

Updating the Science Education KLA Curriculum (P₁ to S6)

Position of Science Education KLA in the School Curriculum

- Science is the study of phenomena and events around us through **systematic observation** and **experimentation**.
- Science education cultivates students' **curiosity about the world** and enhances **scientific thinking**. Through systematic inquiry, students will develop **scientific knowledge and skills** to help them evaluate the impact of scientific and technological development.
- This will prepare students to become lifelong learners in science and technology, who will become **responsible citizens** and **contribute to our scientific and technological world**.

Rationales of Updating the Science Education KLA Curriculum

Focusing, Deepening & Sustaining

1. Science Education KLA

- In response to rapid development in science
- Developing a solid and balanced science foundation among students
- Strengthening vertical continuity and lateral coherence within and across KLAs

2. STEM education

- Enhancing students' ability to integrate and apply knowledge and skills
- Nurturing diversified talents for enhancing international competitiveness of Hong Kong

3. Ongoing renewal of the school curriculum

- STEM education as one of the key emphases of the ongoing curriculum renewal
- Other key emphases of ongoing renewal of school curriculum, e.g. refined generic skills, values education, information literacy, Language across the Curriculum (LaC)

Updating the Science Education KLA Curriculum

Focusing, Deepening & Sustaining

Building on Strengths

Sustaining

- Emphasising scientific literacy
- 6 strands in science curriculum
- Open & flexible curriculum framework

Deepening

- Science process skills & nature of science
- Holistic curriculum planning
- Strengthening the interface between Key Stages
- Information Literacy, e-learning

Focusing

STEM Education

- Strengthening ability to integrate and apply knowledge and skills, promoting creativity and problem solving skills, and nurturing entrepreneurial spirit
- Enhancing collaboration among KLAs

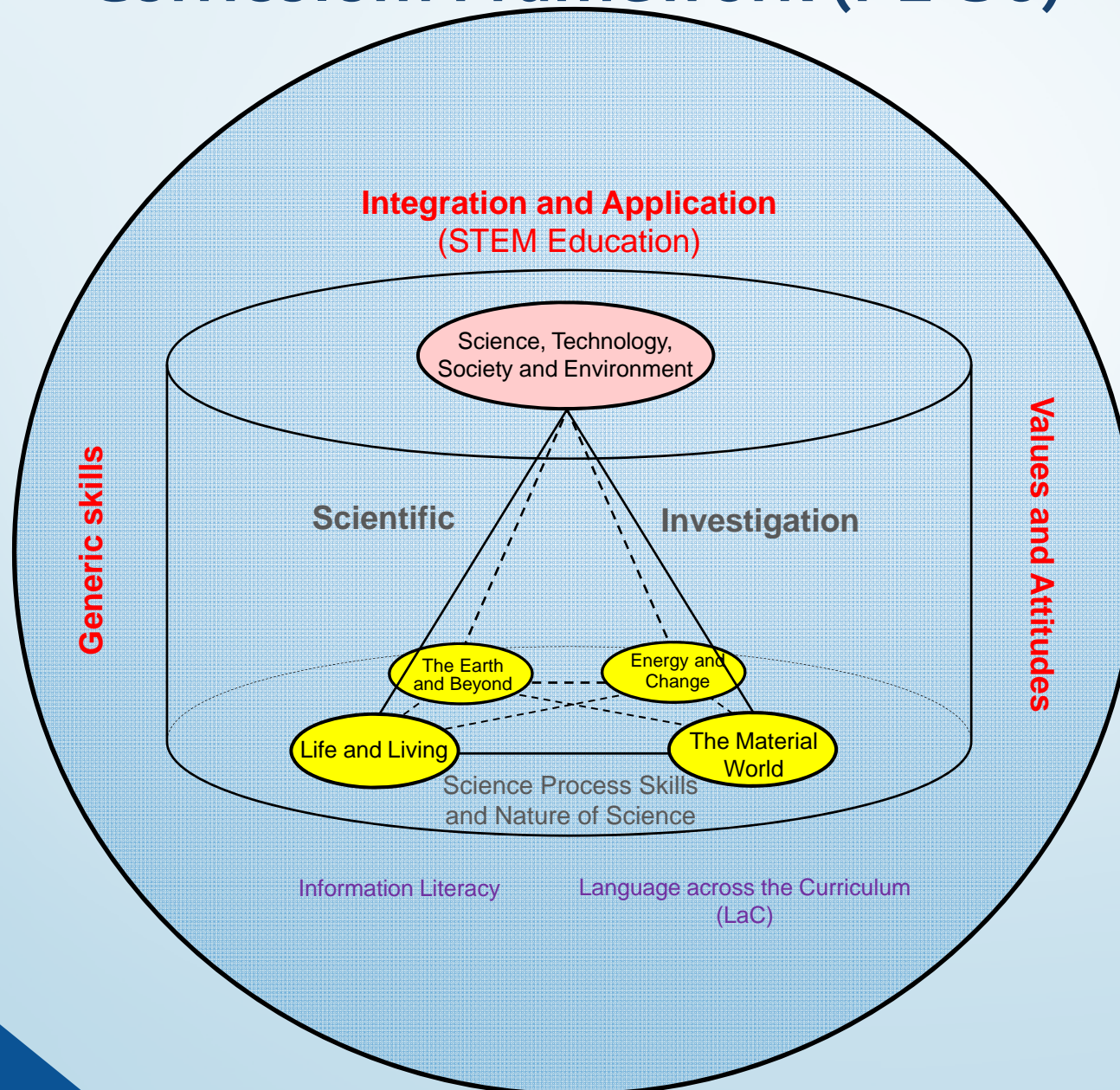
Updated Curriculum Emphases of Science Education

- Strengthening students' ability **to integrate and apply knowledge and skills** (including hands-on skills)
- Nurturing students' **interest in science** and related disciplines
- Emphasising development of **scientific thinking** and **problem solving skills** among students
- Fostering students to **make informed judgements** based on scientific evidence
- Nurturing students to become **self-directed learners** in science
- Catering for students with **different needs** and **aspirations**

Updated Aims of Science Education

1. Develop **curiosity** and **interest in science**
2. Develop the ability to make **inquiries** about science and **solve problems**
3. Acquire **scientific knowledge** and **skills**, and develop the ability to **integrate and apply the knowledge and skills with other related disciplines**
4. Become familiar with the **language of science** to communicate science-related ideas
5. Recognise the social, ethical, economic, environmental and technological **implications of science**; and develop an attitude of responsible citizenship and a commitment to **promote personal and community health**
6. Develop an understanding of the **nature of science**
7. Become a **lifelong learner in science** for personal development
8. Be prepared for **further studies** or **future careers in scientific, technological and engineering fields**

Updated Science Education KLA Curriculum Framework (P1-S6)



Highlighting the Importance of Scientific Literacy

Science Process Skills

- **Why?**

- Foundation for scientific method
- For studying science
- For problem solving
- Facilitate understanding of nature of science
- Develop positive values and attitudes towards science

- **Essential Science Process Skills**

- Observing
- Classifying
- Designing investigations
- Conducting practical
- Inferring
- Communicating

Nature of Science

- **Why?**

- Increase students' interest
- Enhance understanding of scientific knowledge
- Foster students to make informed decision about science-related issues

- **Some widely accepted views of the nature of science :**

- Scientific knowledge is durable and tentative.
- Science attempts to explain natural phenomena based on consistent patterns in natural world.
- Scientific knowledge is supported by evidences and empirical standards.
- Scientific knowledge relies on creativity, innovation and skepticism.
- Scientific methods include the empirical testing of new ideas generated by deductive and/or inductive logic.
- ...

Updating of Science (S1-3) Curriculum

Direction of review:

- Fine-tune and update the **curriculum content**
- Nurture students' **interest in science**
- Help students build a **solid and balanced foundation** in science
- Strengthen the **bridging between junior and senior secondary** science curricula

Updating of Science (S1-3) Curriculum

Major updates:

- Keeping abreast of the rapid development in science and technology, especially in the field of life sciences
- Strengthening the bridging between junior and senior secondary science curricula
- Unifying concepts are introduced to enhance students' understanding of the connections and overarching coherence across different science disciplines
- Science process skills are strengthened, e.g. basic quantitative treatment in scientific investigations, including interpretation of data and graphs, and use of symbols, equations and graphs for representation and communication of ideas
- Learning and teaching activities are enriched for students to integrate and apply knowledge and skills in problem solving to create solutions and make inventions with hand-on experiences, e.g. projects, design-and-make activities

Updating of Primary General Studies Curriculum

- The contents are updated to put more emphasis on the **relevance of science and technology to daily life** (e.g. low carbon living, global warming).
- **Basic science process skills**, including observing, measuring, classifying and communicating, are enhanced in science investigation (e.g. fair test) to strengthen the **interface between primary and junior secondary levels**.
- Learning and teaching activities related to the **application of science and technology** in solving everyday life problems are enriched (e.g. energy use in daily life, the use of simple machines)

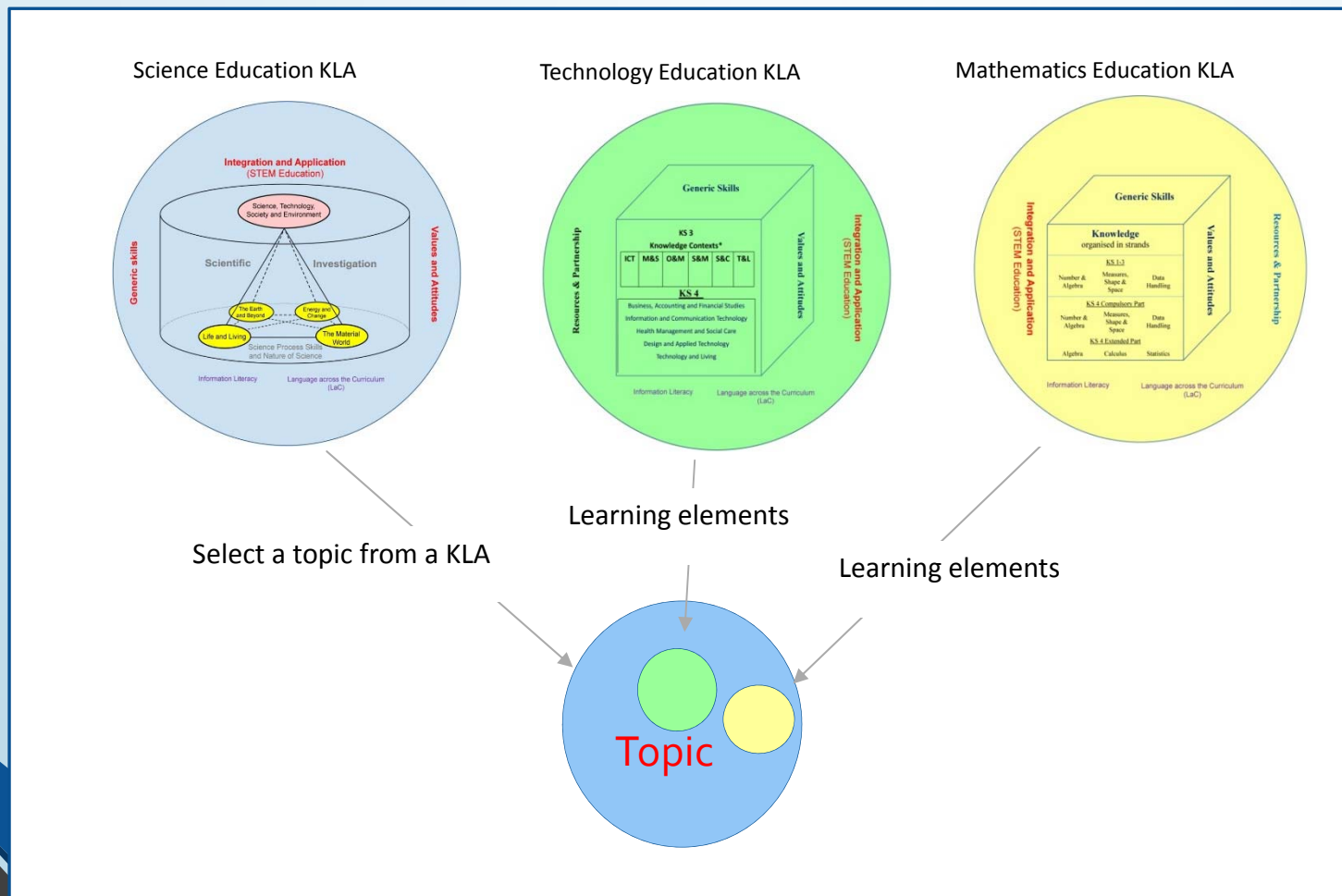
Promoting STEM Education

- Further develop among students a **strong knowledge base** in step with the latest developments in SE, TE and ME disciplines
- Strengthen their **ability to integrate and apply knowledge and skills** in meeting the changes and challenges in the contemporary world
- Nurture their **creativity, collaboration** and **problem solving skills**, which can foster **innovation** and **entrepreneurial spirit** as required in the 21st century.

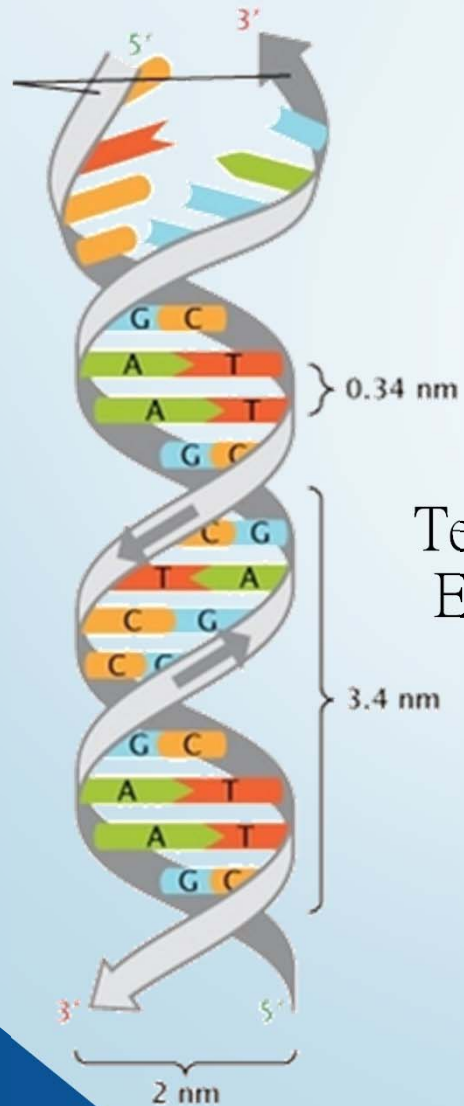
Approaches for STEM Learning Activities

Approach One

Learning activities based on a topic of a KLA



DNA Model Making



Structure of DNA

Genetic Code

Science Education

Technology Education

Model Design

Model Making

Measuring

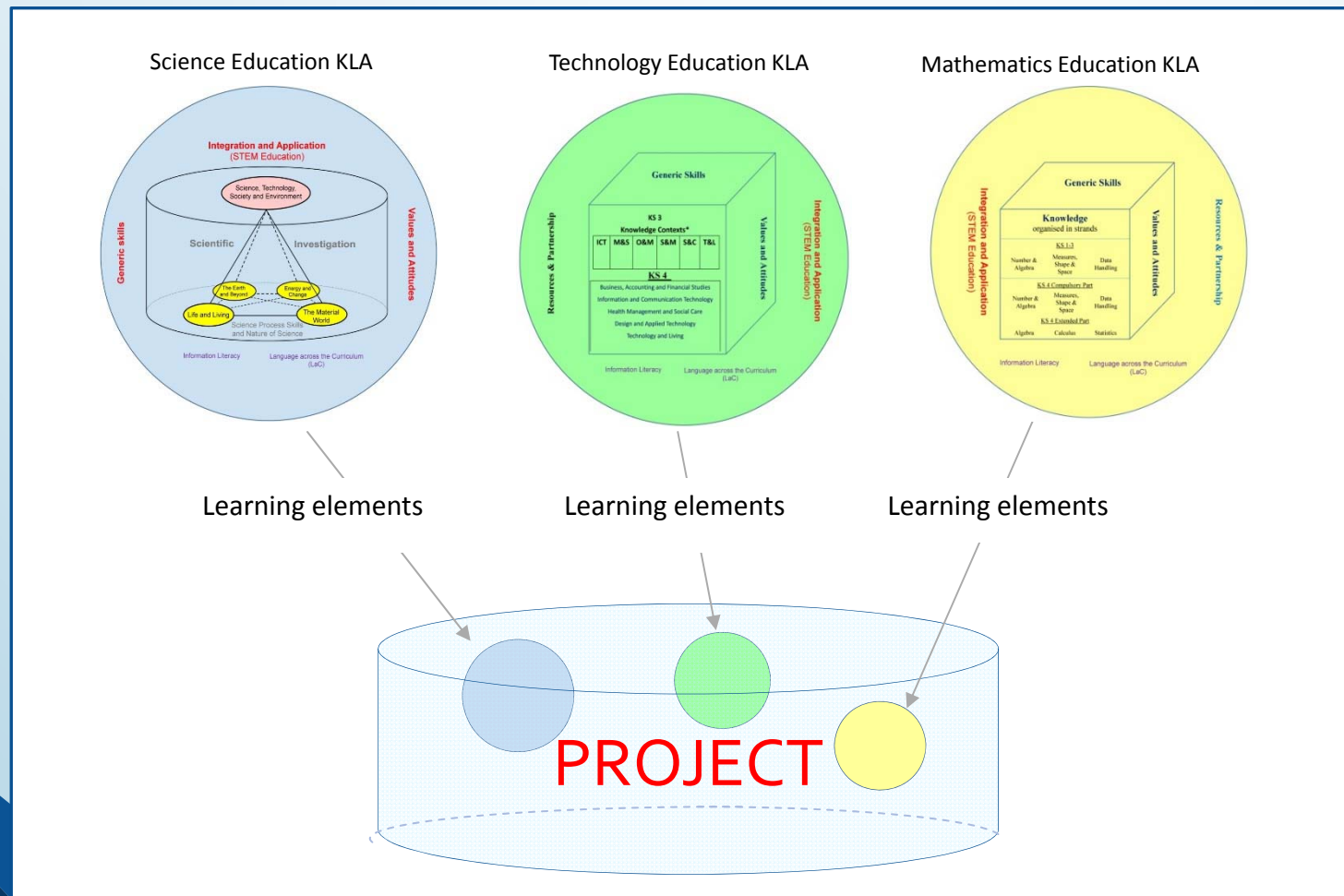
Ratio

Mathematics Education

Approaches for STEM Learning Activities

Approach Two

Projects integrating relevant learning elements of different KLAs



Healthy Diet



Food
Substances

Food
Pyramid

Science
Education

Technology
Education

Food Research
&
Development

Food
Preparation
Food
Hygiene

Estimate
and
measure

Collect
and
organise
data

Mathematics
Education

- Design menu
- Design mobile application for calculating calorie value
- Food research and development

Other Key Emphases of the Ongoing Renewal of School Curriculum

Refined Generic Skills

Basic Skills 基礎能力	Thinking Skills 思考能力	Personal and Social Skills 個人及社交能力
Communication Skills 溝通能力	Critical Thinking Skills 明辨性思考能力	Self-management Skills 自我管理能力
Mathematical Skills ¹ 數學能力	Creativity 創造力	Self-learning Skills ² 自學能力
IT Skills 運用資訊科技能力	Problem Solving Skills 解決問題能力	Collaboration Skills 協作能力

Remarks: ¹Numeracy Skills and ²Study Skills were used respectively in *Learning to Learn: The Way Forward in Curriculum Development* (2001)

- In Science Education KLA, generic skills can be developed through scientific investigations, experiments, field work, group discussion, debates on science-related issues, project learning, cross-disciplinary STEM activities, etc.

Other Key Emphases of the Ongoing Renewal of School Curriculum

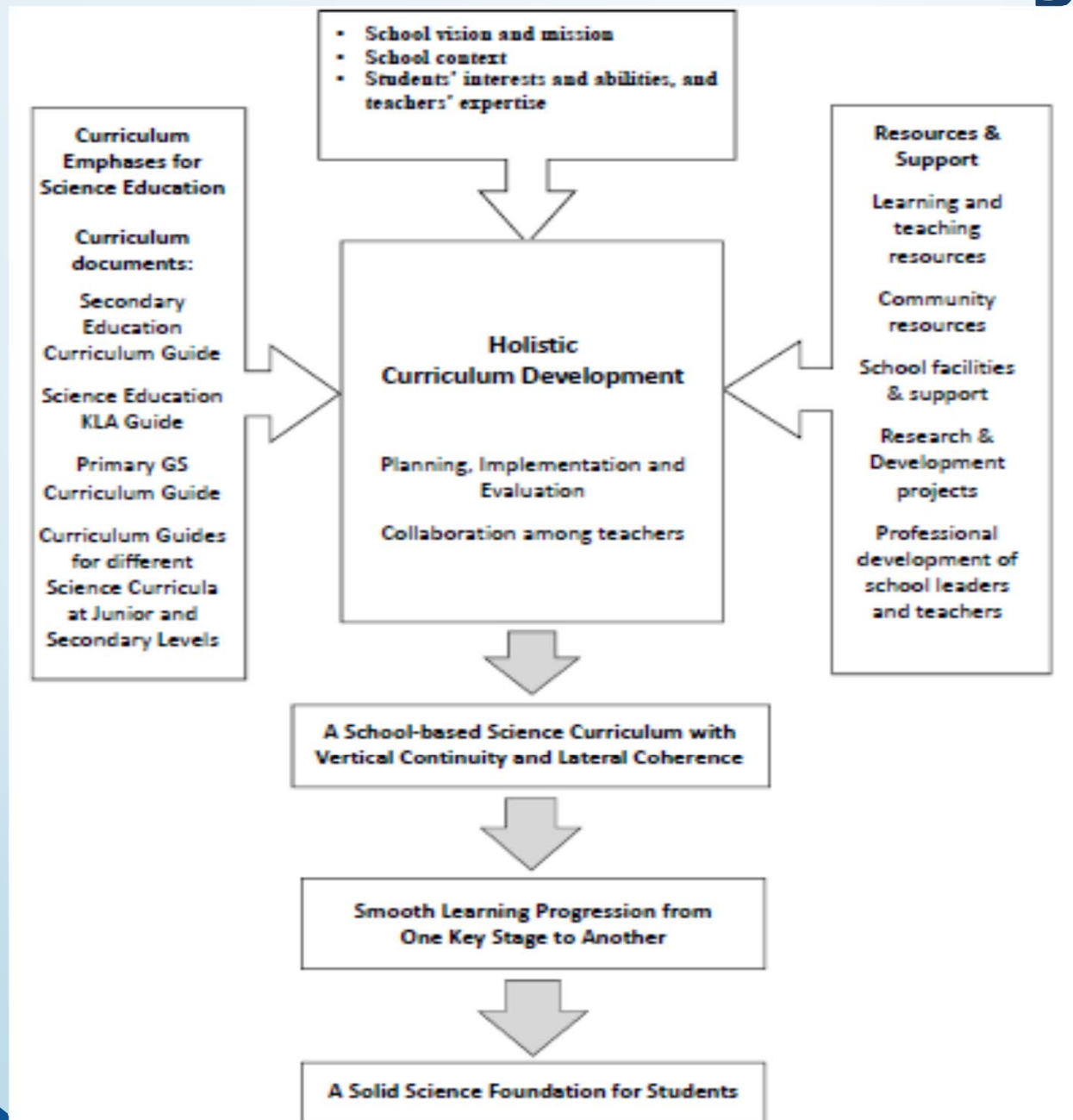
Promoting Values Education

- Values education is an **integral part of the school curriculum**; cultivated through KLAs/subjects
- In Science Education KLA, values education can be carried out through relevant topics and appropriate learning and teaching activities that help students **apply and reflect on positive values and attitudes**
- Other values and attitudes which could be permeated:
 - curiosity, critical reflection, open-mindedness, respect for evidence, caring for the living organisms and their environment, committed to sustainable development of the environment, etc.

Other Key Emphases of the Ongoing Renewal of School Curriculum

- Strengthening **Language across the Curriculum (LaC)** through tasks/strategies:
 - **reading to learn**, e.g. using graphical organisers, unpacking and packing science ideas and language focus
 - **learning to write**, e.g. writing laboratory safety rules and investigation report
- Strengthening **information literacy**, e.g. data collection, organisation, analysis, interpretation and reporting in **scientific investigation**
- Promoting **e-learning**, e.g. **using mobile devices for experiments, flipped-classroom teaching**

Holistic Curriculum Planning



Promoting Effective Pedagogies

- Effective L&T strategies:
 - Practical work , investigation, problem-based learning, context-based learning, discussion/role-play/debate, project learning
 - STEM-related learning activities
 - e-Learning
 - Cater for learner diversity

e-Learning in Science Education

- Using **data-loggers** to conduct experiments.
- Using a **flipped-classroom** approach by recording and uploading short video clips to the school's intranet or the Internet so that students can watch the clips and prepare for the lesson beforehand. Teachers could then spare the lesson time for more engaging learning activities, e.g. group discussion and solving problems.
- Using **mobile devices** such as mobile phones and tablet computers and apps inside and outside the classroom for interactive learning, and to extend science learning beyond the classroom.
- Using **online platforms** for discussion, dissemination of resources and collaborative learning.

• ...

Measures to Cater for Learner Diversity

- Teacher should attend to students with different **learning styles, needs, interests** and **abilities**, and take appropriate action to help different students learn better.
- Teachers equip themselves with a **repertoire of tactics**, such as flexible grouping, remedial and extension activities, and varying the curriculum, pedagogy and the assignments
- **Groom students** with a special talent in science and STEM disciplines, to develop their full potential.
- **Enrichment activities** and additional **tasks of challenge**
- Encourage students to participate in a variety of local and/or overseas **learning programmes or science competitions**.

Assessment in Science Education

Summative and Formative Assessment

- Assessment *of* learning
- Assessment *for* learning
 - on a continuous basis
 - identifying students' strengths and weaknesses and providing quality feedback for improving
 - providing teachers with evidence to review curriculum planning and teaching practices
- Assessment *as* learning
 - engaging students in reflecting and monitoring their progress of learning
 - self-assessment and peer assessment

Assessment strategies for Science Education

- Paper and pencil
- Written assignments
- Oral questioning
- Observation
- Practical assessment
- Project work
- e-assessment
- Portfolios
- ...

Assessment for STEM-related Learning Activities

- Assessment should match with the nature and progress of the activity
- Assessment include:
 - integrate and apply knowledge and skills
 - problem solving
 - creativity, innovative ideas
- Assessment strategies
 - observation, oral questioning, class discussion, presentation of designs/plans of project

Strengthening Collaboration with Technology and Mathematics Education KLAs to Promote Science/STEM Education

- Providing a **favourable environment**
- **Holistic curriculum planning**
- Organising **KLA-based and cross-disciplinary** learning activities of different nature; providing **meaningful contexts** closely geared to daily life to engage students in problem solving
- Encouraging and supporting **STEM-related competitions** and other **fun-filled learning activities**
- Promoting **collaboration among teachers** at school level

Supporting Strategies to Schools

- **Enrich learning activities for students** e.g. student education fair
- **Provide Learning and teaching resources** – EDB One-stop Portal, e-resources, community resources, etc.
- **Strengthen partnerships** with key players in the community
- **Enhance professional development** of schools and teachers – symposia, professional development programmes (PDPs), PDS of EDF, etc.

Frequently Asked Questions

Q1. What are the implications of curriculum updating of the SE KLA in school-based curriculum development?

- A1. - Promoting **holistic curriculum planning** for **vertical continuity** and **lateral coherence** within and across KLAs, and collaboration among teachers
- Enriching learning and teaching activities, such as **scientific investigations, design-and-make activities** and **problem-based learning**

Q2. How can schools allocate time for promotion of STEM education?

- A2. - **Effective use of lesson time** with infusion of STEM-related learning activities
- **Appropriate use of school-based flexible time** of central time allocation / outside classroom learning for STEM-related projects and competitions

Q3. What are the resources and supports available to schools?

- A3. - Resources and supports from EDB, e.g. PDPs, resources at One-stop Portal, Edblogs
- Community resources provided by other government related/non-government organisations
- Other resources, e.g. QEF project, PDS of EDF

Summary of Key Updates

- Updating the **curriculum framework**
- Emphasising **holistic curriculum planning**
- Promoting **STEM education** (strengthening the ability to integrate and apply knowledge and skills within and across KLAs)
- Other key emphases of ongoing curriculum renewal, such as refined generic skills, values education, LaC, information literacy, e-learning



Thank you