

# How to attract the next generation of chemists

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Getting the next generation to participate in chemistry will require dismantling normative approaches to education and mentoring. Inclusive pedagogy that incorporates social issues and innovative teaching with special attention to historically excluded groups are keys to unlocking the full potential of future scientists.

## Challenging time for students

In the past three years in the USA, the next generation of chemists has witnessed a racial reckoning following the murder of George Floyd, changes to learning environments due to the coronavirus pandemic, an increase in anti-LGBTQ legislation that primarily attacks transgender youth and the overturning of the right to access an abortion in many states. Our students come into our classrooms confronting these profound social challenges on top of long-standing negative stereotypes of minoritized people that are often unaddressed and reinforced in the culture of our classrooms and research programmes.

As a result of this complex social and cultural context, chemistry education is at a cross-roads. We have to reimagine how we mentor and educate if we hope to increase participation by the younger generation, especially by students with minoritized and intersectional identities<sup>1</sup>. The traditional culture of chemistry is deeply technical and objective, leaving no room for integrating cultural and social issues in our curriculum and mentoring conversations. However, it is becoming increasingly difficult for educators to be effective in the classroom if they do not acknowledge these challenges and integrate them in student learning. We need to sensitize ourselves to social and cultural factors that inhibit students from realizing their full potential, so that they have the best chances to develop resilience and go on to thrive. Fostering a sense of belonging is a key pillar of how we excite, educate and mentor our students<sup>2</sup>.

## Social media as a tool

To promote science and increase participation, we need to start by meeting students where they are. Social media, used overwhelmingly by Gen Z students, has emerged as a powerful tool to learn about, and engage with, their culture and social concerns (Fig. 1). It provides students the autonomy to educate themselves in an environment outside the standard academic setting – removing the barriers that have alienated many with minoritized identities and alternative learning styles from participating in STEM. Interactive videos with strong connections to their lived experiences are highly desired by this generation. On social media, educators can capitalize on this learning style, delivering relevant scientific material quickly, in a personalized, relatable way without losing detail.

While it seems like a challenging task, there are many educators who already use social media platforms such as TikTok to great effect. Science communicator Hank Green (hankgreen1) breaks down scientific concepts to a general audience, captivating the minds of future scientists and piquing the interest of anyone who comes across his videos. His use of humour and current issues as vehicles for scientific discussion keeps science relevant and at the forefront of his audience's mind. Chemistry professor Kim Hilton (chemicalkim) draws people in with eye-popping demonstrations that transition into powerful chemistry lessons. Inna Kanevsky (dr\_inna), a psychology professor, counters misinformation presented by other creators (with her unique brand of sass) with journal articles that provide accurate information on the topic. Joel Bervell (joelbervell), a medical student, uses his



**Fig. 1 | Making connections.** Social media facilitates deeper connections through shared interests such as dance.

platform to educate his audience about medicine through the lens of the black patient experience, highlighting racial biases in the US medical system and inspiring future black medical doctors. Away from the social conventions of STEM culture, social media allows avant-garde creators to play with the power of absurdity by juxtaposing scientific ideas with cultural satire (see content by itsdimpey and adrianbliss). These creators have harnessed their unique perspectives to develop novel approaches to educating the younger generation by fusing scientific learning with humour, art, commentaries on race and human social dynamics, many of which run counter to the objective scientific culture but are effective at breaking down the barriers to participation.

### Diversity is a strength

Social media outlets are one example of how we can use new approaches to deliver educational content. However, any new teaching method needs to incorporate efforts to increase the participation of students from historically excluded groups. Deficit thinking, in which those who are capable persist, and those who do not persist are assumed to have been lacking in some respect, has been the foundation of our pedagogy for the past 30 years<sup>3</sup>. Interventions targeted at compensating for deficits have not led to an increase in the numbers of participants from historically excluded groups because they have failed to address the culturally unresponsive nature of our science education<sup>4</sup>. We need to update the picture of a chemist, broaden participation through interventions that have proved to work in the education sphere and do critical self-reflection on how we, intentionally or not, reinforce the barriers that prevent others from coming in<sup>5</sup>. Diversity adds strength to the scientific community. We need broader engagement to answer the questions we ask and to generate novel questions for the community to solve.

### How do we proceed?

Mentors and educators need to promote a sense of belonging in their students. One way of doing so is to share our own stories of overcoming challenges we faced during our education, which might require us to be vulnerable. Being vulnerable allows us to bring our authentic selves to our students who increasingly look to us for hope and help in navigating the world they are inheriting. We need to move away from the old approaches to teaching and mentoring by updating our language, materials and methods of delivery to be more reflective of our students'

needs, with increased awareness of social issues in and out of the classroom. Students must be encouraged to bring their self-expression and interests to the learning spaces they occupy. We underestimate the positive impact that diverse representation has on students – we must work to elevate the voices of successful minoritized chemists. We also need to promote the expression of joy in our classrooms and laboratory spaces. In the scientific community, we celebrate students with unhealthy work–life balances as models for productivity. In doing so, we signal our disapproval of the other rewarding facets of student life. As educators, we need to model and support a healthy work–life balance. The scientific community values publications even if it comes at the cost of students' mental health. At the same time, we know that good mentors think about students holistically. Students cannot do transformative scientific work if they feel they have to leave important aspects of themselves at the door of the lab or the classroom before entering. They need to bring their full selves and what drives them to work, and that must be valued by their instructors and mentors. Breaking down barriers is uncomfortable but necessary work. We must challenge the status quo and actively advocate for a more welcoming and inclusive environment in chemistry.

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### Competing interests

The author declares no competing interests.