NEW SPECIAL PROGRAMME: PROBLEM X (PX) CHALLENGE

NATURE OF PROGRAMME

1.1 Problem X (PX) Challenge is a new programme jointly organised by Gifted Education Branch, Ministry of Education (MOE) and Singapore University of Technology and Design (SUTD) in 2020. The target participants are Year 2 to 4 students who demonstrate strong aptitude, passion and motivation for inquiry in Science and Mathematics.

1.2 In PX Challenge, participants will form teams to work on a given complex real world problem, seeking possible "solutions" for it by considering different perspectives and leveraging knowledge of different disciplines, particularly in Science and Mathematics. The solutions proposed have to be supported by sound research, and analysis and evaluation of available data and practices. Through this programme, we seek to develop students' capacity to navigate complexities and ambiguities, see connections across disciplines and cultivate critical 21st century skills in problem-solving, collaborative learning and communication. Just as importantly, we hope to develop deep curiosity about issues, open-mindedness to diverse perspectives, as well as other-centredness and personal agency to make a positive difference to the community.

1.3 The focus for problem-solving in 2020 is the COVID-19 outbreak. Participants will assume the role of an Infectious Disease Response Team formed by Public Service, Singapore to address public concerns and allay fears based on an assessment of the outbreak trajectory. The challenge requires participants to produce a video clip and an accompanying report that will offer the Singapore public an informed understanding of the COVID-19 situation at a particular juncture in time. The task will involve an assessment of COVID-19's rate of spread in Singapore and its implications. Participants are expected to consider how best to engage the community as part of the measures to manage the outbreak as well as respond to concerns, rumours and misinformation about COVID-19 to establish trust and authority.

2. STRUCTURE AND TIMELINE OF PROGRAMME

2.1 In view of the COVID-19 outbreak and current MOE guidelines to avoid mingling of students across different schools and reduce students' exposure to crowds, this programme will take the form of online learning and project review.

2.2 The timeline for the Programme is as follows:

Date	Activity
30 March	Online launch
4 April to 29 May	Mini lectures related to the task will be posted online. More details will be shared with the teacher-in-charge.
30 July	Submission of entries (by school) to GEB
17 Aug	Project Review: Summary of panel's feedback on key strengths and areas for improvement on projects submitted for PX Challenge in 2020 (online) Notification of shortlisted teams by GEB to schools
28 Aug	Finals involving presentation by shortlisted teams (either online or at a culminating event) and results

3 REQUIREMENTS FOR PARTICIPATION

3.1 Participants should be Year 2 to 4 students. Each team should comprise no more than 4 members. Students within a school can form a multi-grade team (i.e. a combination of students from different grade levels).

3.2 Each team has to submit a written report for Task 1 (no more than 1000 words, excluding references) and a 1 minute video bulletin for Task 2. Only 1 entry is allowed per team.

3.3 For the report, use font type and size **Arial 12**. The names and school of the participants should be in **bold** on the first page.

3.4 **Plagiarism is an offence**, and teams found plagiarising will be disqualified. Teams from the same school with identical answers will also be disqualified from the challenge.

3.5 The video must be saved in the format given: PX_2020_<school name>_<team #> in MP4 format (1080p).

3.6 Teacher-in-charge will submit the names of school participants via email to Ms Lee Xuefen at lee_xuefen@moe.gov.sg and Mr Tan Shao Xun at tan_shao_xun@moe.gov.sg by **Monday, 13 April 2020**.

3.7 All completed entries are to be submitted to Ms Lee Xuefen and Mr Tan Shao Xun by **2.00 p.m.** on **Thursday, 30 July 2020**. More details will be given to the Teacher-in-charge.

3.8 All submissions must be made through the Teacher-in-charge of the participating school.

4 SHORTLISTING OF SUBMITTED ENTRIES & FINAL JUDGING

4.1 All submitted entries will go through a preliminary round of selection by SUTD and MOE, GEB. The selection criteria are listed in Annex A. Products submitted for this challenge may be used for publicity purposes.

4.2 In the event that GE Branch is unable to host the finals due to the COVID-19 situation, shortlisted finalists will be asked to submit a video recording of their presentation. This video, which should encompass the bulletin, must not exceed 5 minutes.

4.3 Teachers-in-charge will be informed of the results of shortlisting via email by **Monday, 17 Aug 2020.**

4.4 All participants will receive certificates of participation, and the top teams will receive certificates of distinction.

Problem X (PX) Challenge 2020

Problem: COVID-19 Outbreak

The novel coronavirus was first detected in China's Wuhan City in late December 2019. Though it belonged to a large family of viruses that resulted in the common cold, the Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV), it was previously not identified in human beings. The novelty of the strain meant that people around the world had not developed immunity to it and were thus susceptible to infection.

In the attempt to stem the spread of the novel coronavirus disease, China imposed a lockdown in Wuhan and other cities in Hubei province on 23 January 2020, an unprecedented move in public health history. Among the earliest countries hit with imported cases of the disease, some took stringent measures, imposing quarantine on suspected cases, and denying entry to foreign nationals who visited China and posed the risk of transmitting the virus. Several airlines suspended all flights to China while others reduced their number of flights or terminated flights to certain major cities. On 30 January 2020, the World Health Organisation (WHO) declared the outbreak a global health emergency and advised limiting trade and human movement to contain it. This advice was taken more seriously by countries hit by imported cases, leading to an unevenness in preventive measures taken globally.

The novel coronavirus disease was given the official name of COVID-19 by WHO on 11 February 2020. Soon after, more than 400 experts and funders convened for a global research and innovation forum on COVID-19 to address issues of diagnostics, accelerate existing vaccine candidates and preventive measures for infection. In the meantime, the window of opportunity to contain the outbreak on the global front continued to narrow as the disease spread far and wide. In March, the epicentre of the virus shifted to Europe where new cases emerged at a higher rate than anywhere else in the world, particularly in countries like Italy and Spain. In Middle East, Iran was hardest hit whilst in Asia, South Korea held the record for the highest number of infected cases outside China.

On 11 March 2020, WHO declared COVID-19 a pandemic a stern reminder to all countries to prepare for the risk of widespread community transmission, adjust their travel policies, work out viable plans for the containment and mitigation of the disease, and expedite the development of therapeutics and vaccines. It became evident to the global community containing and managing the outbreak was a tall order. A combination of public health measures including rapid identification, contact tracing, diagnosis and management of cases, infection prevention in health care settings, implementation of health measures for travelers, raising public awareness in the population and risk communication was required.

As of 27 March, about 23950 people have died as a result of COVID-19 and approximately 526,544 infected. More people had been infected worldwide than by

other infectious diseases like SARS, MERS or Ebola in recent years. The global race is now on for effective treatment interventions, but a cure for the disease is still elusive due to gaps in understanding about its clinical spectrum, severity and transmissibility.

On the local front, Singapore had a total of 683 infected patients (2 deaths and 172 who have recovered and are discharged) by 27 March 2020. Since the discovery of the first few cases of COVID-19 disease in Singapore in January 2020, Singapore has been rigorous in implementing measures to decrease the risk of imported cases and slow down the virus transmission. A multi-ministry task force was set up to deal with the coronavirus situation. Early intervention measures taken ranged from contact tracing, enforced quarantine, social distancing, tightening of borders to reduce imported infections, and adoption of a vigilant monitoring system. On 7 Feb 2020, the Disease Outbreak Response System Condition (DORSCON) level was raised from Yellow to Orange, following several cases of novel coronavirus without any links to previous cases or travel history to mainland China. Schools implemented staggered recess time and suspended certain activities involving mass gathering. Many public and communal events, and even religious services involving large-scale gatherings were suspended, deferred or cancelled. Further border control measures were introduced when there was a spike in imported cases of COVID-19 in mid-March. Singaporeans were advised to defer all travel abroad, and further restrictions were imposed on travellers and foreign domestic workers coming into Singapore. With effect from 20 March 2020, all Singaporeans, permanent residents, and long term pass holders entering Singapore were issued a 14-day Stay-Home-Notice (SHN) and by 23 March, short-term visitors barred from Singapore. A new app to facilitate contact tracing was launched.

On 24 March, Singapore announced stricter measures. The spike in imported cases signalled a new phase in the combat against COVID-19. From 26 March, gatherings outside work and school would be limited to 10 persons or fewer. Entertainment venues such as cinemas, discos and karaoke outlets would be closed. All centre-based tuition and enrichment classes would be suspended to reduce intermingling of students from different schools. All religious services and congregations would be suspended. All events and mass gatherings must be deferred or cancelled. To deter travelling, Singaporeans or long-term pass holders who travel overseas from 27 March will not be given subsidy for COVID-19 treatment if infected.

Singaporeans have been advised by the government to be mentally prepared that the impact of the coronavirus is expected to be greater in scope, depth and duration than the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003. Though Singapore has been adopting very stringent measures for the containment and control of the disease, it cannot shut itself from the rest of the world if it wants to maintain its competitive edge on the global front. What must Singapore do to safeguard the lives and well-being of its people in this crisis?

27 March 2020

Sources:

- Channel News Asia: https://www.channelnewsasia.com
- Coronavirus Information – Singapore: moh.gov.sg/covid-19
- Coraronavirus advisory information: who.int.emergencies
- Coronavirus condition overview: who.int/health-topics
- Coronavirus Incubation Worldometers: https://www.worldometers.info/coronavirus
- Coronavirus - The Straits Times: https://www.straitstimes.com/singapore/health
- Financial Times: https://www.ft.com/coronavirus-latest
- TIME: https://time.com/ta/covid-19/
- Wall Street Journal: http://www.wsj.com/livecoverage/coronavirus

Problem X

In view of the COVID-19 outbreak, you are invited by the Public Service to be part of Singapore's Infectious Disease Response Team. You have **two main tasks** – use mathematical modelling to predict Singapore's COVID-19 outbreak trajectory, and produce a 1-minute video bulletin to address public concerns at a selected juncture in the trajectory you have projected.

Task 1

- Use the Susceptible-Infectious-Recovered (SIR) Model and current data as they unfold, to estimate the outbreak trajectory for Singapore in the next 6 months, from April to September 2020. What will be the number of new infections, deaths, and recovered patients? When will the outbreak peak? When will the coronavirus curve flatten?

- Be explicit in stating and justifying the assumptions for your predictions. You may take reference from some or all of the following:

  I. the structure, function, and life cycle of the virus.
  II. its epidemiological properties (e.g. transmission mode and mechanisms, reproduction naught (R_0), incubation period and infection rates, recovery and fatality rates).
  III. key similarities and differences in behaviour between COVID-19 and other infectious diseases [e.g. SARS-CoV in 2003, H1N1 (swine flu) in 2009 and MERS-COV in 2015]
  IV. current treatment and explorations for a cure

- Based on the predictions you have made, identify key juncture(s) in the outbreak trajectory. What are key challenges at these junctures? Which are the public health measures, and changes in social norms required to manage the outbreak?

- Capture your points succinctly in a report (max of 1000 words, excluding the reference page).

Task 2

- Choose one of the significant junctures you have identified and craft a specific communication and engagement video bulletin of approximately 1 minute. This message serves to prepare the general public for the range of measures to be taken and encourage them to make informed decisions that are socially responsible. When conceptualising your message(s), you may consider the following:

  I. What is critical and urgent at this juncture and should be foregrounded in your message?
  II. What can be done in your communication and engagement to advocate for more vulnerable groups?
  III. How can this message serve the larger purpose of instilling social responsibility?

- At the start of the video, identify which juncture of your team's projected trajectory (e.g. peak of viral spread) the bulletin addresses, and how the bulletin is designed to effectively reach out to the public.

Helpful Tips

Communication and Engagement Message for Task 2

In order for your communication and engagement message to achieve its purpose of developing preparedness, social responsibility and community spirit among the Singapore public, it should be

a) culturally appropriate, tailored for the demographics in the Singapore context.
b) empathetic, showing sensitivity to affected communities and responsiveness in addressing anticipated public concerns, anxieties and fears.
c) clear in communicating the status and implications of the outbreak, and explaining the rationale for the measures (preventive and mitigating) that have to be taken, as well as the changes to be made by the public, to control or manage the outbreak.
d) fair-minded and resolute in countering rumours, misinformation and negative stereotypes so that social cohesion, and global trust in Singapore's management of the outbreak, can be maintained.
e) positive and future-oriented, strengthening community spirit and ethics, infusing hope and building confidence in the Singapore public that their collective effort could make a positive difference in the fight against COVID-19.

Annex A

Selection Criteria and Rubrics for PX Challenge

Task	Dimensions	Below Expectations	Meeting Expectations	Exceeding Expectations
1	**Accuracy**	☐ Content has **significant inaccuracies**	☐ Content is **largely accurate,** with a few slips	☐ Content is **accurate**
	Depth and Complexity	☐ Content reveals **superficial** understanding; connections between disciplines are **not evident**	☐ Content offers **some insights**; **some connections** made between different disciplines	☐ Content shows **depth and complexity, integrating knowledge** from different disciplines well
	Quality of Reasoning	☐ Claim is **flawed**; sources of evidence may not be reliable; assumptions are not identified	☐ Claim is **somewhat valid**; sources of evidence tend to be valid; some assumptions may be identified	☐ Claim is well-supported and **credible**; sources of evidence are ample and assessed for reliability; key assumptions are identified
	Soundness of Literature Scan	☐ **Little evidence** of sound research	☐ **Some evidence** of sound research	☐ **Strong evidence** of sound research
	Accuracy in Citation	☐ Sources are **largely amiss** in citation.	☐ Sources are **generally appropriately cited**, with occasional slips	☐ Sources are **consistently and appropriately cited**

Task	Dimensions	Below Expectations	Meeting Expectations	Exceeding Expectations
2	**Effectiveness of Messaging and Clarity of Purpose**	☐ Core message may be **vague,** and/or **diffuse**; content used does not address needs of target audience	☐ Core message is **somewhat clear**; content is **appropriate** for target audience	☐ **Core message is clear**; deliberate use of **compelling content** to address target audience
	Precision with language	☐ **Limited ability** to use **precise and appropriate vocabulary** to express key message clearly	☐ **Largely able** to use **precise and appropriate vocabulary** to express key message clearly	☐ Sophistication in using **precise and economical language** to express key message clearly and persuasively
	Effectiveness of visuals	☐ **Some inappropriate choices and limited ability** to adopt features of visual communication mode to achieve intended effect	☐ **Largely appropriate choice and some ability** to manipulate of features of visual mode to achieve intended effects	☐ **Judicious choice and strong manipulation** of features of **visual mode** to achieve intended effects
	Originality	☐ **Insights are not sufficiently developed,** conventional ideas	☐ **Some** interesting insights with sufficient development, **few original ideas**	☐ **Keenly** insightful, with fresh, original ideas and **excellent** elaboration
	Sensitivity to the world at large	☐ **Little awareness of world views and limited capacity** to handle relevant social/cultural issues and show thoughtful response	☐ **Some awareness of world views and moderate capacity** to handle relevant social/cultural issues and show thoughtful response	☐ **Strong** awareness of world views and strong capacity to handle relevant social and cultural issues, **showing thoughtfulness** in one's response