INGENUITY

Education for the future

We asked young scientists: Are our schools and universities adequately prepared to educate young people for future challenges? What is the most pressing issue in your field, and what one improvement could your country make to its current education system to prepare students to face it? The responses expressed concerns about the current state of education in countries around the world. Many students lack access to the information they need, and those with access are often constrained by curriculum that emphasizes rote learning and isolated subjects. Our respondents suggested a variety of improvements to prepare the next generation for success.

Connection with nature

There is a growing disconnect between humans and nature. For many people in Poland, nature is just a boring word associated with a subject taught at primary school. I propose creating opportunities for positive outdoor experiences by taking teaching outside the classroom. Positive outdoor experiences not only benefit students' mental and physical health, they create the bonds that lead those students to care for the global environment.

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Australia's growing urban population is becoming culturally disconnected from the effects of land and water degradation and the loss of native wildlife. The education system must develop programs that reconnect students in urban and rural Australia. Through tourism and sustainable agriculture, regional communities and environmental assets will continue to bring jobs and growth to future generations, including those in the cities.

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Because nature conservation is the responsibility of all citizens, and because there is no better way to learn than to experience, Hong Kong's universities should implement a compulsory field course for undergraduate students from all disciplines of study. Seeing is believing; through field expeditions, students will learn to appreciate the beauty of biodiversity. We can then tell our future pillars of society how humans have affected the natural environment and how we could mitigate the situation. In this sense, one little course may mean a lot to biodiversity conservation.

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Interdisciplinary collaboration

To address the increasingly complex and interdisciplinary challenges of the future, U.S. education must give up the current conveyor-belt model of education, which focuses on testing and standardization in isolated subjects, each with its own terminology. Instead, we should move toward a model in which students learn to collaboratively design creative solutions to complex problems. Project-based learning poses grand design questions, for which there are no single and simple answers. Students form groups to investigate the question, explore the question from different viewpoints, and finally form a joint decision. Rather than abstract knowledge, students work on real-life problems that are relevant to them.

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Despite decades of modern research, complex disorders such as cancer and cardiovascular disease remain major health issues and claim millions of lives worldwide every year. To address these challenges, Turkey's education system should emphasize memorization and testing less and focus instead on group projects that encourage students to think broadly and work together effectively. We must prepare students for cross-disciplinary work, which is inherently collaborative, as it brings together individuals with a variety of expertise.

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U.S. schools are not properly preparing students to become the scientists of tomorrow. Whereas liberal arts and languages are often required courses for students across all fields, classes like computer science and machine learning are often taken only by students focused on physics, engineering, or technology. A generation of chemical, molecular, cellular, organismal, and natural biologists have had to learn how to adapt and create technology when they start...
their research. To promote an environment of equity and inclusion, high schools and colleges should mandate computer programming courses for future scientists.

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Health and safety

Many students struggle with self-regulation in a world of digital temptations. Online games, social media, and mobile apps are designed to be as rewarding and addictive as possible. Norway’s schools should take an active role in monitoring internet addiction and teach coping skills for these temptations.

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Sex education has long been a taboo topic in India’s schools. It is time for the country to introduce comprehensive sex education in middle school in an effort to prevent sexual assault. Educational values inculcated at such an early age could go a long way toward shaping children’s views and creating a platform for them to act as responsible citizens.

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As gene sequencing costs decrease, the role of genetic information in society will continue to expand, both within and beyond the medical health arena (including direct-to-consumer testing and applications in law enforcement and insurance). Although the Australian secondary education curriculum covers emerging gene-editing techniques, the security and ethical issues surrounding the privacy of genetic information are not sufficiently emphasized. Using its successful anti-cyberbullying, social media, and online safety campaigns as models, the Australian education system should create courses to address genetic privacy concerns. By raising awareness of the current and future role of sequencing within society, these courses would ignite discussions that would lay the groundwork for implementing robust changes to consumer protection policies and genetic privacy laws in Australia.

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China’s education department should provide compulsory courses for all grade levels on network security management. The courses should teach students how to prevent and resolve network threats they may encounter while playing online games, shopping online, and using mobile apps. Students would then be prepared to protect their personal information and develop safer and healthier online habits.

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A major oversight of the current U.S. education system is the assumption that students will automatically acquire the skills necessary to cope with difficulties when they arise. Yet skills such as emotion regulation and interpersonal communication can be taught. To truly prepare students for future challenges, these skills should be an integral part of the curricula at every stage of training.

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Equal access

The biology curricula in Pakistan largely ignore the topic of biological evolution, hindering students from fully understanding such diverse fields as medicine, pharmacology, nutrition, and agricultural sciences. Teaching biological evolution, especially with the support of theologians who acknowledge its importance, would help students connect the dots between the development, spread, and prevention of antibiotic resistance.

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In India, and most developing countries, there is still a wide disparity between the education available to the poor and the prosperous. Establishing a consistently high-quality education infrastructure, compulsory for all, is the first step to preparing young people for future challenges. Because India is culturally and physically diverse, the education system should identify and address local challenges by embracing cultural background.

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The contents of primary and secondary textbooks in Taiwan are only revised about once a decade. The lag time between revisions inevitably results in students who are not well informed about pressing issues such as ocean acidification, global warming, or abuse of antibiotics. The standardized textbooks also force students to memorize outdated facts while ignoring new scientific discoveries. Textbooks for the sciences should be revised every other year to keep pace with the urgent developing issues.

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False information involving science will continue to disseminate until scientific education is available to all young people, regardless of income, race, location, or socioeconomic status. In the United States, programs for gifted children are overwhelmingly targeted toward wealthy communities, whereas low-income and high-diversity schools often face difficulties simply securing faculty with adequate teaching experience.
credentials. Equal education opportunities at the elementary level will ensure that all talented children have the potential to pursue higher education. Such higher education should be affordable to individuals of all income levels. Only if we embrace the gifts of every individual in the upcoming generation can we be confident in confronting the greatest challenges the world has yet to face.

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Despite the obvious benefits of computational knowledge in today’s society, many secondary schools in the United States do not offer a single computer science course. This lack of opportunity disproportionately affects minority and low-income students, systematically excluding would-be innovators of the next generation. Just as communication and comprehension are recognized as fundamental, the basic understanding of how information is stored, shared, and leveraged should be taught to all students.

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Students in third-world countries, such as Bangladesh, lack access to information about current issues. The Bangladeshi education system should provide students with temporary laptops or smartphones. Once the students learn about problems such as climate change, they can begin to address the challenge.

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Communication

What is missing from U.S. science education is storytelling, the art of communicating science’s relevance to the world around us and its application to societal issues. Budding scientists must learn to explain the context of science, provide its backstory, and make it accessible.

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Canada’s education system must be proactive in training professionals for potential shifts in responsibilities. Training medical students to be effective communicators and team members will be even more important in the wake of artificial intelligence, as care providers will still be required to relay information to team members and provide patient counseling.

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Social responsibility

In India, where there is unrestricted sale of over-the-counter antibiotics, no national antibiotic policy, and no national antimicrobial research agenda, problem-based training on antimicrobial resistance and antibiotic stewardship should be made mandatory for all undergraduate and postgraduate medical students.

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Creativity

Memorization is a key component of Taiwanese education, but this task can now be achieved more accurately and quickly by cloud computing. To prepare students for the era of artificial intelligence, Taiwan’s educators need to cultivate creativity. Class assignments should motivate students to seek out resources instead of rewarding rote learning. This will inculcate students with the habits required to learn constantly, which will be critical as they work to keep up with technology.

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Now that facts can be accessed within seconds, the value of education should no longer be mastery of subject but rather ability to ask questions that improve or overturn existing knowledge. In Ghana, assessment based on limited existing facts creates the impression that everything is known, and that if there are problems, we just need to wait for someone else to solve them. The power to ask profound questions is a more honest and dynamic means of assessing mastery and training great minds.

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The Indian education system needs to be revamped to include practical learning. Educators should be trained to encourage students to think and not just memorize. Project-based learning will bring out creativity among children. Real-world scenarios must be discussed to sensitize students to challenges such as climate change, food insecurity, antimicrobial resistance, or artificial intelligence. To design a better future, students need to design solutions for those who are hit hardest. The future will only be prosperous if it is inclusive to all.

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Egypt consumes energy in a careless way. Students must be taught the importance of energy and how to mitigate its usage in their daily life. Schools should raise awareness about energy challenges, and students should be rewarded for reducing energy waste and using renewable sources.

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Future education must prepare students with the knowledge and skills to address antibiotic resistance.

It is imperative that the U.S. engineering curriculum acknowledge the responsibility that the discipline had in creating the climate crisis through industrialization. We must understand how the climate crisis and environmental injustices are the product of human activity, much of it engineered by well-meaning scientists and designers like ourselves. This will hopefully lead to engineers who strive for not just useful designs, but designs that can be used for the lasting betterment of our global society.

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Students need to learn to think about inequality. Sweden’s schools should emphasize that not everyone will be able to avoid the consequences of future
the severity of issues such as water shortage, climate change, and food security. Schools should visit nearby research institutes, where discussions with scientists can motivate students to pursue research and solve problems through innovation.

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Because creativity often requires proficiency in other fields, U.S. medical school admissions offices should place more value on nonmedical work experience. Encouraging applicants with real-world work experience rather than applicants who just completed an undergraduate degree would result in future physicians with the backgrounds and skills from which creativity is born.

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The next generation faces a choice: Either resign themselves to a dystopian environmental future or come up with solutions to problems we don’t even know exist. The latter option will only be possible with ingenuity and imagination. Unfortunately, the current South African school system is trapped in old ways of thinking. To overcome this, we have to start by breaking the barriers between science and art. Without imagination, environmental solutions will always be reactive. To cultivate a cohort of futurists, we need to ensure that the most creative and imaginative children are lured into science, not isolated from it.

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Critical thinking

Avoiding violent conflicts, especially among developed countries, is a necessary precondition for tackling future challenges such as climate change and food security. The Czech Republic needs to start teaching children the value of cooperation, peace, and democracy, while highlighting the costs of lies, corruption, and conflict. In doing so, educators must teach students how to distinguish facts from deliberate misinformation. As support for totalitarian regimes soars, the risk of serious conflict increases. The older generation in the Czech Republic grew up in a totalitarian environment; we must teach the next generation a better way.

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We need to teach the future policy-makers and consumers in developed countries to consider a global perspective before accepting or rejecting a technology such as genetically modified (GM) crops. GM crops can contribute to poverty reduction in developing countries, which are directly influenced by GM regulations in developed countries. Widespread misinformation has kept the governments of developed countries from adopting the technology, and the cost of delay can be thousands of human lives. Solving global food insecurity is merely an acceptance problem now. By teaching science-based evaluation of GM organisms to students in developed countries, we can move toward implementing solutions.

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To close the gap between research and policy, Australian universities should encourage all undergraduate students to participate in cutting-edge research programs and provide them with experience that emphasizes the importance of fundamental as well as applied scientific research. This is critical for students in the humanities, business, and law, who traditionally transition more readily to political life. Similarly, science students should be given insights into political decision-making to encourage more participation of scientifically educated people in politics. If we educate larger cohorts of students who appreciate how evidence-based decisions can advantageously inform policy, our future will be much brighter.

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South African students (and those across the world) are being overwhelmed by “alternative facts,” especially on social media. Many of these views are based on fearmongering and anecdotal evidence. We must teach children how to evaluate the available evidence in a scientific manner. This will enable them to give an informed opinion about climate change, food security, and future challenges that are not even on our radar yet.

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To combat scientific illiteracy, Greek students should learn not only facts but how to think critically, seek necessary information, and reach their own conclusions. To achieve this, Greece should train teachers to lead scientific workshops, in which students would learn how to start from a question, collect information, reach conclusions, and support their conclusions in front of their peers. Meanwhile, classes that teach students to believe without doubting, such as those taught from a religious perspective, should be removed from the Greek educational system.

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