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Shoring up Singapore's Stem workforce

With more demand for workers trained in science, technology, engineering and mathematics, rethink how these subjects are taught to motivate students to join and stay in Stem-related jobs

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For The Straits Times

Many of the fastest-growing industries, such as informatics, biomedicine and green energy, require people who are trained in Stem, says the writer, adding that more can be done to attract and retain talent. ST PHOTO: JASON QUAH

If the recent spike in community Covid-19 cases demonstrates anything, it is that Singapore will have to continue battling the effects of the global pandemic for the foreseeable future.

Our post-pandemic economy will be one where Stem (science, technology, engineering and mathematics) education is going to play an important role.

This is because many of the fastest-growing industries, such as informatics, biomedicine and green energy, require talent who are trained in Stem.

There is no question that Singapore needs more Stem workers in areas like research, manufacturing and science policymaking than we have now.

This can be achieved by attracting foreign Stem workers, but there are risks when there is over-reliance on foreign labour, as evidenced by the need to close borders in these current times.

Another strategy is to train more locals in Stem.

Unfortunately, a substantial number of local graduates do not continue in Stem-related career paths. More can be done to meet these goals. Singapore's response to this problem has so far largely centred on highlighting successful Stem graduates and making such jobs more attractive by boosting salaries.

As an assistant professor at the National University of Singapore (NUS), I am involved in outreach activities such as open-house and student recruitment events. Based on my observations, career prospects and salaries can influence what students choose to study. For instance, we have seen an increasing number of students applying for computer science in response to the rise of the tech industry.

However, most Stem industries cannot pay as much as tech companies, while emerging industries like biotech need more time to grow in the business ecosystem here.

To effectively boost retention of local students in Stem, there may be a need to go beyond the current narrative on career and salaries, to understand why most students would choose Stem subjects in secondary and pre-university schools but quit afterwards.

From my experience as a student, and current role as an educator, my view is that students may enter Stem because their parents and teachers advised them to, and most choose to stay in Stem because they see a purpose in the field.

The good news is that based on the global State of Science Index survey by 3M, a high percentage of Singaporeans trust (90 per cent) and agree that science education is crucial to the continued progress of society (79 per cent).

Here, I have some suggestions for motivating students to join and stay in Stem-related jobs.

Although these ideas are primarily targeted at reducing the number of students leaving Stem after pre-university and university, they could also be relevant in the earlier stages of education.

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ENCOURAGE OPEN-MINDED LEARNING BY MOVING AWAY FROM 'MODEL' ANSWERS

The most fundamental ethos of science and research is to maintain an open mind. The common practice of memorising and being rewarded for "model" answers may cause students to become fixated on getting the perfect solution.

To encourage open-minded learning in the education system, we could create more opportunities for students to make use of evolving scientific knowledge to challenge conventional beliefs and reward them for thinking outside the box.

One example of evolving science is the role of bacteria in humans. Most of us have been taught from a young age that bacteria are disease-causing organisms and we should try to keep them out of our bodies.

However, emerging research suggests that bacteria that reside in our bodies can positively mediate health, including responses to cancer therapy. At NUS, a number of researchers, including myself, are taking this further by engineering bacteria that seek out and release drugs into solid tumours.

To create an open-minded learning environment, students from pre-university onwards could be given assignments that require them to draw on contradicting scientific literature and debate one another.

Through such debates, they would be able to acquire critical thinking skills, such as evaluating the limitations of experimental studies. They would also learn to move away from "model" answers and accept ambiguity as a part of many Stem-related jobs, and be more creative in using non-traditional approaches to solve real-world challenges.

As more countries and research institutions enter into open-access agreements with publishers, students should find it easier to learn from cutting-edge peer-reviewed research.

No doubt this suggestion is going to require additional commitment from teachers and students, but it can be rolled out and perfected progressively with small, targeted student populations before implementing it system-wide.

CULTIVATE A CULTURE OF RESILIENCE BY TEACHING THE HISTORY OF SCIENCE

It takes time for good research to bear fruit and when students learn about scientific discoveries without the historical context of the immense effort they required, students might under-appreciate the value of resilience in science.

When they can learn through history that scientific research rarely yields immediate results, they are likely to become more patient and remain committed to their research endeavours for a longer time.

Building on the trend of online learning, students can be directed to sources such as OpenMind and Biography that engagingly teach the history of science before learning technical content in classes.

It can also be helpful for curriculum planners and teachers to weave history into science education and encourage students to learn from platforms such as physical and online science museums.

I tested this idea during an NUS seminar when I taught the history of how brain cells (specifically neurons) were discovered and why the giant squid was an important animal model to understand how neurons communicate.

This was because the giant squid has one of the largest and most accessible cellular tube-like structures, known as an axon, that neurons use to send electrical signals to one another.

Students shared with me that they found my approach refreshing, and many gave me feedback that they were able to better retain the concepts I taught.

The hope is that as students revisit history, they would learn to appreciate, be inspired by and develop the qualities of scientific ground-breakers – unwavering enthusiasm, patience and resilience – to prepare them for inevitable setbacks they may encounter during their education in science and research.

PROMOTE AND REWARD SCIENCE OUTREACH TO BOOST OUT-OF-CLASSROOM LEARNING

Science outreach benefits society, especially students who can gain from being mentored, from having role models and even getting early exposure to research.

The role of a researcher goes beyond developing the science, to communicating and delivering the science to the public via means such as written articles and lab tours that are easily relatable while highlighting the potential of science to impact society.

To excite students about Stem, I have partnered with my alma mater, Temasek Junior College, and led a group of young researchers from NUS to present our research findings to these students.

We also created a platform for the pre-university students to receive mentorship and information about Stem from working scientists, who can be excellent role models for aspiring researchers.

Institutions could find ways to train and reward their researchers for efforts in out-of-classroom science outreach, thus boosting the interest of Stem students and retaining them.

GUARDING AGAINST COMPLACENCY

Singapore is investing a record $25 billion in science and innovation for the next five years, but our budget still pales in comparison to that of bigger economies (even as a percentage of gross domestic product).

In the next few years, the United States is planning to spend up to US$250 billion (S$332 billion), the European Union is committing €100 billion (S$161 billion) and China is also increasing its research budget, with the possibility of overtaking that of the US. Private companies in these countries are also more active in research funding than those in Singapore.

According to a report from Unesco, Singapore's primary strength in Stem is our high density of researchers per million inhabitants. On this front, our city state is currently ranked fourth globally.

But when we compare ourselves with major cities that are leading Stem research, such as Boston, San Francisco, London and Shenzhen, we lose this competitive edge.

More importantly, countries like the US and China have a significantly larger domestic population to tap for Stem jobs and compared with places like the United Kingdom, Singapore continues to lose out as the top work destination for international researchers.

In order to stay competitive, Singapore should further its commitment to investing in science, and continue to adopt an open-door labour policy to strengthen our Stem workforce.

At the same time, we need to rethink how we are teaching Stem formally in classrooms and informally through outreach, to continually inject innovation in our approach to nurturing home-grown talent.

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