

# Graduate Schools Respond to COVID-19: PROMISING PATHWAYS TO INNOVATION AND SUSTAINABILITY IN STEM EDUCATION

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**“Every cloud has a silver lining”** has renewed currency today as university administrators confront COVID-19, the crisis of a lifetime for most of their institutions. As challenging as the current situation is, when considered against decades of calls for improving graduate education, the pandemic has introduced an unparalleled climate for innovation. The pandemic’s silver lining may be this: it offered the opportunity, and in some instances, required meaningful reform in master’s and doctoral education.

This study documents the challenges posed by the COVID-19 pandemic to graduate education and illuminates strategies the institutions used to respond to those challenges. Our research, comprising a series of expert interviews and a comprehensive national survey followed by a virtual convening, paints a detailed picture of actions taken by U.S. graduate schools as they worked to ensure the academic and research progress and overall well-being of STEM graduate students, and to sustain graduate programs through the pandemic.

Our study relied on data collected from graduate deans at 208 leading institutions awarding graduate degrees in STEM fields, including 191 of the largest doctoral institutions and 17 of the largest master’s institutions. Within the 208 responding institutions, 52 were minority serving institutions.

### COVID-19’s Disruptions Were Significant

- Research disruptions were rampant: On average, institutions reported 67 percent of their STEM research was delayed or discontinued.
- Institutions were unprepared for the shift to online education: Nearly one-half of institutions (48 percent) rated their institution’s technical capacity to provide online learning prior to the pandemic as only marginally or somewhat capable. Less than one in five institutions (18 percent) rated their institutions as fully capable of supporting online/distance learning prior to the onset of COVID-19.
- Mentoring and advising suffered: Less than one-quarter (24 percent) of institutions reported they agreed that graduate students received consistent advising from graduate faculty during COVID-19, and even fewer (12 percent) said they agreed that virtual advising was an adequate replacement for in-person contact.
- Graduate deans expressed serious concern for the welfare of students: Students’ feelings of loneliness was the most frequently reported concern (37 percent), followed by other mental health concerns (33 percent), and physical health concerns (20 percent).
- Minority-serving institutions (MSIs) and their students were significantly more likely to report technological challenges: MSIs were significantly less likely than predominantly white institutions (PWIs) to report being fully prepared for online instruction prior to COVID-19, and significantly more likely than PWIs to report that during the pandemic their students faced obstacles to accessing reliable computer hardware and software.

- International graduate students faced particular challenges during the pandemic: Nearly one-half of institutions (45 percent) reported international students faced large financial impacts (partially due to the inability of some institutions to employ international students who were unable to enter the United States during the pandemic). Additionally, over three-quarters of institutions anticipated either a large (24 percent) or moderate (54 percent) decrease in international graduate student retention.
- Budget cuts loom: About two-thirds (67 percent) of institutions reported they anticipated needing to cut the budget of their graduate school or programs as a result of the pandemic and its consequences.
- Retention is anticipated to decrease: 32 percent forecast a moderate decrease of domestic student retention, and over three-quarters anticipated a decrease in international student retention.
- Graduate students' career prospects are dimming: For PhD graduates, 91 percent of deans expected either a significant (36 percent) or slight (55 percent) decline in placements. For master's graduates, 84 percent of deans reported either a significant (22 percent) or a slight (62 percent) decline in securing jobs upon graduation.

## Amid a Crisis, Innovations Emerged

Traditionally, U.S. graduate schools have been regarded as bastions of academic conservatism. This study suggests COVID-19 turned many of them into laboratories for innovation. Graduate schools employed many strategies in response to the crisis—some enabled by technology, some involving policy changes, and some reflecting new practices or processes.

Key innovations included:

- Expanded use of holistic admissions practices: 40 percent of graduate schools expanded their use of holistic review during the admissions process (in addition to the 40 percent who had already adopted this process prior to COVID-19).
- Permanent expansion of online and hybrid courses: 94 percent of survey respondents reported that after the effects of COVID-19 have passed, their institutions would likely increase the number of classes offered in a hybrid format; 83 percent would likely increase the number of courses conducted solely online.
- Proliferation of entire graduate degree programs conducted wholly online or in hybrid formats: More than three-quarters (82 percent) of institutions anticipated expanding the number of entire graduate programs offered in a hybrid format; more than one-half (54 percent) anticipated expanding the number of entire graduate programs offered solely online after the pandemic has passed.
- Development of new positions for graduate students: Several graduate schools designed and adopted new types of assistantships to help with remote course design and delivery (e.g., “technical teaching assistantship” and “remote course facilitators”).
- Nearly universal adoption of online processes for key academic milestones: Nearly all graduate programs authorized and used online processes for dissertation proposals (99 percent); dissertation defenses (99 percent); thesis defenses (98 percent); doctoral exams (97 percent); and qualifying exams (94 percent). Each of these practices had been used by less than one in five graduate schools before the pandemic. In addition, the virtual participation of external dissertation committee members became standard.
- Increased efforts to connect with graduate students: Efforts implemented by at least three-quarters of all institutions during the pandemic included coordinating meetings about wellness (78 percent); increasing the frequency of communications (77 percent); and hosting virtual academic meetings (75 percent).
- Expanding notions of research and curricula: New, creative thinking emerged around what constitutes research in STEM, with a new emphasis on systematic review and meta-analysis. Multiple institutions noted the pandemic forced them to review and reform their curricula and some made a conscientious effort to expand use of universal design for learning principals.
- Formative assessment gained traction: Over half of respondents either agreed (14 percent) or somewhat agreed (45 percent) that the pandemic expanded the need for more regular and ongoing evaluation in graduate courses.

## Broader Implications

This study documented human and institutional costs triggered by COVID-19. Several institutional respondents noted the pandemic highlighted broader issues of social and racial justice that continue to persist on campus and in particular within STEM fields. Although this study did not directly address the specific ways in which the pandemic has exacerbated racial and ethnic disparities, the data highlighted the critical need for future research to identify and assess the disparate impact of COVID-19 on graduate students and the larger STEM enterprise across the United States.

Several unambiguous conclusions emerged from this research. During the pandemic, STEM graduate students encountered daunting obstacles as they struggled to make academic and research progress and maintain personal well-being. Simultaneously, many graduate schools and programs struggled to adapt to major disruptions, support their students, and preserve their programs. But in the face of these experiences, meaningful innovations emerged. Projecting forward, this study revealed that COVID-19 was a magnifying glass, highlighting policies and practices in graduate education that were outdated, unneeded, or unfair. The pandemic may also have had a silver lining by providing graduate school leaders a vital opportunity to step back, re-examine, and reconsider longstanding practices, and, in the process, to innovate and usher in needed changes to graduate STEM education.

## About the Study

This research was funded by the rapid response research (RAPID) program in the Innovations in Graduate Education program within the Division of Graduate Education, Directorate of Education and Human Resources at the National Science Foundation. The grant supported three main activities:

1. **A web-based national survey requested of 300 senior university officials overseeing graduate education in summer 2020**
2. **A virtual convening of 120 senior officials in graduate education and research in September 2020**
3. **A multipronged dissemination of project results to assist institutions in addressing ongoing COVID-19 challenges**

The detailed methodology is found in Section 1 of this report.

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