), regardless of their response to the statement, "*I want to become a grade 7-12 teacher*." Additionally, many categories showed "medium" or "large" effect sizes leading to practical significance of the results. Of note are categories where a significant p-value was accompanied by an effect size of "medium" or "large" (Cohen's D >0.5 and >0.8, respectfully). Specifically, the category "Employee Benefits and Stability" showed statistically and practically significant results across all three comparisons (pre/post, post/delayed, and pre/delayed). This result is not surprising given the student-facing presentation was designed to target common misconceptions about teaching related to teacher salary, benefits, and life satisfaction. The presentation appears to be effective in impacting students' perceptions of teaching both immediately and longer-term with respect to the main topics it covers.

A curious result is the significant p-values in the category of "Personal Enjoyment." Though the practical significance of these results was "small" or "negligible," we found statistically significant differences in this category for pre/post, post/delayed, and pre/delayed t-tests of the treatment groups in both years and of the control group in Year 2. This is intriguing because the presentation was not designed to address "Personal Enjoyment." Rather than influencing through content, the act of viewing a presentation about teaching may have sparked self-reflection in the treatment groups; the Year 2 control group may have experienced the same phenomenon after seeing GFO posters on campus. Further examination of this result is warranted; analysis of Year 3 data from 2023 may lead to insight on this finding.

In addition to the statistical analysis, we also performed a courtesy analysis of the treatment group students' responses to the statement, "*I want to become a grade 7-12 teacher.*" In both years, a fraction of students agreed with this statement in the pre-survey (2021, 21%; 2022, 17%). After viewing the presentation, students' career interests shifted. Agreement to "*I want to become a grade 7-12 teacher*." increased, roughly doubling in the post-survey results for both years (2021 & 2022: 41%). This shows the potential for a single intervention (i.e., the student-facing presentation) to influence students' career interests favorably towards teaching. These results are also consistent with GFO's external evaluator's findings from student-facing presentations given by faculty across the country.

Implications

There is a shortage of middle and high school teachers in STEM disciplines. GFO aims to distribute accurate facts and data through resources, like the student-facing presentation, to repair the reputation of the teaching profession. To date, university faculty have shared the presentation with over 6,500 students from across the US. Results from the PTaP survey indicate that using GFO resources can increase student interest in and perceptions of grade 7-12 teaching as a career. The effectiveness study on the student-facing presentation is currently being repeated in a Year 3 (2023) study. Future work includes analyzing data between control and treatment groups

and across years. We also aim to grow the network of faculty who share these resources to promote more students to join the teaching profession and inspire young minds.

Acknowledgements

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