Gifted Education Section, CSD, EDB
Course ID: CSD020240168

Nurturing innovation and technology talents
in the STEAM education Classroom and Beyond

4.12.2023

Time (PM)	Content	Speakers
2:15 – 2:30	Registration	
2:30 – 2:40	● **Introduction** The Rationale and Objective of setting up a School-based Student Talent Pool	Dr LAM Tat-ho, Lander Chief Curriculum Development Officer (Gifted Education), Curriculum Support Division, Education Bureau
2:40 – 3:20	● **Experience sharing session (1)** Interactive and Inspirational Education for Gifted Students with Diversified Learning Needs	Prof CHEUNG Chak-chung Ray Associate Provost (Digital Learning) City University of Hong Kong
3:20 – 4:00	● **Experience sharing session (2)** Promoting School-based Student Talent Pool: Nurturing Innovation and Technology Talents through Tier 1 Whole-class Project-based Learning	Mr WAT Hoi-tim Cheung Sha Wan Catholic Secondary School
4:00 – 4:15	Break	
4:15 – 4:55	● **Experience sharing session (3)** Establishing School-based Student Talent Pool: The Story of Building a 3D Bioprinter from Scratch	Mr TO Ching-yuet and Mr WONG Wae-ming Po Leung Kuk Laws Foundation College
4:55 – 5:30	● **Sharing of other teaching ideas** Unleashing Creative Potential: Fostering Gifted Students' Creativity in STEAM Education and Expanding the Student Talent Pool ● Conclusion and Q & A	Mr YU Ka-kit, Steven Curriculum Development Officer (Gifted Education), Curriculum Support Division, Education Bureau

The Rationale and Objective of setting up a School-based Student Talent Pool

Dr LAM Tat-ho, Lander

Chief Curriculum Development Officer (Gifted Education)

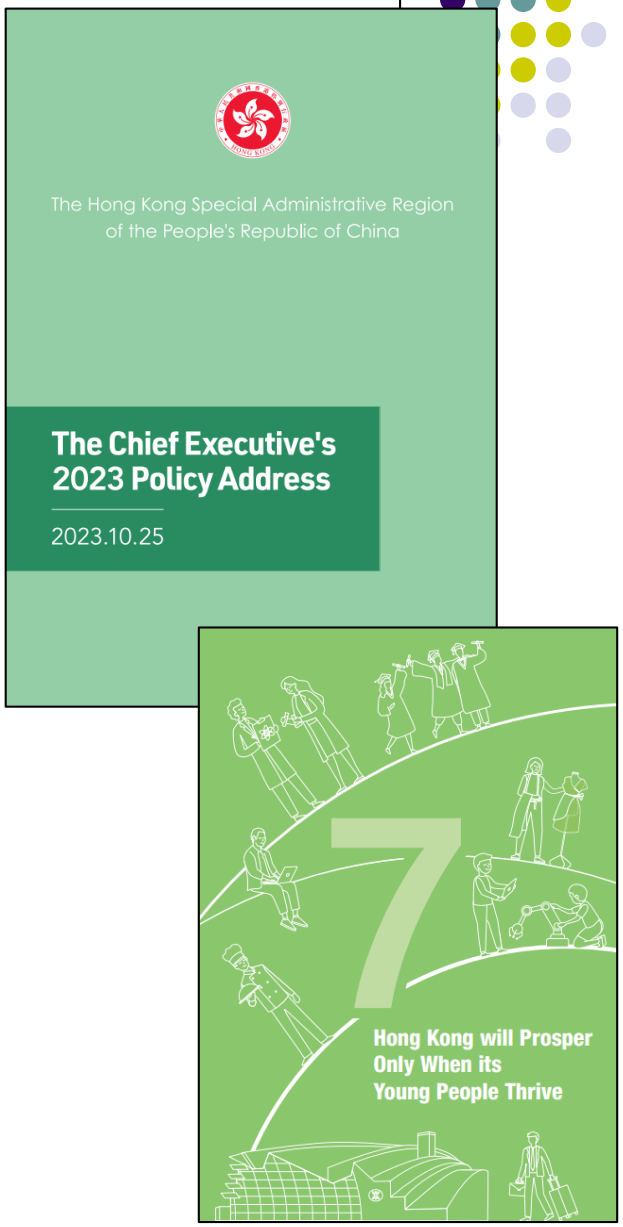
Curriculum Support Division, Education Bureau

Policy Address 2023

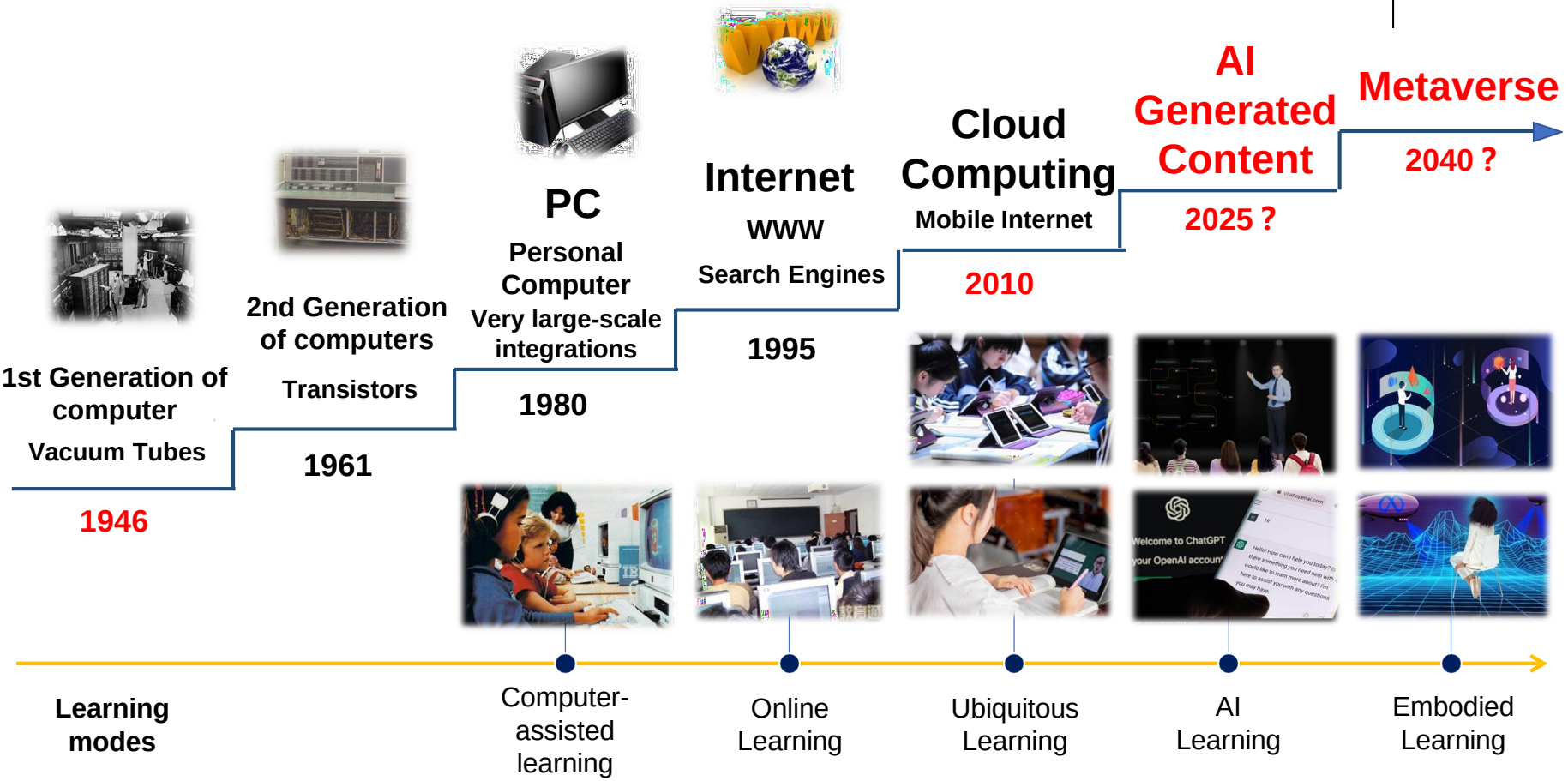
STEAM Education

- Promote the **setting up of a school-based student talent pool** in schools; enhance collaboration with the Hong Kong Academy for Gifted Education to arrange students with potential in STEAM to participate in systematic training and competitions of reasonable scale.

- "…set up school-based student talent pool in at least 75% of the publicly-funded primary and secondary schools to identify and nurture gifted talents by the end of 2024/25 school year…"



New opportunities for the development of “ AI and Education”



The ideas are adapted from Prof WU Long-kai, Central China Normal University

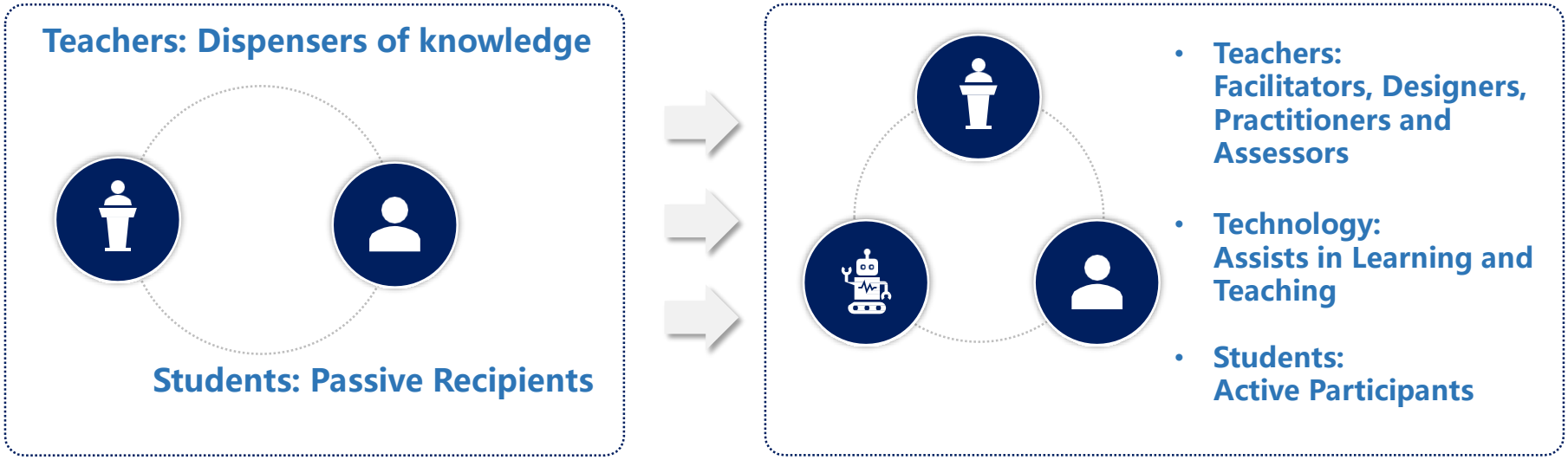
New technology brings new opportunities in education

Scene	Interaction between T and S	Social interaction and Machine communication
Content	Static	Dynamic
Learning methods	Collaboration	Human technology synergy
Environment	Informatisation	Digitalisation
Instructional style	Teaching-oriented	Learning-oriented
Teaching philosophy	Knowledge-centered	Values-centered

The ideas are adapted from Prof WU Long-kai, Central China Normal University

Educational scene:
from binary structure to ternary structure

- Smart tools **bridge** the human and digital worlds, enhancing education through active participation in teaching and learning activities.
- Empowering teachers and students, smart tools **transform** traditional education dynamics, fostering interactive and collaborative learning environments.



The ideas are adapted from Prof WU Long-kai, Central China Normal University

How to make good use of the school-based student talent pool

Set up a school-based student talent pool
(by using Talent Databank Module of WebSAMS and other online platforms)

Talents identification

- Make good use of diversified criteria, channels and tools to identify student talents.
- Identify the underachieving and/ or twice-exceptional gifted students.

Talents development

- Select students to participate in school-based gifted pull-out programme.
- Strengthen students' cognitive and affective developments.

How to make good use of the school-based student talent pool

School Administration and Development

- Increase teachers' awareness of students diverse talents through professional developments.
- Learn more about the rationale of setting up a school-based student talent pool and establish clear policy and practices.

Curriculum development and implementation

- Implement and review Level 1: whole-class teaching approach and Level 2: gifted pull-out programmes for developing school-based gifted education programmes

Achievement Showcase

- Through different channels, demonstrate students' learning outcomes in different areas
- Let stakeholders understand students' potential and achievements.

How to make good use of the school-based student talent pool

- Identify students' potential (**Talent Search**)
- Nurture students' strengths (**Talent Development**)
- Nominate students to
  - participate in inter-school/ regional/ regional/ national/ international competitions
  - become a member of the Hong Kong Academy for Gifted Education
  - take the Off-school Advanced Learning Programmes (subsidised by the Gifted Education Fund) or gifted programmes in post-secondary institutions
  - participate in scholarship/ mentoring programmes

如何善用「學生人才庫」規劃及推展校本資優教育

建立校本學生人才庫

(可運用網上校管系統「人才資料庫」模組，試算表及其他網上平台等)

識別學生的才能

- 善用**多元化準則、渠道及工具**以識別學生的才能
- 教師亦須識別**潛能未展的資優學生**或**雙重特殊資優學生**

學校行政與發展

- 教師培訓：讓教師更認識學生的各種才能，以及進一步了解建立**校本人才庫**的重要性
- 為發展校本資優教育制定清晰的**校本政策**和**實踐方向**

課程發展與實施

- 提升教師了解資優學生的**多元學習需要**
- **規劃**及**檢視**「第一層全班式資優教育課程」及「第二層校本抽離式資優課程」
- 讓教師更掌握資優學生的多元潛能及所需後，**發展校本資優課程**

學生發展

- **甄選學生**參加校內培訓／增潤課程
- 透過不同類型校內培育課程，讓資優學生在**認知**和**情意發展**方面得到進一步發展

學習展示

- 透過**不同渠道**，**展示**學生在不同範疇的**學習成果**，並讓持份者了解學生的潛能及成就：
  - 頒獎禮／分享會
  - 成績表／學生學習概覽
  - 校內報告板／校刊／學校網頁

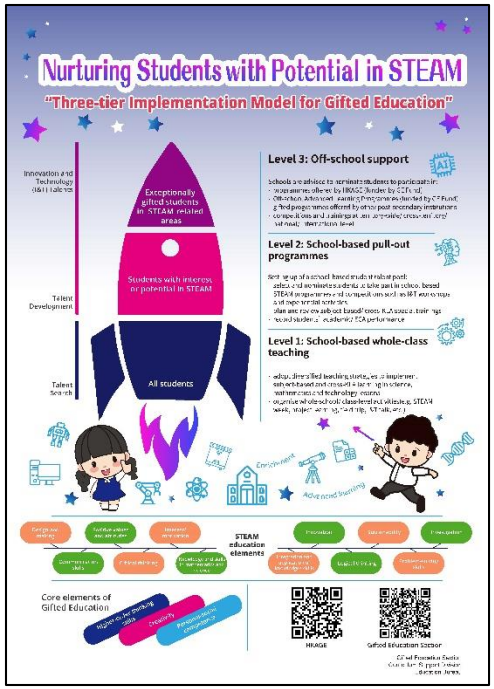
發掘學生潛能（浮尖）、讓學生發揮所長（展才）

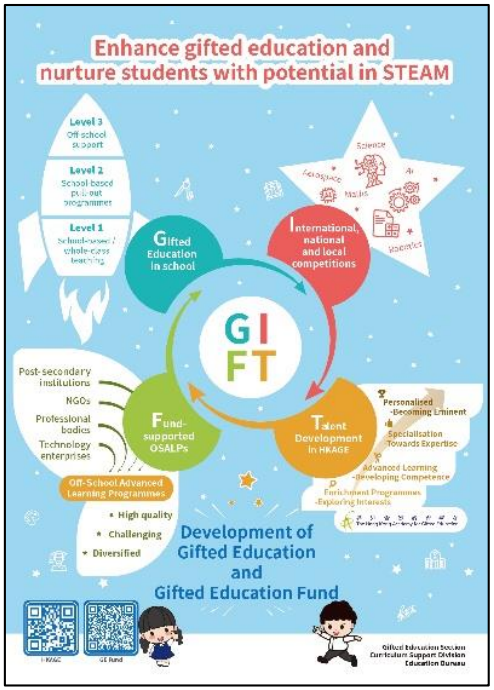
推薦學生

- 參加校際／全港／跨地域／全國／國際比賽
- 成為香港資優教育學苑學員
- 修讀校外進階學習課程(資優教育基金資助)／專上院校資優課程
- 參與升學／獎學金計劃

教育局
課程支援分部
資優教育組

For more information about school-based talent pool and developing school-based gifted education,
please refer to our official webpage:
https://www.edb.gov.hk/en/cd/ge





Interactive and Inspirational Education for Gifted Students with Diversified Learning Needs

Prof CHEUNG Chak-chung Ray

Associate Provost (Digital Learning)

City University of Hong Kong

Promoting School-based Student Talent Pool: Nurturing Innovation and Technology Talents through Tier 1 Whole-class Project-based Learning

Mr WAT Hoi-tim

STEM Education Coordinator

Cheung Sha Wan Catholic Secondary School

Break (10 mins)

Establishing School-based Student Talent Pool: The Story of Building a 3D Bioprinter from Scratch

Mr TO Ching-yuet
Gifted Education committee
Vice Convener
Po Leung Kuk Laws Foundation College

Mr WONG Wae-ming
Science Gifted Education
Coordinator
Po Leung Kuk Laws Foundation College

Unleashing Creative Potential: Fostering Gifted Students' Creativity in STEAM Education and Expanding the Student Talent Pool

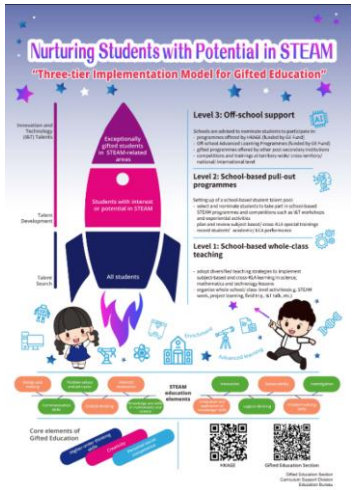
Mr YU Ka-kit, Steven

Curriculum Development Officer (Gifted Education)

Curriculum Support Division, Education Bureau

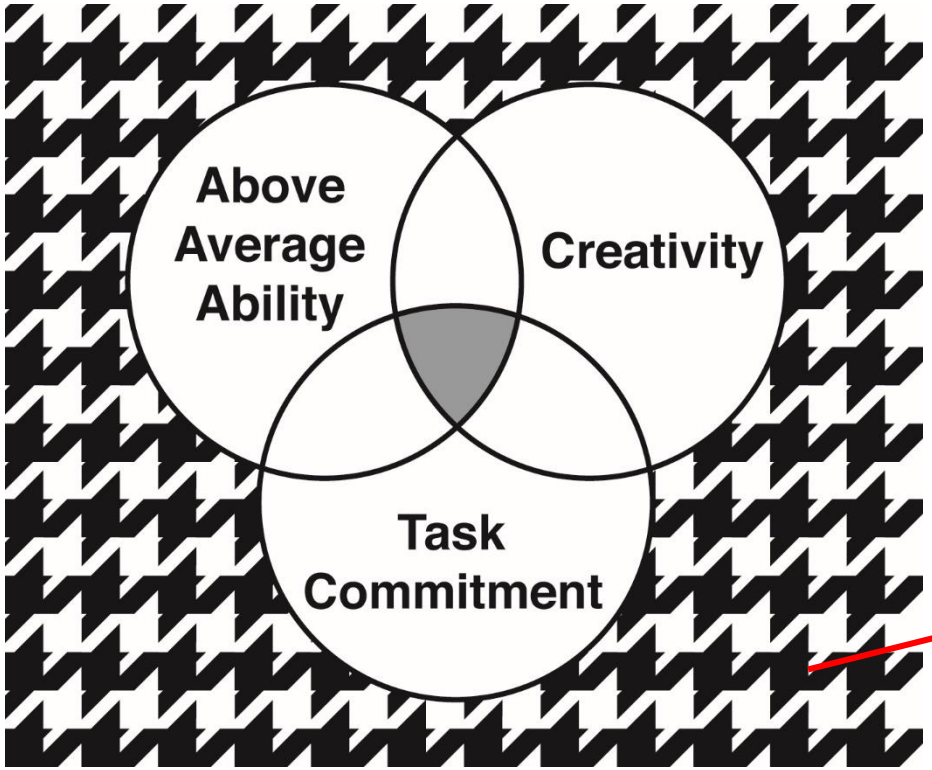
Promoting STEAM education

- support the development of Hong Kong as an international innovation and technology (I&T) hub
- promote the setting up of a school-based student talent pool
- equip our students with the 21st century skills (e.g. 4Cs)
  - **Creativity**
  - Collaboration
  - Communication
  - Critical thinking



- How to identify and nurture creative-productive giftedness?

Renzulli's Three-ring Conception of Giftedness



What's that?

Schoolhouse Giftedness
vs
Creative-productive Giftedness

Creative pedagogy for nurturing gifted students

Teaching for creativity

forms of teaching that are intended to develop students' creative thinking or behaviour

Creative teaching

- focuses on teachers' action
- approaches to make learning more interesting and effective

Creative learning

focuses on learners' action

(Lin, 2011)

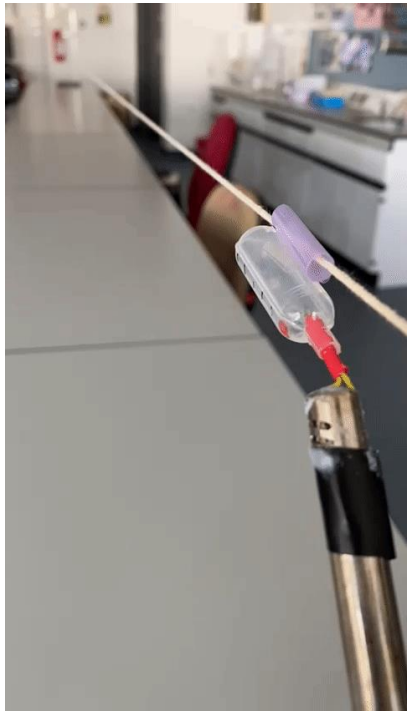
Strategies to promote creativity in STEAM education

- Adopt teaching approaches for enhancing student creativity
  (**Teaching *for* creativity**)
  - Creative problem solving, Open-ended discovery, Invention (SCAMPER model), Inquiry-based learning, Engineering Design Process, Six Thinking Hats, Design Thinking…etc.

- Promote ***creative teaching*** for nurturing the gifted
  - Make a *'twist'* of conventional teaching

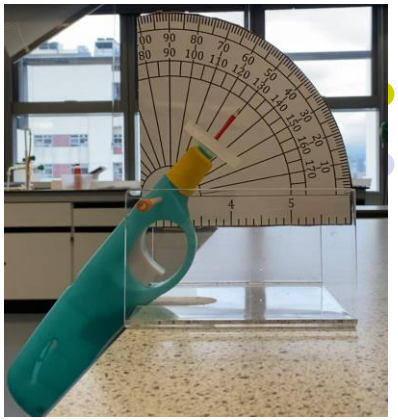
Rocket Science

Water rocket



Hydrogen rocket

Rocket investigations



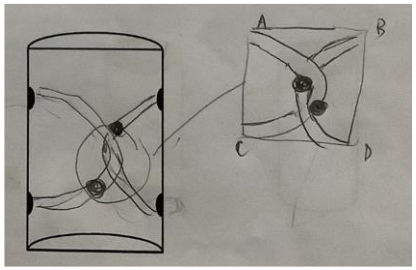
- Real-world applications of stoichiometry in aerospace science and technology
- Students investigate the stoichiometric volume ratio of H_2 and O_2. Energy generated from the combustion reaction of H_2 is used to propel a gas-mixture container in a rocket-like manner.
- The experiment is conducted in a micro-scale to ensure laboratory safety.
- Enriched concepts involved:
  Chemical stoichiometry

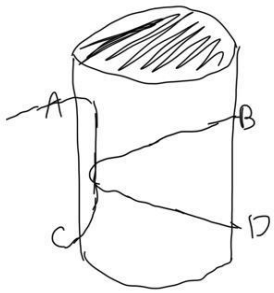
Acknowledgements
The learning activities are co-developed with Mr TO Ching-yuet at Po Leung Kuk Laws Foundation College, Mr WONG Tak-shing at Po Leung Kuk Choi Kai Yau School, Mr. MAK Wai-kuen at Carmel Alison Lam Foundation Secondary School under the Gifted Education School Network (STEAM education) 2022/23.

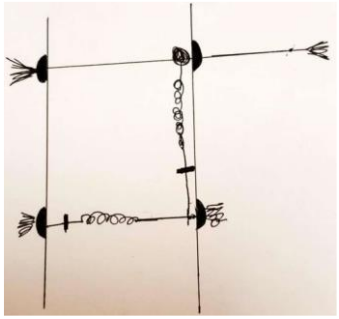
A mystery tube

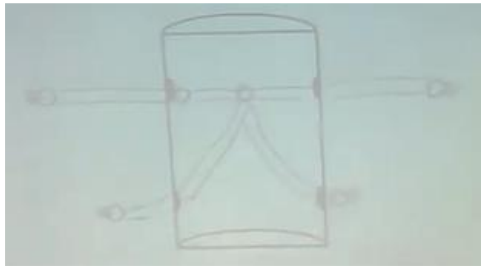
<u>Teaching the nature of scientific inquiry</u>

- Students determine what the inner structure of a mystery tube looks like.
- Students pose hypotheses for what they are observing and are asked to test/ modify their hypotheses by drawing and building models.
- Several models can be created from a set of observables.





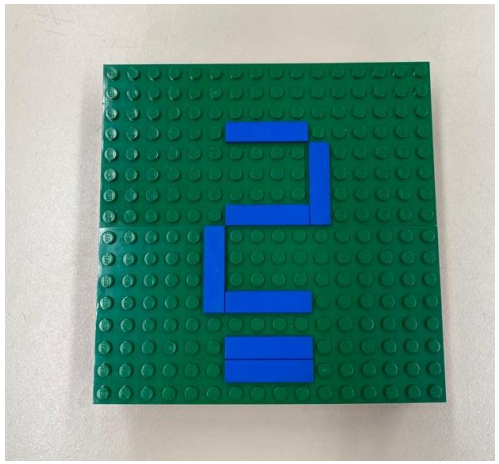


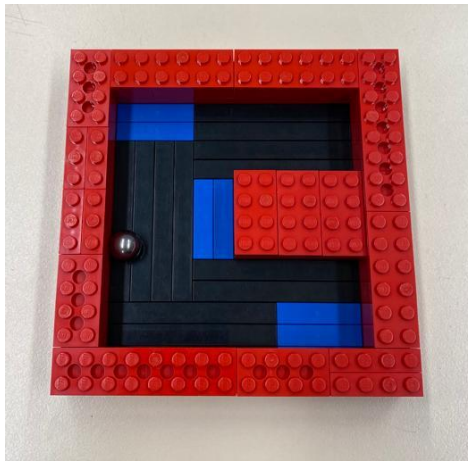


Acknowledgements
The learning activities are co-developed with Mr POON Ka-yeung and his team at St. Paul's School (Lam Tin) and Mr TO Ching-yuet and Mr WONG Wae-ming at Po Leung Kuk Laws Foundation College under the Gifted Education School Network (STEAM education).

Alternatives

- A brick-based mystery box

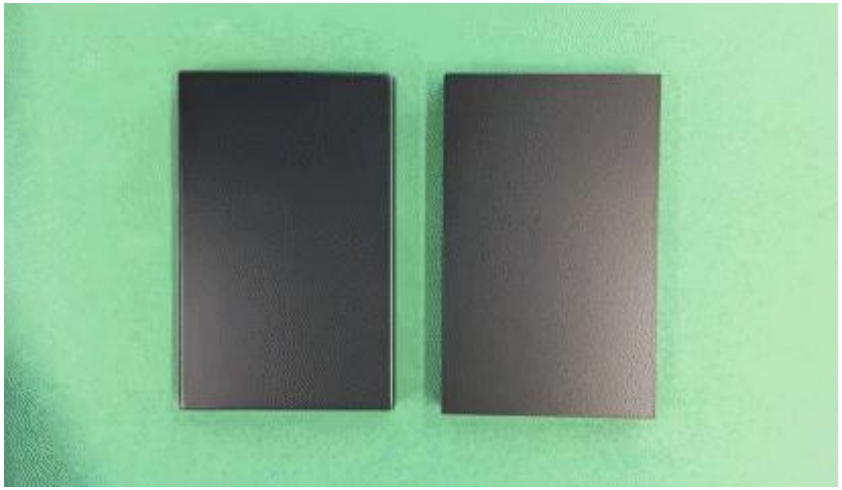




- A 3D printable mystery box

Why does the ice melt faster?

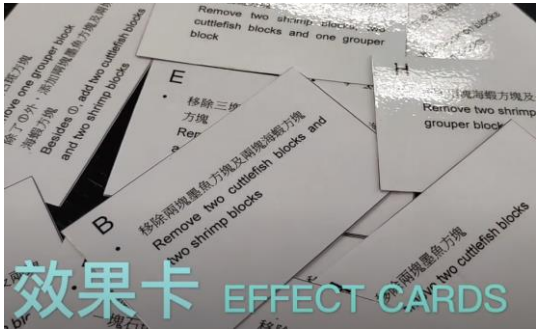
<u>The concepts of heat</u>



- Students watch a time-lapse video for what happen to the ice cube placed on each of the black blocks.
- Students ask as many investigative questions as they can. (For example, are the ice cubes the same?)
- Students then design and conduct experiments to find out the reason why the ice melt faster.

Game-based learning: Marine Food Chains Model

- Students use dynamic models to identify the balance of food chains and ecosystems.
- Students predict and explain the impact of ecological impact brought about by "event cards", and manually operate the models to strengthen students' understanding of causality, etc.
- Advanced concepts involved:
  Keystone species



Acknowledgements
The learning activities are designed and implemented with Mr LEUNG Wing-cheuk at Po Leung Kuk Mrs Ma-Cheung Fook Sien College and Ms NG Shuk-yi, Sandy at Canossa School (Hong Kong), and other teachers under the Gifted Education School Network (STEAM education).

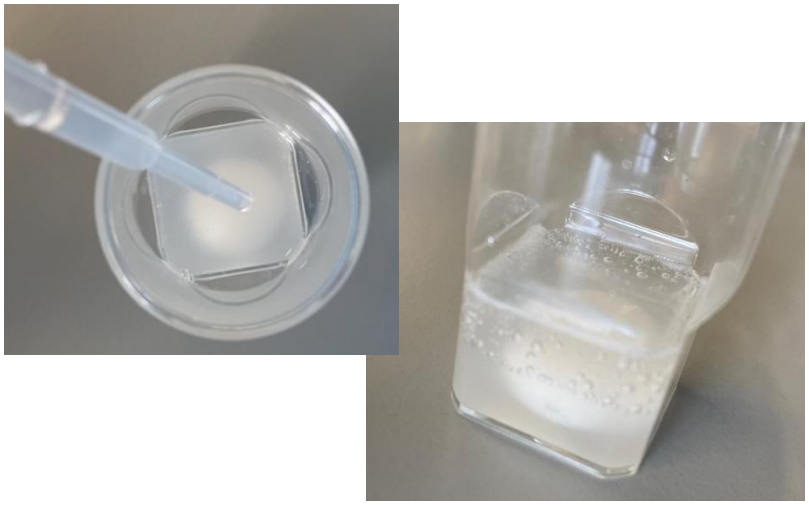
Soda geyser ➡ Quantitative analysis

The rough surface of the candy can catalyse rapid gas evolution.

A micro-scale approach for the weak acid-weak base titration

e.g. determining the concentration of citric acid with baking soda and Mentos mint

$$HCO_3^- + H^+ \rightarrow CO_2 + H_2O$$



Modified from a JCE journal in Feb, 2023

A simple preparation of a wide range buffer (pH 2.0 – 12.0)

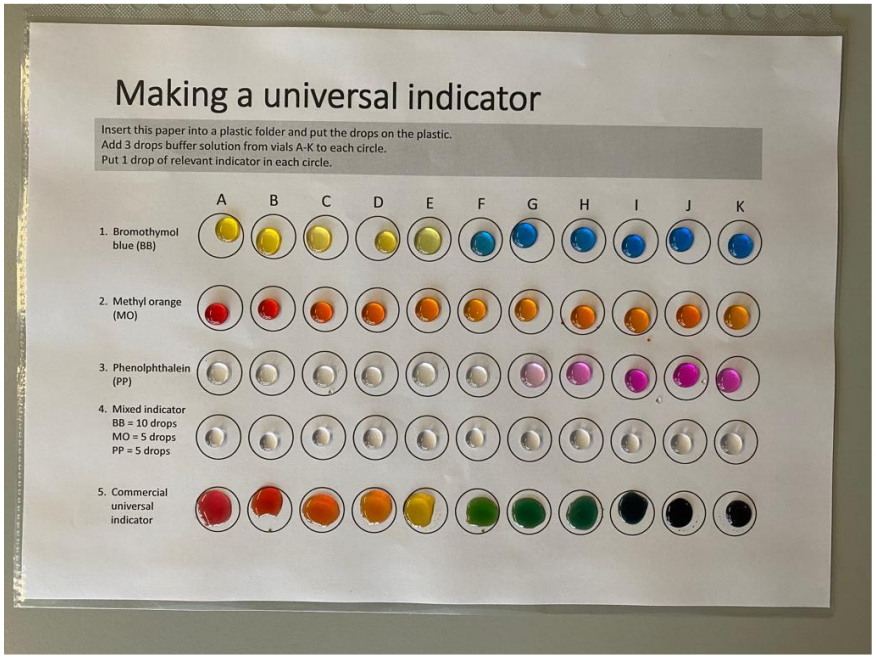
- **Solution 1:**
  0.2 M boric acid, 0.05 M citric acid
- **Solution 2:**
  0.1 M tertiary sodium phosphate

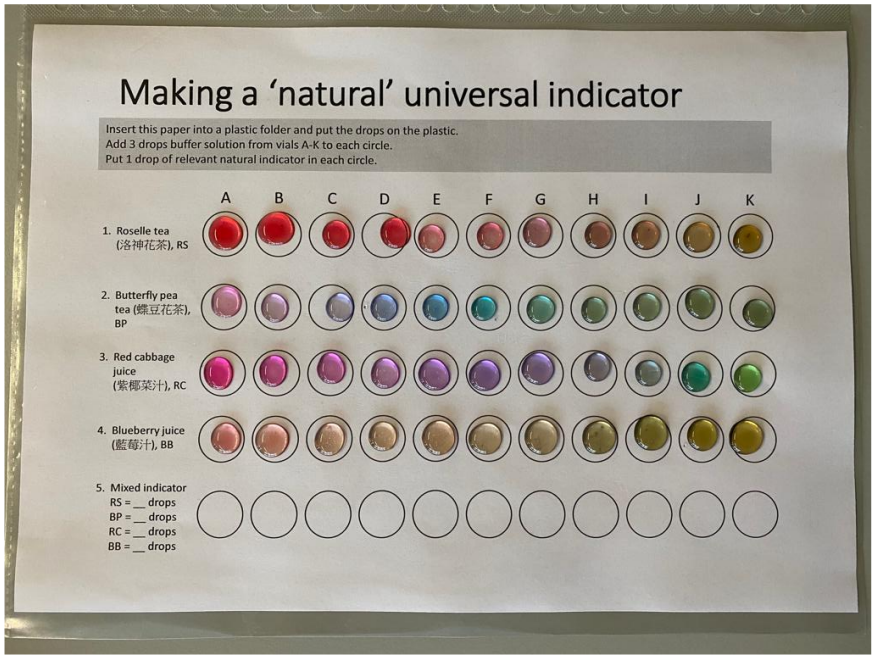
Vial	A	B	C	D	E	F	G	H	I	J	K
# of drop of **soln 1**	20	18	16	14	12	10	8	6	4	2	0
# of drop of **soln 2**	0	2	4	6	8	10	12	14	16	18	20

Carmody, W. R. (1961). Easily prepared wide range buffer series. *Journal of Chemical Education*, *38*(11), 559.

Making universal indicator in a micro-scale approach

- Reduce ‘noise’ of experiment (e.g. refilled chemicals, breaking of glassware, washing apparatus…)
- More time for lab discussion, development of higher-order thinking skills



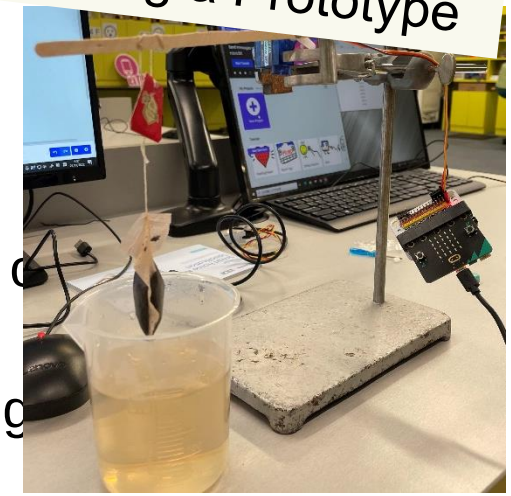


Everyday invention: Smart Tea Brewer

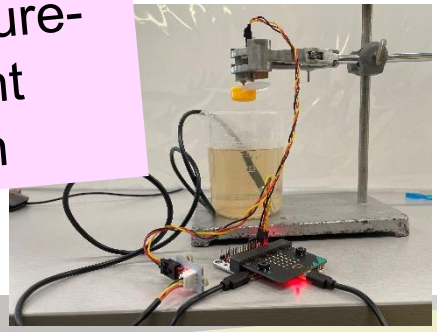
Design thinking: constraint & criteria

- Drinking hot tea or coffee almost triples your risk of c
  cancer
- Iron deficiency anemia due to excessive tea drinking

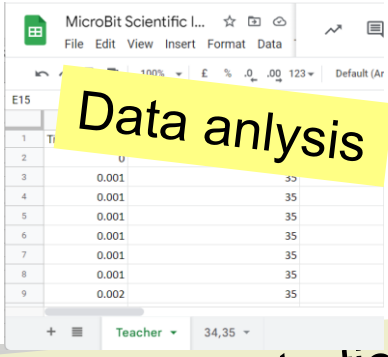
Making a Prototype



Temperature-dependent Smart fan

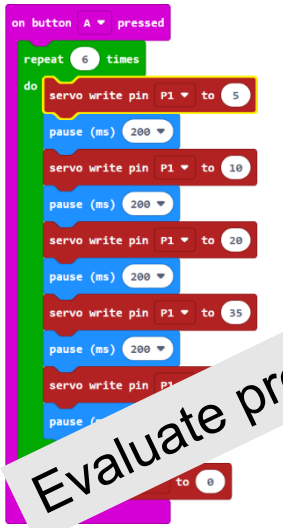


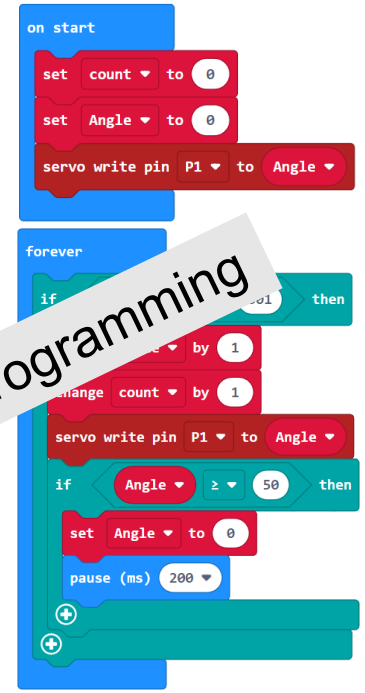
Data anlysis



Indirect measurement of tea concentration

Evaluate programming





Acknowledgements
The learning activities are co-designed and implemented with Mr CHIU Chun-wai at The Y.W.C.A. Hioe Tjo Yoeng College under the Gifted Education School Network (STEAM education).

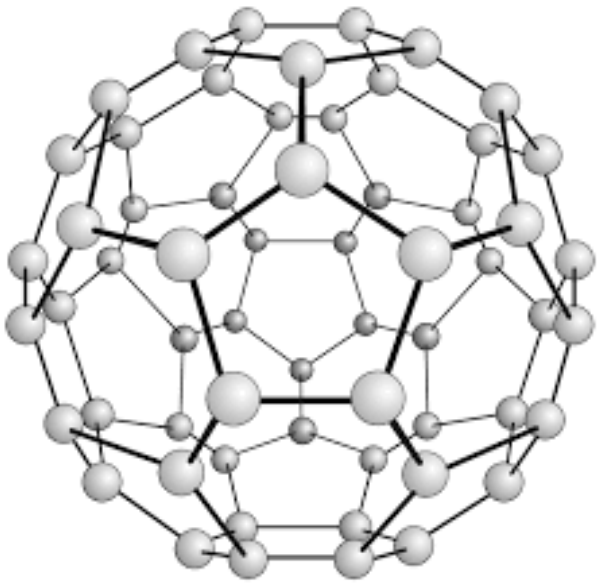
Teachers are the key to promote student creativity

- "… the **enthusiasm** of teachers is important. If you don't have an enthusiastic teacher it may be difficult – yet enthusiasm is more subtle than most people realize. How a **teacher interacts with a student** is very **subjective** as far as the student is concerned. I found some teachers – whom **other people didn't like**, didn't find very interesting, or found boring – to be **quite interesting to me**"

Cardellini, L. (2005). Chemistry, Creativity, Collaboration, and C60: An Interview with Harold W. Kroto. *Journal of Chemical Education*, *82*(5), 751.

Who is Kroto?

- Buckminsterfullerene



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