



Helping the PANDEMIC GENERATION

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Physics undergraduates have returned to classrooms, but pandemic trauma has endured. How can the community assist?



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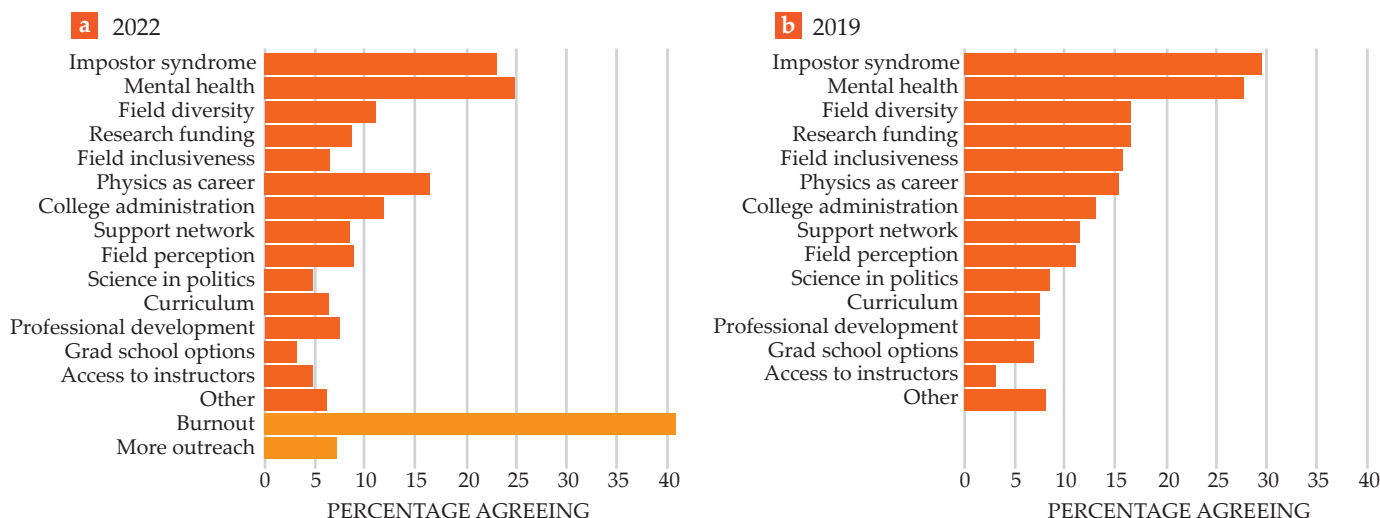


Although the COVID-19 health emergency of the past three years is fading, its effects will be felt on college campuses for many years to come. It shouldn't come as a surprise to anyone that a global pandemic that shut the world down for years significantly impacted students' educational journey. Although the extent of the disruption is still being measured, the pandemic clearly affected aspects of the physics undergraduate experience, such as experimental courses and summer laboratory internships. It also made it hard for students to build an identity as part of a cohort and develop relationships with faculty.

The pandemic's effects were not uniform and will likely not be fully understood for decades. Studies have shown that some students fared no worse during the health emergency^{1,2} and have gotten back to business as usual now that in-person instruction has returned.³ But many others have struggled.^{4,5} Students' experiences have been uneven because the abrupt changes to university instruction during the pandemic affected them at different stages of their professional development. Students who are now beginning their fourth year of college likely experienced their first year of college mostly virtually.

For many students, college is their first extended time away from home. It is where they develop foundational skills in communication, studying, prioritization, and managing stressful situations. The pandemic generation was removed from support systems that are traditionally vital to undergraduates—for example, physics club meetings, in-person study sessions, and informal hallway discussions—and that are especially crucial for first-generation college students and those who come from underrepresented groups.⁶

Departments should be commended for how they helped students continue their



(a) THE RESULTS of a student survey at the Congress Workshop at PhysCon 2022. Participants were asked to list the two most important issues facing them and their Society of Physics Students chapter. **(b)** The results of a similar survey at the previous congress, in 2019. Although the survey posed the same question, the provided responses differed slightly. Nevertheless, it is clear that the pandemic worsened existing mental health issues among students.

“Burnout and impostor syndrome affect nearly every single physics and astronomy major.”

studies as best they could in the face of a public-health crisis. Moving an entire college-level course sequence from in-person to virtual instruction essentially overnight is something most physics and astronomy departments didn’t see coming and likely didn’t even think was possible. Universities have now largely returned to in-person instruction, but it shouldn’t surprise anyone that students missed out on things that previous generations would consider to be normal or even fundamental. Our students are very bright, and they are looking for ways to show us they missed out on those experiences. We need to listen to them.

Lessons from PhysCon

Every few years, the physics and astronomy honors society, Sigma Pi Sigma, hosts PhysCon (short for “Physics Congress,” although going forward the event will be formally called the “Physics and Astronomy Congress”). It brings together current undergraduates—mostly juniors and seniors—from over 250 colleges and universities to share in three days of community building, professional-development activities, leadership training, and workshops. The conference seeks to understand how the physics and astronomy community needs to evolve so its members can best support each other and build a better future for the physical sciences.

One of the most important parts of the meeting is the Congress Workshop, which asks attendees to consider their under-

graduate experience so far and identify the most important issues that they or their chapter are facing. The workshop focuses on how attendees can support each other and make progress on the issues students are facing in their capacities as individuals, as representatives of their departments, and as part of the broader community.

Originally planned for late 2021, the most recent PhysCon was held in fall 2022 because of a pandemic postponement. Panel a of the figure shows the results of a survey conducted at the Congress Workshop in which the authors of this article asked students to list the two most important issues facing them and their chapter. The most common response was burnout, with 40.6% of the students in the room who responded stating that it was the biggest challenge. That should not be surprising. It’s rational to feel burned-out after a global pandemic, and the prevalence of the response is a strong indicator of the issues students are dealing with.

Comparing that result with a similar survey conducted at the previous PhysCon in 2019 (see panel b of the figure) is instructive. Although that survey was slightly different, we can still learn much from it. Tellingly, burnout was not even listed as a potential concern in 2019, and it wasn’t written in by anyone either. At that time, the largest issue of concern was impostor syndrome (29.6%), and mental health was a close second (27.9%). Of course, mental health and burnout are linked.

The PhysCon survey touches on an array



of deep-seated issues that we as a community can help to address. They were exacerbated by both the rapid transition to online learning environments and the prolonged changes to student support structures such as undergraduate groups and faculty connections. For many students, those issues were compounded by a loss of access to research, summer experiences and income, and even housing. Similarly, course expectations were changed in ways that often conflicted with educational goals.

The pandemic also robbed the current generation of students of one of the most important aspects of the college experience: connections to their peers. Many students stay in physics and astronomy because of those connections, which help them develop their identity as budding scientists. If students are removed from their course-related cohorts, their self-identity and support networks suffer. That is especially true for students from underrepresented backgrounds.⁶ In many cases, the pandemic also physically isolated students or stunted their opportunities for connection and learning outside of the classroom, such as research experiences or interactions with faculty. Lack of connections probably also hampered recent gradu-

ates: New degree holders employed in the private sector report that teamwork is the most-used skill they learned as a physics major.⁷ Feeling disconnected might be part of the reason why 36% of physics and astronomy undergraduate students who completed their degrees in 2020–21 reported that they changed their postgraduation plans because of COVID-19.⁸

Differentiated experiences

For instructors, it is important to realize that not all students were affected by the pandemic equally, and that will create difficulties in the classroom for some time. On the one hand, some students came through the pandemic unscathed or even empowered. For example, when freed from the distractions of campus life, one student the authors of this article have worked with was able to dive deeper into studying and make rapid improvements. Despite receiving poor grades in the first semester of college, that student ultimately earned admission into a PhD program. Another student formed a pod of study partners and benefited from increased time with family.

But many other students—often those from marginalized parts of society⁴—did not

“Imagine starting your career with no friends to meet up with.”



“The lack of outreach and connection creates a culture and a public reputation of elitism.”

fare as well. Some of them may have had to drive to fast-food-restaurant parking lots so that they could access the internet to attend their class, or spent months living in their cars. Some may have had family members who lost their jobs or had to take on extra part-time work just to get by. Those experiences speak to inequities in resource access. Lower-income communities in New York City, for example, saw a disproportionately higher rate of COVID-19 infections, hospitalizations, and deaths.⁹ Should we really be telling a student who lost multiple family members due to COVID-19 to focus on their homework?

That presents an important question for educators: How can they meet the needs of students who weren't affected by the pandemic and students who have fallen far behind? On the one hand, instructors may have classes filled with eager students prepared in the same way that many students were before the pandemic. Those students are generally tired of COVID-19 and ready to proceed to the next level in physics. On the other hand, educators may have classes filled with students who, during the pandemic, may have missed out on critical high-school mathematics, lost family members, or

had to live in a small space with fewer resources than normal. Those students are also sick of the pandemic. The reality is that both sets of students are probably present in all classrooms.

Many of the students who are struggling have missed out on key academic-development opportunities. They don't just have low math scores: Often they don't possess the study skills¹⁰ or expert-like thinking¹¹ necessary to succeed in physics and astronomy. Inequity and impostor syndrome were already major problems in physics and astronomy before the pandemic. Students would look at their high-achieving peers and wonder if they had the ability to succeed. Those problems may now be worse, because educators and employers sometimes assume that students have had certain experiences without understanding the reality of college life during the pandemic.⁶

The term “hidden curriculum” loosely captures the collection of unwritten skills for being successful in college that many students from the dominant-culture class have developed over the years.¹⁰ Those skills might include understanding social messages and expectations or intuitively comprehending the appropriate behaviors or



values a student should have at a certain point in their educational journey. Having those skills can give a student a serious edge. Many students from underrepresented backgrounds gain knowledge of the hidden curriculum by connecting with the community through activities like internships, department work, and summer research projects. Although some students had opportunities to do so during the pandemic,¹² there were fewer openings.

Most students have felt anxious or depressed because of the pandemic.¹³ The authors of this article have mentored academically high-performing students who faced extreme mental health conditions caused by, or amplified by, the COVID-19 emergency. One of the unfortunate situations is that because of their success, those students often appear as if their life is going along swimmingly. The outside observer might not see the emotional turmoil that is happening inside the student.

Those are the students who are often key members of student organizations in the department. They are the ones everyone goes to with their problems, questions, and concerns. Even faculty rely on them to accomplish important tasks: An undergraduate

physics club president might be asked, for example, to attend a university open house. In moderation, those responsibilities are typically good for the student's career. But when they're giving everything they have and are on the verge of breaking down, a little extra work might push them over the edge. Mental health support for all students is critical because it encourages social connectedness.¹³

All members of the physics community can help to address the issues facing undergraduates and recent graduates today. As difficult as it is for our students, there are plenty of opportunities for us to help them out and give them the keys to success. Just a little bit can make a huge difference. The rest of this article will discuss some of the things we can do as a community to improve the situation for students.

Inside the ivory tower

College professors can help their students address burnout and the mental health consequences of COVID-19 in several ways.^{14,15} In the classroom, they can promote mental health by designing the social aspects of active-learning activities in ways that reduce anxiety, increasing mastery-based learning,

“When a student gets burned out, they are encouraged to transfer majors instead of to keep going.”

“Students are struggling with the world around them, and their mental health is in the gutter. . . . Often the source of their struggles are systemic issues that cannot be adequately addressed at the individual level.”



and providing students with more choice in course assignments.¹⁴ They can also account for the inequality of students' experiences and help them reacclimate to studying, overcome impostor syndrome, cultivate a sense of belonging, and learn about the hidden curriculum.¹⁵

Even before COVID-19, students came into physics classes with varying levels of preparedness. The spread in that gap is much bigger now. Not every student is going to catch up in one semester. Some of them will need to be pushed: We must make sure they are meeting their deadlines and are giving it their all. Telling those students they can miss class or homework assignments is not going to help them grow. But other students are really at an inflection point. An extra assignment or bad grade can have negative consequences for their mental health. We must identify those students early so that we can help right them when they get off course.

Departments and colleges also have an important role to play. Here we can take inspiration from a few programs already instituted at several universities. At Washington University in St Louis, for example, the diversity, equity, and inclusion committee has designed posters of physicists with a variety of career descriptions and hung them around their department. At Juniata College in Huntingdon, Pennsylvania, a program

sponsored by the Society of Physics Students (SPS) created a mural in the department that depicts physicists and astronomers from a wide variety of backgrounds. Those initiatives communicate the various careers available to graduates with physics degrees and broaden perceptions of who is in the field. Indeed, studies have shown that expanding the culture of physics, which is quite narrow, and providing materials for both educators and students is necessary to create a wider classroom support structure.¹⁶

Another way departments can help is by hosting career events with alumni. They provide an excellent way for students to meet recent graduates who can teach them pieces of the hidden curriculum. Learning about career opportunities can also help motivate students who are struggling to find their career path. SPS's online Careers Toolbox provides a collection of resources that faculty and departments can use to help students with their career search.

Mentorship is another area to focus on. Many SPS chapters or department-level physics and astronomy clubs support programs in which upper-level students help mentor lower-level students. Departments can arrange small meetups between students over coffee or a snack to chat about their studies. Invaluable information about how to succeed as a college student can be passed down in those forums. The value of student-



to-student and recent-alum-to-student interactions cannot be overstated. At the end of the day, education is a deeply personal journey that students undertake not as individuals but as a group: They learn just as much from classmates and friends as they do from giants in the field. In many ways, physics is a team sport: When one student is stressed, all of their classmates feel it.

Almost all campuses host a wealth of support services such as counseling and tutoring centers that students can take advantage of. But many students are afraid to ask for help. Participating in a mentor-mentee relationship can be one way a lower-level student can gain the courage to use those services. When mentors share how they used those services in the past and describe how they benefited from them, lower-level students learn that it's OK to get help.

Colleges and their physics departments should also provide a space for students to have fun, connect with their peers, and feel at home. A strong physics or astronomy club connected to SPS is an excellent way to do so. Such a club allows students to develop a space for themselves and gain a voice in the department.

But it's important for SPS clubs to post and enforce codes of conduct so that they can provide a safe and encouraging educational atmosphere and avoid creating a toxic environment that excludes members of the department. That isn't easy. It takes effort and a lot of patience.

Outside academia

Individuals outside the ivory tower may not think that they can have a role in students' education. Somewhat counter-intuitively, however, being outside of the academic world may actually give them hidden powers to reach students in a meaningful way. Students are often skeptical of career advice from faculty. But when someone in the so-called real world gives advice, it can really hit home—even if it is the same advice that students have received from their professors. Individuals outside academia have a unique opportunity to provide support that faculty are not able to.

Mentoring provides a one-on-one opportunity to help develop someone's career, and many of the American Institute of Physics' member societies have programs that aim to connect physics-trained professionals with hungry students who want to learn. (AIP is the publisher of *PHYSICS TODAY*.) For example, the American Physical Society (APS) has a Career Mentoring Fellows program, which provides funds, resources, and training for professionals to give talks at colleges and universities about how students can build their careers. For those in industry, APS's Industry Mentoring for Physicists program connects students and early-career physicists with industrial physicists for career advice and guidance. Another important program is APS's National Mentoring Community, which facilitates relationships between underrepresented undergraduates and professionals. The American Astronomical Society also boasts several programs that aim to connect students and early-career astronomers with potential mentors in the community.

Strong mentors can be an excellent resource for students who are struggling with their studies and other life situations. A positive mentor might be able to even catch student problems before they become serious and help students overcome them. Mentoring can improve a student's physics identity and their success in physics. Mentoring can also have a huge effect as students transition into the professional world. Transitioning into the industrial world can be particularly daunting for students. One student at PhysCon 2022 remarked, "I am doing my own research on finding jobs and have not seen any way to get my foot in the door of industry." For that reason, senior industrial physicists can make a powerful impact by taking new employees under their wing, especially if those employees are recent graduates struggling with the transition into the working world.

Unfortunately, there is no magic pill that will solve all the problems students are facing. Professors can't change the landscape of mental health in physics all by themselves: It's going to take effort by the whole community. Although mental health issues and inequality have been made worse by the COVID-19 pandemic, they were issues before and will be issues afterward. Physics is hard, and when students push themselves to their limits, they will inevitably test themselves and require support.

But the world needs good physical scientists, especially now that we are facing an increasing climate crisis. We must work together as a community to create an enriching, challenging environment for our students to thrive in. Our students are struggling to handle the lasting impact of a pandemic, and they need our help. The first step is to reach out.

All photos and quotes in this article are from PhysCon 2022. The photos are courtesy of SPS, the SPS National Council, and Sigma Pi Sigma.

REFERENCES

1. E. W. Burkholder, C. E. Wieman, *Phys. Rev. Phys. Educ. Res.* **18**, 023102 (2022).
2. S. Iglesias-Pradas et al., *Comput. Hum. Behav.* **119**, 106713 (2021).
3. A. Nemeth, C. Wheatley, J. Stewart, *Phys. Rev. Phys. Educ. Res.* **19**, 013103 (2023).
4. D. Contini et al., *B.E. J. Econ. Anal. Policy* **22**, 399 (2022).
5. S. Mervosh, A. Wu, "Math scores fell in nearly every state, and reading dipped on national exam," *New York Times*, 24 October 2022.
6. AIP National Task Force to Elevate African American Representation in Undergraduate Physics & Astronomy (TEAM-UP), *The Time Is Now: Systemic Changes to Increase African Americans with Bachelor's Degrees in Physics and Astronomy*, AIP (2020).
7. AIP Statistical Research Center, *Initial Employment: Physics Bachelors and PhDs, Classes of 2019 and 2020* (March 2022).
8. A. M. Porter, P. Mulvey, *Postgraduation Planning During a Pandemic: Effects of COVID-19 on Physics and Astronomy Seniors' Career Paths*, AIP Statistical Research Center (October 2022).
9. M. Schwirtz, L. R. Cook, "These N.Y.C. neighborhoods have the highest rates of virus deaths," *New York Times*, 18 May 2020.
10. S. S. Erickson, *Phys. Teach.* **60**, 398 (2022).
11. T. Hynninen et al., *Phys. Rev. Phys. Educ. Res.* **19**, 010101 (2023).
12. D. Z. Alaei, B. M. Zwickl, *Phys. Rev. Phys. Educ. Res.* **19**, 010135 (2023).
13. I. Riboldi et al., *Int. J. Environ. Res. Public Health* **20**, 4071 (2023).
14. M. Eblen-Zayas, K. M. Burson, D. McDermott, *Phys. Teach.* **60**, 628 (2022).
15. M. Wright, *Phys. Teach.* **61**, 326 (2023).
16. P. Sabouri et al., *Phys. Teach.* **60**, 740 (2022).

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