

# Supports and Challenges in an Educational Crisis: The Impact of the COVID-19 Pandemic on Youth STEM Pathways

**NSF RAPID WORKING PAPER:  
RESEARCH FINDINGS**

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**American Museum of Natural History  
with  
SRI International**

Preeti Gupta, Rachel Chaffee, Karen Hammerness,  
Anna MacPherson & Kea Anderson  
with Youth Co-Researchers:  
Mahmoud Abouelkheir, Lucie Lagodich  
Manaka Shiomi & Erica Chen



# CONTENTS



**03**

YOUTH  
PATHWAYS

---

**04**

RESEARCH  
QUESTIONS

---

**05**

RESEARCH  
CONTEXT

---

**06**

METHODS

---

**08**

KEY  
FINDINGS

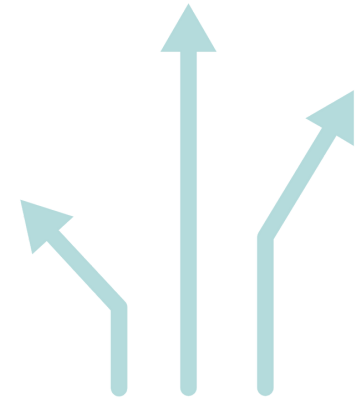
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**14**

IMPLICATIONS &  
RECOMMENDATIONS

# OUR RESEARCH ON YOUTH PATHWAYS

This project aims to investigate the impact of the COVID-19 pandemic on the academic pathways of college youth and identify the critical supports and resources that could help youth counteract the repercussions of the pandemic on their college and career trajectories. This study focuses on **just-in-time data collection** during this critical moment, **as youth navigate major disruptions to their academic experience**, by enabling us to investigate and understand student decision-making at an unforeseen juncture in their careers. To examine the impact of the COVID-19 pandemic upon the college students in our study, **we focused on ways current pathways are disrupted, diverted, or fractured, and turn particular attention to newly emergent obstacles as well as supports and sources of information for decision-making about immediate and future academic and professional pursuits.**



## *EDUCATION IN EMERGENCIES*



Literature on education in emergencies, especially prolonged crises, suggests the critical importance of research that can lead to better preparation (and even prevention) of crises and their impacts. This work of “amelioration, reparation and preparation” (Hallgarten, 2020) is a critical framing for this RAPID study. Key lessons from this literature include maintaining a focus upon long-term goals as opposed to short-term solutions, mitigating unforeseen impacts (i.e. the differential impact of disease-related crises upon lower income communities), supporting students during long-term recovery (which includes attending to trauma, isolation, ensuring students remain in school, and the need for emotional support), and conducting research and evaluation to be better prepared for - or even prevent - subsequent crises.

# RESEARCH QUESTIONS

RQ1. What is the impact of the educational disruptions and loss of opportunities due to the pandemic upon youth who are typically underrepresented in science?

RQ2. What types of supports and resources are youth drawing upon to mitigate these disruptions as they formulate new plans and make decisions during the pandemic in relationship to their academic and professional pursuits?

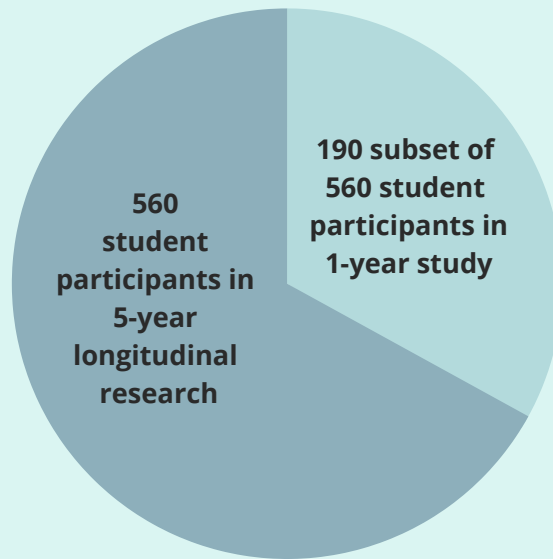


# LONGITUDINAL RESEARCH CONTEXT



This research is part of a longitudinal study examining the pathways of science-interested youth who participated in authentic research with a scientist mentor as part of the New York City Science Research Mentoring Program, a consortium of 23 programs that provide science research mentoring to high school youth who are historically underrepresented in STEM.

Staying in Science  
NSF Grant #1561637  
5-year study  
examining the  
mentored research  
experiences and  
pathways of n=560  
NYC youth

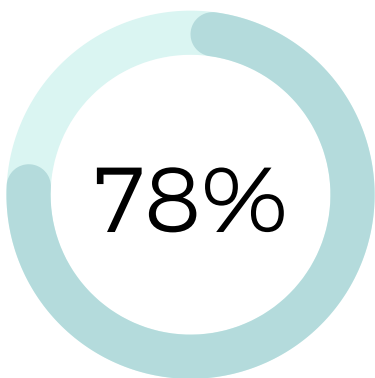


RAPID 1-year study  
examining impact of  
the pandemic of  
n=190 study  
participants



80% of participants identify as BIPOC: The race and ethnicity breakdown includes: 26% identify as Hispanic, 13% identify as Black, 21% identify as East Asian, 17% identify as South Asian, 15% identify as White, 3% identified in race and/or ethnic categories not listed in our instruments; 5% of participants declined to identify their race. The gender breakdown includes: 70% female, 27% male, 1% transgender, 1% non-binary, 1% prefer not to answer.

These students are representative of the racial diversity of New York City, though our sample includes a higher percentage of Asian identifying students and a lower percentage of Black and Hispanic students, compared to the population of students in the entire New York Department of Education.



78% of students have  
declared a STEM major  
**or** plan to major in STEM.



# METHODS & ANALYSIS

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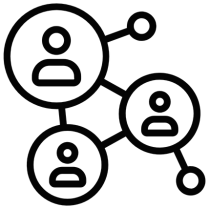
## Student Surveys



We designed and implemented two student surveys (Fall 2020; Spring 2021) that enabled us to capture the impacts of the pandemic on students' college experiences, including: current living and learning situations; academic decisions and plans; resources sought, and concerns for the coming academic year. A two-mode social network analysis component of the Fall Alumni survey asked students to nominate individuals and provide information about the role that person played (e.g., professor, parent, friend etc.) and supports they provided (e.g., financial, academic, moral, etc.) over the course of the academic year.

## Social Network Analysis & Faculty Survey

Drawing on student survey social network data, we generated a list of significant adults to contact as the sample for the significant adult survey. Based on our findings about which adults youth nominated as helpful, we identified the subset of significant adults connected with their college or university for a brief survey, focusing upon their perception of the challenges that college students the interacted with were facing, the resources they and the college/university provided, and the needs that may exist upon the return to campus in fall 2021.



## Student Interviews

We conducted 26 interviews in Spring 2021. Drawing on analysis of the fall 2020 survey, we used a stratified sampling plan to identify participants for whom the pandemic was presenting either extraordinary or few challenges, accounting for participants' race and ethnicity in order to attend to the potential ways the pandemic is affecting youth typically underrepresented in science. The interview protocol asked about how participants' college/university addressed the pandemic during the spring semester; resources provided to students over the course of the academic year; the impact of the pandemic on students' progress and their academic major, decision-making and long-term plans and professional goals; and critical obstacles students faced and the key supports and resources that were especially helpful, including strategies they discovered to help them mitigate the impact of the pandemic.



## Youth Co-Researchers

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In order to **center youth voices and standpoints** so that our research is with youth rather than on youth, our study includes Youth Co-Researchers who are also college students, alumni of the NYCSRMC, and who participated for four years as co-researchers in our prior longitudinal research on youth pathways. Our Youth Co-Researchers provide vital input on the design and pilot-testing of our survey and interview instruments, ensuring that they are youth-focused, clear and succinct, and sensitive to the unprecedented challenges college students are currently facing. They also participated in conducting case study interviews, data analysis, and wrote conceptual memos that brought together their analysis of the data with their own experiences. They participated in dissemination efforts, including co-authoring reports and supporting social media campaigns.

The participation of our Youth Co-Researchers has been integral to our ability to conduct this research during the pandemic allowing the project staff and findings to have authenticity and humility.

# KEY FINDINGS

# 85%

Nearly all students reported the pandemic had an impact on their academic trajectories.

Challenges with online and hybrid courses were a key source of reported impacts. Isolation and changes in academic and social life from closed and restricted campuses, and living at home for many students, negatively impact nearly all students.

Nearly all survey respondents indicated they took college courses remotely or hybrid during the 2020-2021 academic year.

~70% of students learned entirely or almost entirely remotely  
~30% of students had a blend of online and in-person courses



# CLOSED/RESTRICTED CAMPUSES IMPACTED HOW STUDENTS LIVED AND LEARNED

## CHALLENGES TO COMPLETING MAJOR AND DEGREE REQUIREMENTS:

- **Missed opportunities for peer collaboration.** Loss of problem-solving opportunities and formal and informal study groups impacted students' ability to fully engage in coursework. Students who could take in-person courses reported limited opportunities to collaborate due to COVID masking and distancing restrictions.
- **Missed opportunities to develop relationships with peers, faculty, and mentors.** Students felt hindered in their ability to access and build networks with classmates and find mentors to guide their academic decision-making.
- **Missed opportunities to gain hands-on experiences with science practices.** Students who were unable to access labs or other facilities expressed concern that they would not be fully prepared for higher level courses, graduate school or jobs.
- **Limited access to on-campus academic support.** While students often found it challenging to schedule meetings with TAs and faculty, many students took advantage of alternate modes of connecting virtually and benefited from the rise of online chat groups.

## CAMPUS SHUTDOWNS & QUARANTINE CONDITIONS CONTRIBUTED TO STUDENTS' PERSONAL AND SOCIAL LIVES IN MULTIPLE WAYS:

- **An increased sense of isolation had the largest impact on students' academic and personal motivation and productivity.** Students who lived at home with family struggled to be productive in environments that were often not conducive to focused academic work and struggled to balance their academic responsibilities with their expectations of their families.
- **An inability to create community and a sense of belonging, particularly for students of color.** Students struggled to network with people who are similar in race, gender or socio-economic circumstance who are in the STEM field already or are near peers on that same trajectory.
- **Difficulty accessing consistent and reliable mental health resources.** More than half the students we interviewed reported a lack of mental health supports via their campuses.

*Before the pandemic when I [was] still taking Comp Sci classes, it was kind of like a culture of working on Comp Sci. Comp Sci is generally very hard and the classes are very rigorous, so the students have a culture of helping each other, going through it together. There's this community of understanding it, and it's easier just knowing you could talk to a friend or a student next to you and be like, I don't understand the code. What are you doing? You have peer help.*

*- First year South Asian female; switched major to Health Sciences*



*I think when I started at college being a woman and STEM was very isolating for me because a lot of people in my classes didn't really share similar experiences and I just felt like I couldn't connect with them. So I've always felt that way going through college as a woman in computer science. But I think in the pandemic it was even more magnified like, wow. This is very isolating as woman in tech. I reach out to my friends and over time I was able to build a small community of women who do share similar experiences. And I was just talking to them and they also shared the same sentiment about it being an isolating experience.*

*- Second year CS Major, East Asian female*



# FACULTY VARIED WIDELY IN THEIR APPROACH TO ONLINE INSTRUCTION

Students we interviewed articulated **positive ways in which faculty adjusted to virtual environments**, including providing recordings to lectures and online office hours. Students reported that **flexibility around academic workloads and deadlines was central to their success** in their coursework during the pandemic, but **over half of the students we interviewed did not experience that flexibility** from the faculty teaching their courses. Students reported uneven policies for adjusting workloads and deadlines, including faculty who added work to courses that students' felt did not support learning. While many students we interviewed who experienced flexibility in courses found it beneficial, some expressed frustration with low expectations. In some circumstances, **faculty limited communication** between themselves and students and between students and their classmates by turning off Zoom chat features and/or not welcoming questions or interaction during online lectures students were required to attend in real time. These approaches **further isolated students already cut off from in-person interactions and experiences they had relied on to advance their studies**, negatively affecting student morale and for some, academic progress. Further, minimal opportunities for in-person & virtual interaction **hindered students' ability to develop relationships with faculty** needed for future recommendation letters or connections to internships.

“  
*You don't really get INTERACTION when it came to having online classes. If you were confused, the professor wouldn't really know [as it is] through a camera.*  
”  
- Second-year STEM major, Hispanic Black male

## INSTITUTIONAL POLICIES CHANGES PROVIDED STUDENTS INCREASED ABILITY TO MAKE ACADEMIC DECISIONS.

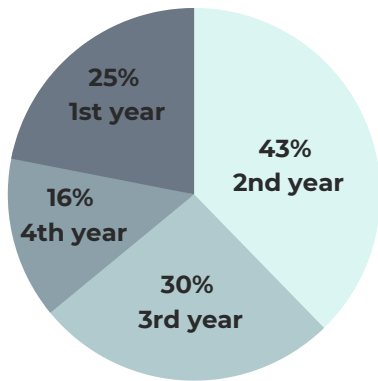
Students cited changes to institutional policies regarding grading and course credit as vital to their ability to successfully complete their semester. These included:

- credit/no credit policies so that low grades would not negatively impact students' GPAs
- extended pass/fail deadlines so that students could still select a pass/fail option up to the end of the semester rather than by midterm
- changes to their required course loads, enabling students to take few classes during the semester but remain at full-time status
- Colleges also provided various support via wifi hotspots and laptops to students who could not afford them or did not have consistent access to the necessary tools to complete coursework remotely

While many students spoke positively about these institutional decisions, a number of students stated that their colleges did not listen to students' needs or communicate well with the student population (e.g. only communicating via large email blasts) and lacked guidance on how to access vital resources such as financial aid and mental health support.



# CHALLENGES TO DEGREE AND MAJOR REQUIREMENTS APPEAR MOST SEVERE FOR STUDENTS WHO ARE JUST FINISHING THEIR SECOND YEAR OF COLLEGE



Percentage of students reporting challenges to degree & major requirements by year

We found that COVID-related disruptions are more likely to be an obstacle to completion of advanced level coursework and degree requirements as one gets closer to declaring a major.

A small percentage of participants state that the pandemic has either caused them to switch majors (14 individuals over the course of the year, or 7.4% of the sample) or consider switching majors (11.1% in the Fall) and (9.2% in the Spring). Our interview data suggests that there are several reasons for college students switching majors during the pandemic: Courses that require computation thinking and mathematical problem-solving were described as difficult to complete in a virtual learning environment and participants did not want a major that required more such courses. Some participants noted that inability to engage in particular practices of science like collecting data and collaborative work which they felt was critical to succeed in their intended major.

## PANDEMIC DERAILS FIRST GENERATION STUDENTS' PLANS TO MAJOR IN STEM

Jada is an Hispanic female-identifying first generation first-year college student who was majoring in Physics as of Fall, 2020. For Jada, campus shutdowns and moving home to attend college remotely while living with family impacted every component of her college experiences and decision-making. Here, she describes how multiple contributing factors related to the pandemic forced her to switch out of a physics major:

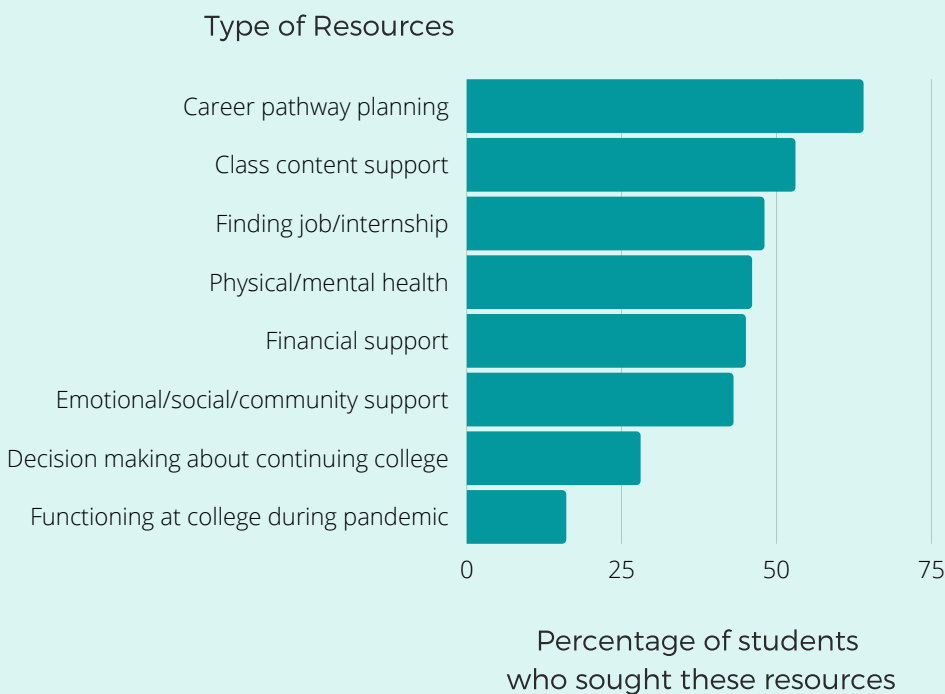
*During the pandemic, that's when I was starting to finish my prereqs and getting into my necessary courses. I started with some CAL courses. I think it was chemistry as well. But it was very hard to keep up with these courses, because I'm also...I'm first-generation, right? So aside from being a college student, a lot of me is expected as the first daughter at home. And so I found it hard to manage both at once....very, very hard actually. ... I needed a lot of time to study and focus and I couldn't do that when I often was need to help my younger brother who is also in school. And so ...it was kind of sad because.... this is kind of a dream I'm going to have to let go and I'm going to have to pursue something more sustainable or easier in a way. So I went and I switched over to economics.*

*I have to find .... another way to do this because I also have to help my brother with his work. I have to help at home with chores. And we're also...we were kind of going through a small financial crisis as well. ... And the family members were also sick. It was all happening at once and I felt it was very overwhelming and I really was sad and devastated that I couldn't continue because I did like physics. .... I love the sciences but I just...this was a hard reality I had to face in that moment, and I was like, okay. I have to do what's best for me and my GPA and my financial aid, because I'm already in college. Now I had to make this adult decision at this point.*

Jada struggled to get help with this important decision about her major during the pandemic; her academic counselors did not give her sufficient time to consider options. Rather, based on very little knowledge about her passions or interests, they guided her to Economics because she was good at math. Jada remained uncertain and uncomfortable about this advice, given her interests and career goals. Her parents were not supportive of a change in major, and her unsuccessful attempts to connect with her college's financial aid office only further complicated her decision-making and heightened her anxiety.

# STUDENTS PURSUED A WIDE RANGE OF SUPPORTS TO SUSTAIN THEM THROUGH THE CHALLENGES THE PANDEMIC PRESENTED

Survey findings suggest that if students attended a college/university that had a strong plan for advisors and mentors as well as career planning resources, then those supports were used by participants during the pandemic. However, if the institutions had weak supports in terms of advisors and connecting to mentors, those participants struggled during the pandemic. In both fall and spring survey results, students most commonly reported seeking career pathway planning support and class content support, with help finding a job or internship ranking third in most commonly sought help.



## SOCIAL NETWORK ANALYSIS REVEALED THAT STUDENTS SOUGHT MULTIPLE TYPES OF SUPPORT FROM ALMOST EVERYONE IN THEIR NETWORKS

*I barely if at all communicated with them prior to the pandemic. We connected because we were online and had to communicate online.*

*- third-year STEM major, Hispanic female, explaining how she became close to three classmates during the pandemic*

Survey findings revealed that **friends and peers were identified as the most utilized source for both academic and personal/social support** during the pandemic. Peers provided vital guidance regarding courses, including course content support and decisions about course taking. In interviews, students detailed common strategies used to access academic support from peers via virtual environments like WhatsApp and Discord. Students described how these groups have been critical for them because it is where they felt comfortable revealing where they need help, using peers to problem solve and at the same time, develop trusting social relationships.



## **AFTER PEERS, ACADEMIC ADVISORS, RESEARCH ADVISORS, AND FACULTY WERE IDENTIFIED AS SIGNIFICANT INDIVIDUALS WHO PROVIDED ACADEMIC RESOURCES DURING THE PANDEMIC**

More than half the students we interviewed (55%) discussed the ways these individuals provided important resources to them while they were attending school during the pandemic, including being accessible to answer course-related and/or research-related questions through online office hours and advice about college and career planning.

Faculty felt prepared to offer academic support during the crisis, but less prepared to provide academic and career pathway and social and emotional support.

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## **FRIENDS AND FAMILY MADE UP OVER HALF OF THE PEOPLE SURVEY RESPONDENTS IDENTIFIED AS VITAL PERSONAL AND SOCIAL SUPPORTS**

This pattern was similar across our interview data: 81% of interviewees identifying peers and friends as the most utilized source of personal support, followed by 66% of students identifying parents and other family members (e.g. siblings, aunts, cousins) as important resources for support.

# FUTURE CONCERNS FOR THE 2021-2022 ACADEMIC YEAR

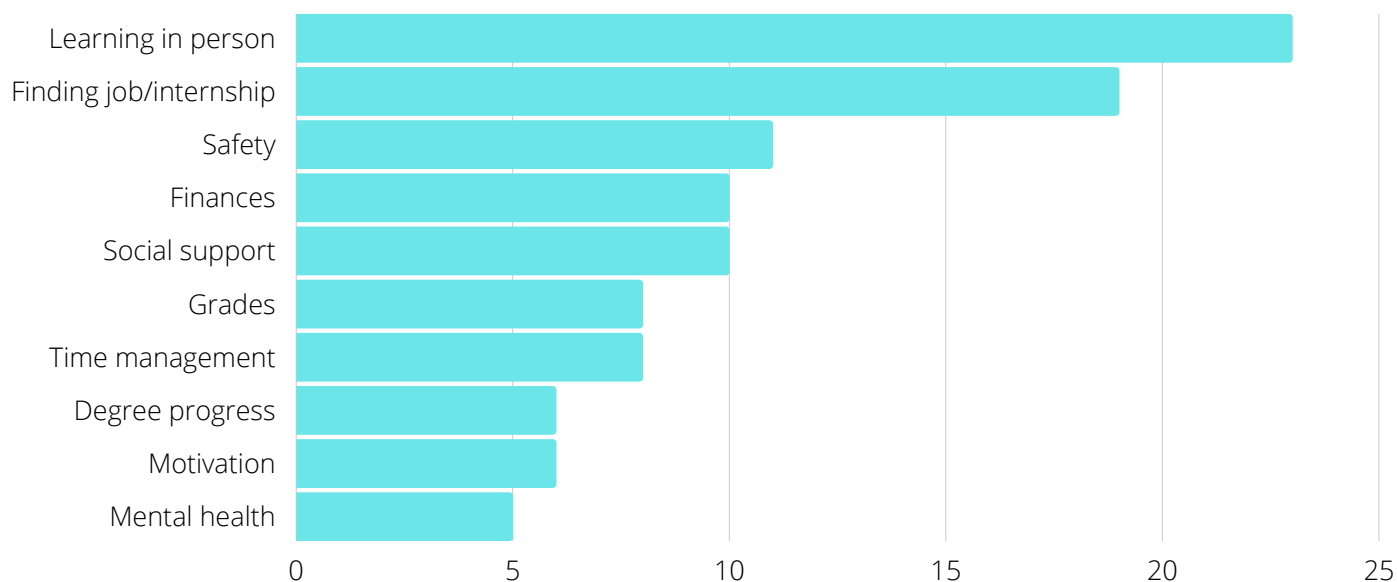
Among students who responded to an open-ended survey item about their biggest worry in the 2020-2022 academic year (n=116), learning in-person and finding a job-internship were the top concerns.

Students were asked what additional resources they wished existed during the pandemic. While very few participants mentioned “mental health” as a concern going into the next academic year, “mental health resources” was the top suggestion about additional resources that would be helpful.



“*I am worried I will repeat my behavior from this spring, during which I struggled with classes due to mental health challenges as a result of being a student during the pandemic.*  
- Fourth year STEM major, White male”

## Top concerns for 2021-2022 academic year



Number of participants who reported concern

# IMPLICATIONS

While younger students struggled during remote learning, our research showed that college students (despite their maturity and greater familiarity with technology) also faced challenges associated with online learning. In addition, concerns about future careers, about the depth of their understanding, returning to in-person learning, and mental health also emerged during the pandemic for the young people in our sample.

To help ameliorate these considerable concerns, our findings point to key shifts, additions and adjustments that faculty members, advisors, department chairs, and STEM mentors can make at the university level; key mentoring strategies mentors can draw upon at this time, and important supports family members of STEM-interested students can use to help support and ameliorate the impact of the pandemic.

While colleges as a rule make an important effort to treat students as young adults, we find that students relied upon their parents and families at this time, so including family members in communication, outreach and advocacy must be especially important right now - even as colleges work to ensure that students have agency and independence.



# RECOMMENDATIONS FOR STEM-INTERESTED STUDENTS



- **Continue to use friends as study partners and mechanisms for sharing information.**

Consider creating or joining existing online peer networks, peer study groups, and any social supports that might help you at this time; know that being a part of a community (remote or even at a distance) can be a really important support for you. Create set times to study together online with your peers, even friends who are in different majors. Use this shared study time to provide you and your peers with structure and motivation that can support you in your studies.

- **Talk to your parents about how the college system works** so they can both support you and empathize with you.
- **Develop a routine for self-care.**

- **Advocate for yourself in terms of course requirements and your major requirements.**

Check in with faculty members, department chairs and your advisors, and let them know about any concerns you have about fulfilling your major and your work, and ask for their support and help. Point to specific concerns about missing courses, unavailable options and gaps in your requirements and ask for help fulfilling those.

- **Suggest supports that your department and advisor can include as you return to in-person coursework** and continue your pursuits in STEM. Ask for flexibility, additional time on key ideas, and longer review of key ideas from earlier courses. Encourage your department to increase/offer access to free tutoring and peer supports.
- **Find and join national or regional STEM support student networks to maintain a connection to a community of students of similar race and gender** (ie. National Society of Black Engineers, Girls Who Code, NCWIT). Utilize these organizations and networks to connect with students pursuing similar college and career goals.
- **Share the results of this study with your STEM supports so they know this is part of a larger challenge!**

*As far as being socializing and forming community, just going on Zoom calls with friends and just even eating dinner ... and talking and just not isolating yourself completely, even if you can't be physically in the same space was really helpful for me. I know a lot of people were in a really emotionally dark space during the pandemic, like with quarantining, but just reaching out to people you care about and just not losing that connection was really important.*

*-first year STEM major, South Asian female*

# IMPLICATIONS FOR PARENTS AND FAMILY MEMBERS OF COLLEGE STUDENTS

- **Understand that your student is not alone** in their concerns and challenges in this moment; offer reassurance that they are not alone.
- Talk with your student about how you might support them in **navigating college resources** that may help find internships and summer opportunities.
- Support your student in advocating for themselves and their peers for **extra support and course adjustments** that may help accommodate and support their concerns about fragile understandings from remote learning.
- **Help them review requirements**, examine course requirements, and maintain clarity around course requirements, as well as ensuring their decisions reflect their passions and interests.
- **Help them connect** to friends, peer groups, and any free or additional tutoring that could help them as they transition 'back to school' in person.
- **Affirm their concerns** but also share your support and advocacy for them: underscore their abilities and potential.



# RECOMMENDATIONS FOR FACULTY MEMBERS WORKING WITH UNDERGRADUATES AND DEPARTMENT CHAIRS IN STEM

- **Sharing recordings, documents, and aligning class material to exams is helpful**; given students' concerns about depth of understanding of foundational ideas during remote instruction, ensure ample time to develop key ideas as well as time for review.
- **Provide opportunities for informal as well as more low-stakes assessments** to help guide your understanding of your students' prior knowledge and learning.
- **Incorporate strategies for students to develop relationships with each other.** If the class needs to be hybrid, try to make the first few sessions in-person. **Use some time for relationship-building**, because students continue to value and use peer support.
- Consider using some class time to **help orient and connect students to career counseling.** Know how to guide students to sources of support in your institution.
- **Inform students of national or regional STEM support student networks** they can join to maintain a connection to a community of students of similar race and gender (ie. National Society of Black Engineers, Girls Who Code, NCWIT).



# RECOMMENDATIONS FOR DEANS & PRESIDENTS AT INSTITUTIONS OF HIGHER EDUCATION



- **Give faculty support** in effectively leveraging the affordances of online learning spaces.
- **Listen to students' needs and desires** before implementing major changes.
- **Set clear expectations and protocols for online learning** and communicate those to both students and faculty.
- **Create mechanisms for extra academic support** for those who learned content of introductory courses virtually.
- **Review and strengthen advising and counseling supports;** during this prolonged crisis, students are especially reliant upon them.
- **Help students to identify and join external networks** that could be useful for them. This helps when experiencing potential isolation caused by various factors but also provides new insights.
- **Use alumni networks** to create intentional ways for older near peers within the same major to make connections with younger students.

- **Increase funding for mental health services** so that more students can consistently access services:
  - Consider options for virtual therapy
  - Encourage flexibility for counseling availability (e.g. early sessions, evening sessions) so that students can access sessions more easily
- **Offer free opportunities** such as subscriptions to online therapy apps that enables students to text with therapists but also provide opportunities for phone or virtual conversations with mental health professionals.
- Enable students to make mental health appointments through an **online scheduling system**.
- **Provide students with longer 'health breaks'** (i.e. students reported that a full week is more restorative than several shorter breaks of 1-3 days for "health breaks").
- **Support faculty in increasing their awareness of students' mental health concerns** as well as the range of supports available so that they can help guide and advise students during this prolonged crisis.

## COLLEGES AND UNIVERSITY RECOMMENDATIONS TO SUPPORT STUDENTS' MENTAL HEALTH NEEDS



# IMPLICATIONS FOR MENTORS OF STEM-INTERESTED YOUTH

- **Help students seek out internships and summer opportunities.** Support students in thinking about work and internship opportunities that might be non-traditional and/or outside of their intended major, but are equally useful for skill-building.
- **Advocate for extra support and course adjustments** that accommodate and support students who are worried about fragile understandings from remote learning.
- Because your students may be reaching out to you and leaning on you for support at this time, **help your student review requirements, examine major requirements, and maintain clarity around course requirements.**
- **Help them connect** to friends, peer groups, and any free or additional tutoring that could help them during this prolonged crisis.
- **Affirm their concerns and share your support and advocacy for them: underscore their abilities and potential and the important role they can play in STEM in the future.**



# IMPLICATIONS FOR NON-PROFIT ORGANIZATIONS THAT SERVE HIGH SCHOOL STUDENTS



- **Send regular messages to your alumni** that offer support, mentoring and advising.
- **Develop ways for alumni to connect and support each other** regardless of major.
- **Reach out to the parents of your community** to share the findings from this report and ask if there are particular resources or supports you can provide them so they can guide their college-aged children.
- For those high school students who are about to enter college next year, **create structures for them to reach back out to you** that can be relied upon during these times of prolonged uncertainty.

# ACKNOWLEDGEMENTS

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## STAY CONNECTED WITH US!

Preeti Gupta, PI, is Senior Director of Children & Youth Programs: [pgupta@amnh.org](mailto:pgupta@amnh.org)

Karen Hammerness, Co-PI, is Senior Director of Education Research & Evaluation: [khammerness@amnh.org](mailto:khammerness@amnh.org)

Kea Anderson, Co-PI, is Senior Education Researcher at SRI Education: [kea.anderson@sri.com](mailto:kea.anderson@sri.com)

Tim Podkul, Co-PI, formerly at SRI Education: [tpodkul@gmail.com](mailto:tpodkul@gmail.com)

Rachel Chaffee is Senior Education Researcher at AMNH: [rchaffee@amnh.org](mailto:rchaffee@amnh.org)

Anna MacPherson is Senior Manager of Education Research & Evaluation at AMNH;  
[amacpherson@amnh.org](mailto:amacpherson@amnh.org)

Follow us on Twitter for research updates:

@pguptascience, @karenhammerness, @rchaffeePhD, @annamacp

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