Developing a scientifically literate citizen

With so much conflicting and constantly changing information about Covid-19, it's important to know how to make evidence-based decisions that can be a matter of life or death

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In this time of pandemic, people have been bombarded with information about the nature of viruses, different diagnostic methods, infection pathways, the science behind safe distancing, and the effectiveness of different materials for face masks in reducing transmission risks.

For many who probably studied science only in school, Covid-19 has presented them with a lot of science to handle. To make informed decisions, it is vital to understand the evidence.

As Stem (science, technology, engineering and mathematics) education professionals interested in science education, we are concerned about confusion due to information overload, lives at risk due to non-compliance or incomplete understanding of information, and poor decision-making due to ignorance about who to believe.

Globally, as scientists and medical professionals seek to make sense of the complexities involved in the pandemic, politicians and laypeople try to wrap their heads around the multiple and volatile pieces of information.

Scientists disagree with one another or shift their stances from one week to another. The difference in interpreting scientific evidences and how they should be translated into implementation policies can vary. Senior health correspondent Salma Khalik's commentary in The Straits Times last Friday illustrated experts' different assessments of vaccines and overseas travel, given the same Covid-19 situation.

Whose advice should we listen to? Should we be wearing a mask? Does a cloth mask protect us from infection? Should we mask up while exercising outdoors?

During such a time, is the younger generation, being more exposed to science in schools, more scientifically literate to understand this information and can reach out to explain it to their parents, grandparents and neighbours?

This highlights the importance of Stem literacy in making personal decisions based on sound scientific evidence.

Rarely do right (or wrong) personal decisions have such great impact at the community, national and global level.

As a society, Singapore can continue to build stronger Stem literacy among citizens. Individuals could refrain from indiscriminately forwarding messages over WhatsApp, and the elderly should understand why they cannot hang out at kopitiams to chat with friends.

As well, people should know that it is the dense living arrangements with poor ventilation in dormitories that make safe distancing impossible and which caused the virus to spread, and not "dirty" habits.

SCIENCE FOR LIFE

Singapore's science education is heading in the right direction with Stem literacy. Its goal is "Science for Life and Society". Singapore's science curriculum aims to enthuse and nurture all students to be scientifically literate.

Two areas of focus are the development of personal and cultural literacy.

By personal literacy, learners develop a scientific mindset with practical knowledge of science and its application to make everyday decisions, and solve problems related to science to improve one's life.

Being Stem literate includes knowing how to seek and evaluate evidence. For instance, a Stem-literate person would know the type of evidence needed to support the claim that a higher alcohol content in hand sanitiser increases its effectiveness.

Theoretically, developing personal Stem literacy should help us make good personal decisions on matters related to science. However, where do we place science in the context of personal beliefs and values? For instance, some "anti-vaxxers" believe that vaccines are immoral and reject them, despite scientific evidence showing they can stop the spread of diseases and save lives.

Personal literacy is connected to civic literacy. Civic literacy refers to the ability to appreciate science as an artefact of humanity and culture, and to apply scientific ideas to engage in socio-scientific issues in an ethical and informed manner.

EXPERT OPINION

Laypeople have limited access to sophisticated laboratories to gather scientific evidence, and the time and expertise to digest research literature. Consequently, they turn to expert opinion. We need sufficient knowledge to evaluate and justify expert opinions. So a person with Stem literacy develops "gut feel" when an expert opinion sounds amiss.

In addition, when considering whether we should trust an expert opinion, we can consider two criteria. First, is there any self-interest? Will the expert benefit in significant ways if people believed his opinion? Think about the battle between Dr Anthony Fauci, a top infectious disease expert, and United States President Donald Trump. A Straits Times report on May 15 noted that President Trump disagreed with the warning given by Dr Fauci about the dangers of reopening the economy and schools too quickly.

Second, does the expert have relevant expertise in the field to provide the opinion? For example, you would consult a medical doctor if you had a fever or a cough, but you would consult a psychologist if you were feeling anxious or depressed.

To be Stem literate, individuals need the ability to discern the authenticity of the information source, and make logical decisions.

In Singapore, much of the communication of Covid-19 information comes from the Government. We moved from "wear a mask only when you are sick" to "wear a mask when you leave your house"; and from "schools are the safest place" to "full home-based learning".

How do we consume these seemingly different yet strongly justified decisions by our politicians? We can comply and complain that the Government is confusing us. Thus, every change in decision is deemed a mistake.

Alternatively, we can seek to understand how science is used, together with systemic constraints and social factors, by the Government to continuously inform and update decisions.

The pandemic is a renewed call for the promotion of Stem literacy – personal and civic. When encountering advice or information related to science, we could ask where and how the evidence was obtained.

The kind of Stem literacy needed to handle an acute crisis such as Covid-19 is similar to yet different from the Stem literacy needed for day-to-day living – understanding the political nature of information, being logical and making decisions based on rationale rather than fear. This justifies the importance of infusing Stem literacy in every aspect of education, and not waiting for a crisis to educate people.

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