



# STEM Education in the Time of COVID - Responses from a National Survey of 869 Faculty

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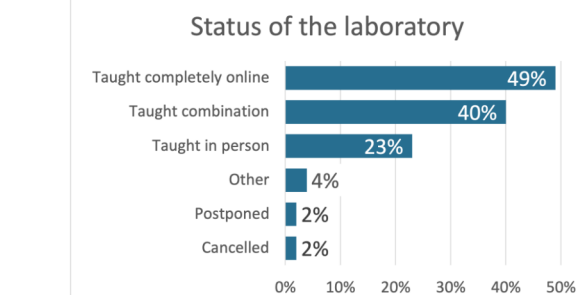
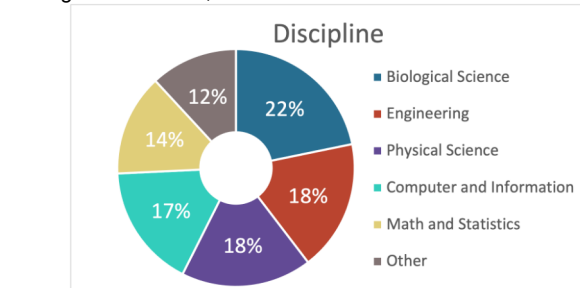
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## Overview

This study, conducted in the fall of 2020, explores the impact of the disruptive shift from face-to-face to distance learning in the US for higher education faculty in STEM fields.

- 73% of respondents converted face-to-face coursework to remote learning, yet more than 33% had no prior online education experience
- There were many barriers to implementing face-to-face courses online for STEM faculty
  - Perceived lack of engagement with students and lack of student motivation
  - Lack of equity among students with and without access to technology and connectivity was exacerbated
  - No experience or access to online labs
- Additional research is needed to understand these barriers and improve the effectiveness of online courses in STEM

Respondents represented all STEM disciplines, were largely male (58%), not adjuncts (86%), and had more than 20 years of teaching experience (65%). Most respondents (62%) were from institutions with greater than 10,000 students.



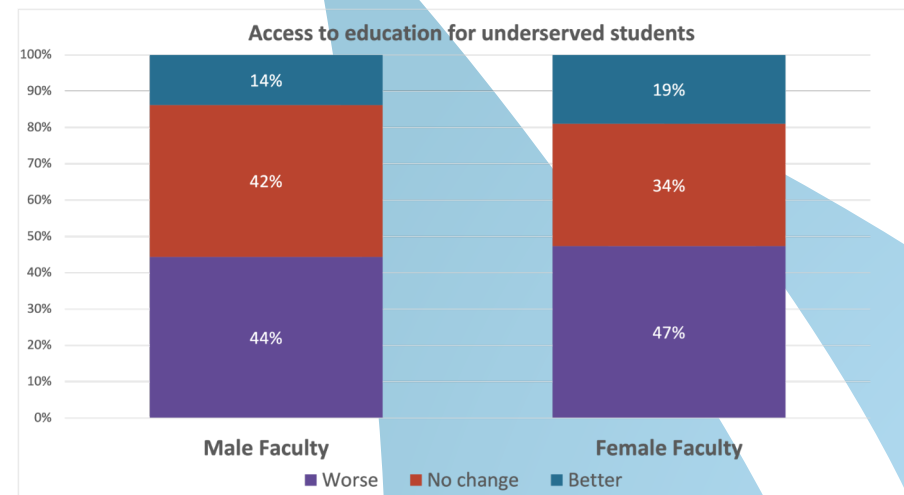
## Methodology

A national sample of faculty representing all STEM fields was obtained using a multi-stage process. Using data a commercial provider representing 93% of all teaching faculty, faculty teaching at least one course in a STEM field were selected. A random sample of this list, proportional to each Carnegie Classification, was obtained. This list was checked against opt-out lists as well as non-functioning email addresses to obtain the final sampling frame.

A total of 869 faculty were included in the analysis, representing the full range of higher education institutions (two-year, four-year, all Carnegie classifications, and public, private nonprofit, and for-profit), and the complete range of faculty (full- and part-time, tenured or not, and all disciplines). Institutional descriptive data come from the National Center for Educational Statistics' Integrated Postsecondary Education Data System (IPEDS) database. Respondents and nonrespondents were compared to ensure that the survey results reflected the characteristics of the entire population of schools in 35 unique categories.

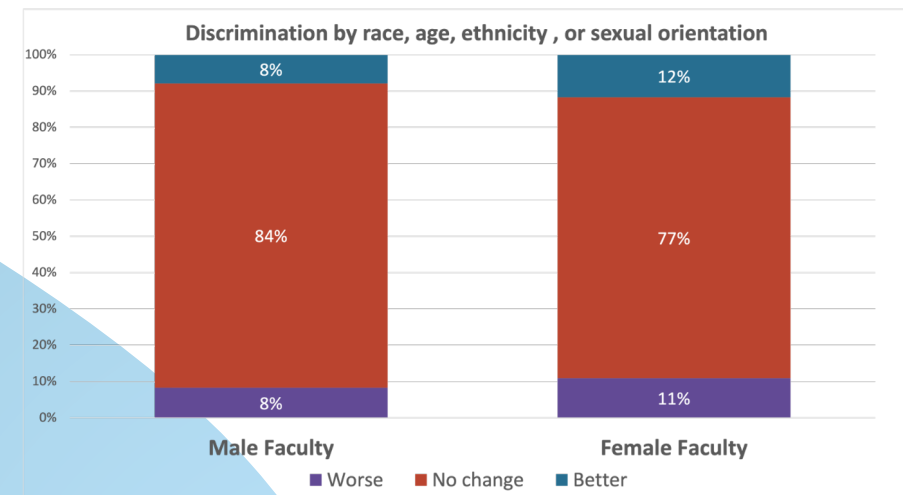
## Results

### Figure 1



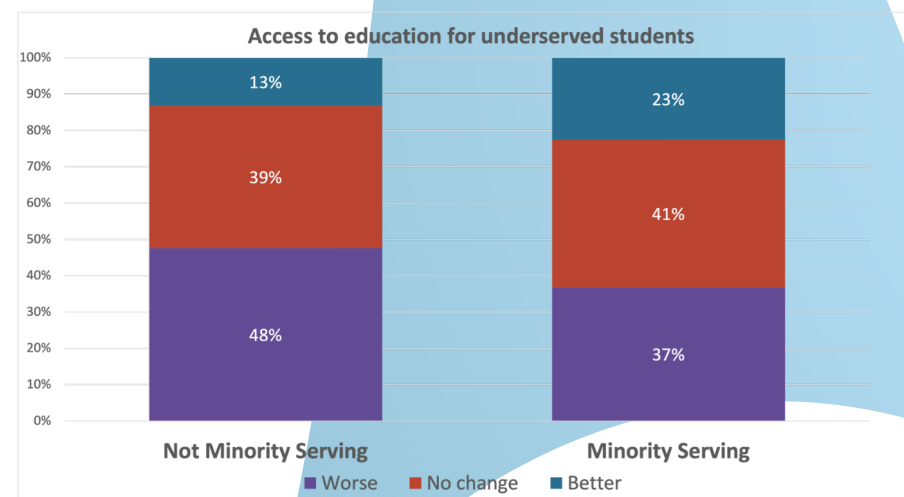
Female professors were significantly ( $p=0.026$ ) more likely to answer that moving to online during the pandemic significantly lowered access to education for underserved students.

### Figure 2



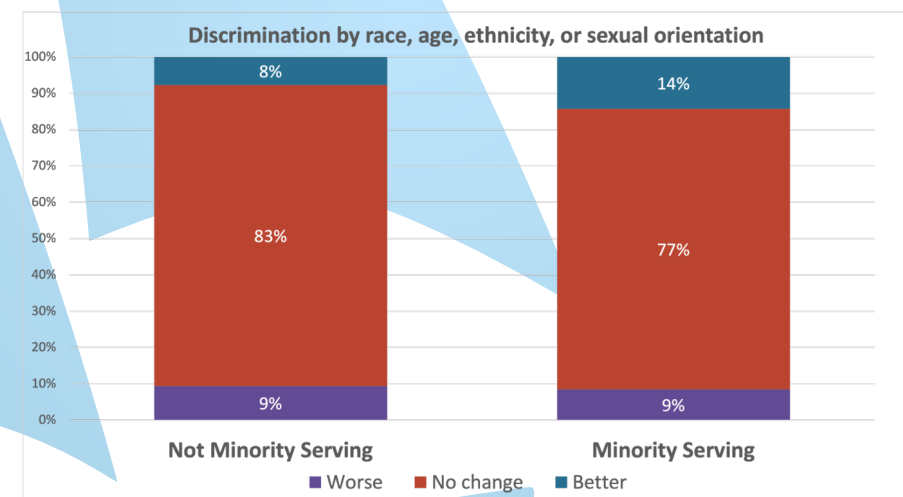
Male faculty believed there was significantly ( $p=0.053$ ) less discrimination or no change in discrimination during the pandemic.

### Figure 3



Faculty at institutions that are primarily minority serving found access to education was significantly ( $p=0.002$ ) greater when moving to online during the pandemic.

### Figure 4



Faculty at minority serving institutions believed there was significantly ( $p=0.023$ ) less discrimination during the pandemic.

## Faculty Voices

*"It is very hard to teach when looking at a screen filled with names; many or all students do not turn their video on. I can sympathize with them (it is hard to stare at a screen the whole day), but it also makes it hard to interact: they see you but you do not see them. :)"* - Mathematics Faculty

*"STEM courses, specifically laboratory courses, provide a subpar education when taught online with no hands-on experience."* - Biological and Biomedical Sciences Faculty

*"I do worry... how many disadvantaged students we will lose or have lost due to equity and financial issues that are a result of the pandemic."* - Biological and Biomedical Sciences Faculty

*"My students are succeeding in the online environment. They love the remote synchronous format."* - Mathematics Faculty

*"There is a physical technique associated with quite a bit of the chemistry lab work that I value. Students need to feel the pipette, move the stop-cock with their hands, etc."* - Physical Sciences Faculty

## Conclusion

Like most of US higher education, STEM classes were forced to move away from traditional face-to-face instruction due to COVID-19 during the fall of 2020.

- In our survey of STEM faculty, 72% believe inadequate online laboratories are the unique and most important barrier to online education. Many faculty are not aware of online laboratory solutions that already exist
- Other barriers to teaching STEM online were similar to our surveys of all faculty during the pandemic with academic integrity and student motivation being most important
- Respondents believe that the transition to online-learning has exacerbated the divide between the have and the have-nots, as a lack of resources unfairly impacts underserved student populations

## Future

The report raises many additional questions that we hope to continue to explore in future projects:

- What sources of information can guide in addressing their perceptions about, and issues with, online labs? How reliable are those sources?
- Do labs and collaborative learning represent a unique challenge within the STEM disciplines?
- How does online STEM education impact equity issues?
- What is the long-term impact of COVID-19 on perceptions and utilization of online STEM materials?

**If interested in collaborating, please reach out:** isabel@bayviewanalytics.com