

Consultation Seminar on the Ongoing Renewal of the School Curriculum: Focusing, Deepening and Sustaining

Mathematics Education KLA Curriculum (Secondary)

Nov 2015

Position of Mathematics in the School Curriculum

- ▶ Mathematics helps students acquire the ability to **communicate, explore, conjecture, reason logically, make choice** and **solve problems** using a variety of methods
- ▶ Mathematics is a powerful means of communication. It **enables information to be presented in many ways** like figures, tables, charts, graphs and symbols, which can be processed to generate further information
- ▶ Mathematics is a creative activity through which students can demonstrate their **imagination, initiative and flexibility of mind**
- ▶ Mathematics helps students laid a strong foundation for **lifelong learning** and **acquired new knowledge** in this rapidly changing world

Rationales of Updating the Mathematics Curriculum

1. Ongoing renewal of the school curriculum: Focusing, deepening and sustaining

- ▶ Key emphases: STEM education, e-learning and others, e.g. generic skills, values education, Language across the Curriculum (LaC) and information literacy

2. Mathematics Education KLA

- ▶ In response to needs of society, development of technology, views of stakeholders and results of PISA and TIMSS
- ▶ Holistic review of Mathematics curriculum (P1–S6) to strengthening vertical continuity and coherence within and across KLAs

3. STEM education

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

Ongoing curriculum renewal

- ▶ The **Learning to Learn** curriculum reform 2001
 - Lifelong learning and whole-person development
- ▶ **Ongoing renewal** of the school curriculum (also known as “Learning to Learn 2.0”)
 - To maintain Hong Kong’s competitive edge
 - To prepare our students for the various local and global changes
 - globalisation and an increasingly interconnected and interdependent world
 - the changing face of learning and teaching brought by advances in technology

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- ▶ **Ongoing renewal** of the school curriculum (also known as “Learning to Learn 2.0”)
 - To maintain Hong Kong’s competitive edge
 - To prepare our students for the various local and global changes
 - To sustain and deepen the accomplishments achieved
 - To identify new focuses in the curriculum
 - e.g. STEM education and e-learning

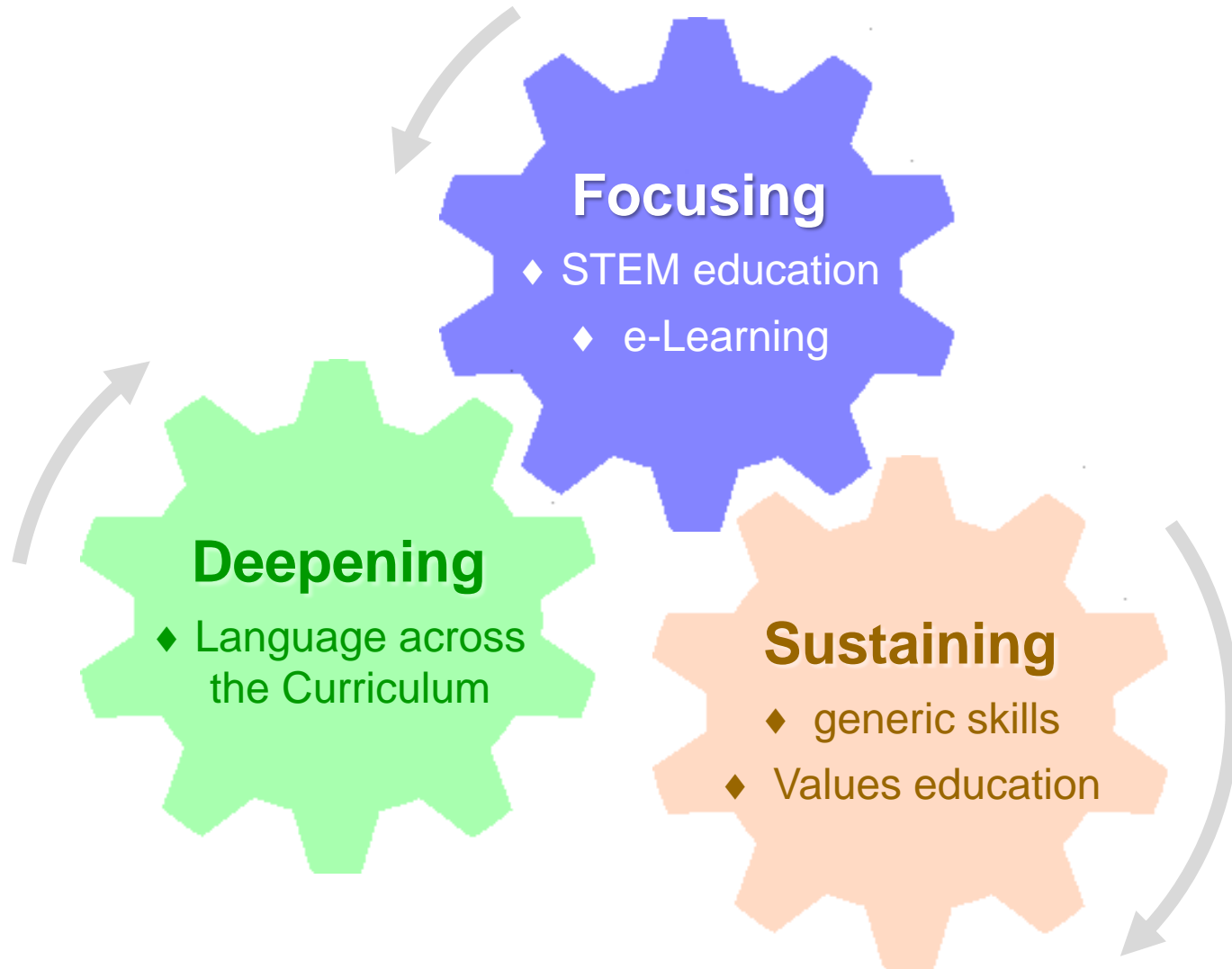
Ongoing curriculum renewal

- ▶ *Basic Education Curriculum Guide (Primary 1–6)* was updated in mid-2014
- ▶ *Secondary Education Curriculum Guide* is being updated and will be available for schools' reference in 2016
- ▶ For details on the Ongoing Renewal of the School Curriculum:
<http://www.edb.gov.hk/tc/curriculum-development/renewal/index.html>

Major Updates

- ▶ Strengthening students' ability to **integrate and apply knowledge and skills** – **STEM education**
- ▶ **Holistic review** of Mathematics curriculum (P1 – S6), enhancing **vertical and horizontal continuity**, strengthening the learning and teaching of **Data Handling**
- ▶ Elements of the Ongoing Curriculum Renewal of School Curriculum – refined **generic skills, values and attitudes**, **Language across the Curriculum (LaC)**, **information literacy**
- ▶ Promoting **e-learning**, strengthening **information literacy**

Key emphases in Mathematics



Updates in Mathematics

In response to

- ▶ the changing needs of **society** and the rapid development of **technology**
 - awareness of the importance of innovation, use of tablet computers in Wi-Fi classrooms
- ▶ **views of stakeholders** collected through different means
 - progression across key stages
 - support to other subjects

Updates in Mathematics

In response to

- ▶ the results of international assessment (e.g. **PISA** and **TIMSS**)
 - e.g. interpreting and applying mathematical outcomes in context, enhancing data handling strand
- ▶ key emphases of the **ongoing curriculum renewal**
 - STEM education, e-Learning and information literacy, Language across the Curriculum

Updates in Mathematics

*Mathematics Education Key Learning Area
Curriculum Guide (P1 – S3) (2002)*



*Mathematics Education Key Learning Area
Curriculum Guide (P1 – S6) (2016)*

- ▶ recommendations are **revisited** and **updated**
- ▶ extended to include the three-year senior secondary Mathematics education
- ▶ Questionnaire survey

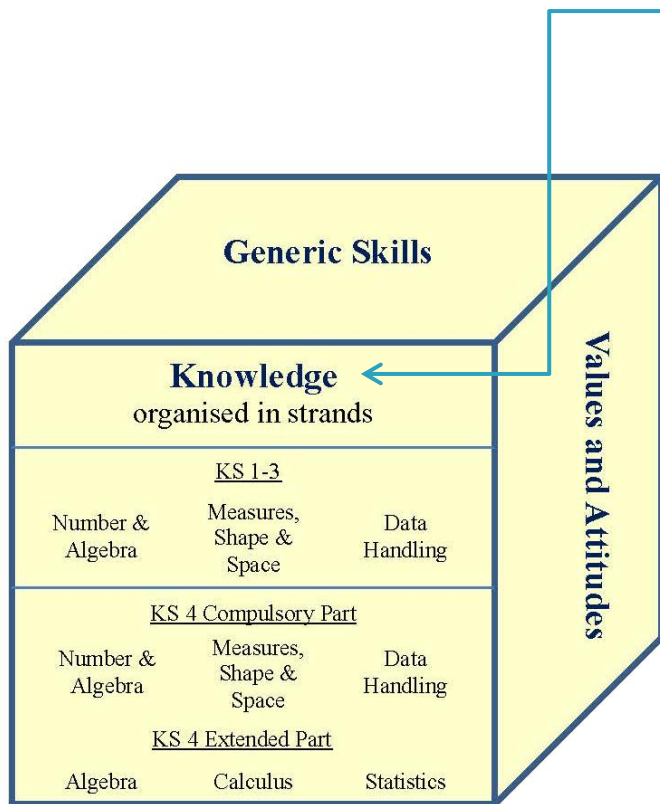
Updates in Mathematics: Aims

(to be kept unchanged)

The overall curriculum aims of the Mathematics Education Key Learning Area are to develop in students:

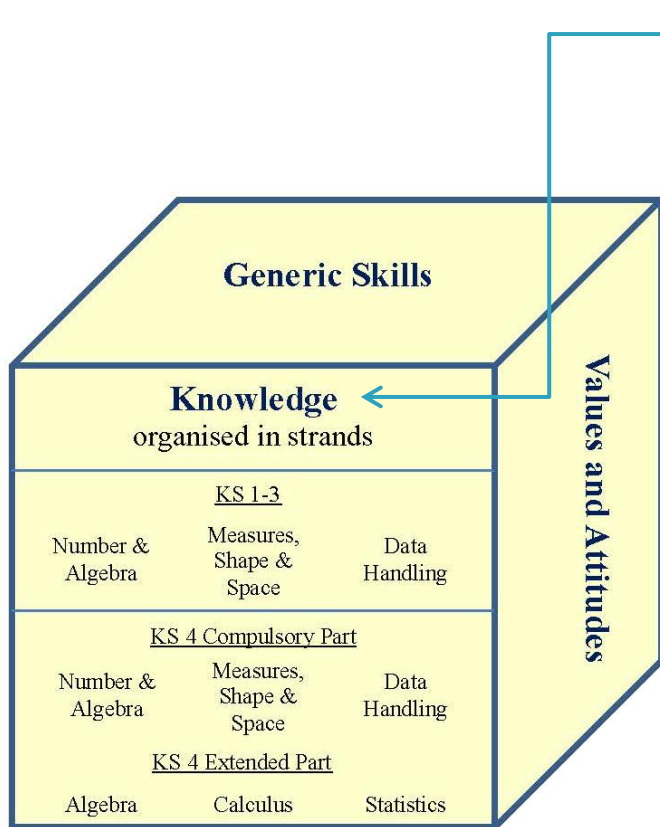
- the ability to think critically and creatively, to conceptualise, inquire and reason mathematically, and to use mathematics to formulate and solve problems in daily life as well as in mathematical contexts and other disciplines;
- the ability to communicate with others, express their views clearly and logically in mathematical language;
- the ability to manipulate numbers, symbols and other mathematical objects;
- number sense, symbol sense, spatial sense, measurement sense and the capacity to appreciate structures and patterns; and
- a positive attitude towards mathematics learning and an appreciation of the aesthetic nature and cultural aspect of mathematics.

Updates in Mathematics



- The framework and content **undergo multi-stage review**
- Recommendations of the NAS Medium-term Review (June 2015) (Senior secondary):
 - kept unchanged for the time being
 - **continues to be reviewed** with the finalised decision to be announced by July 2017
- **Major updates (P1-S3)** to be announced by **late 2016**

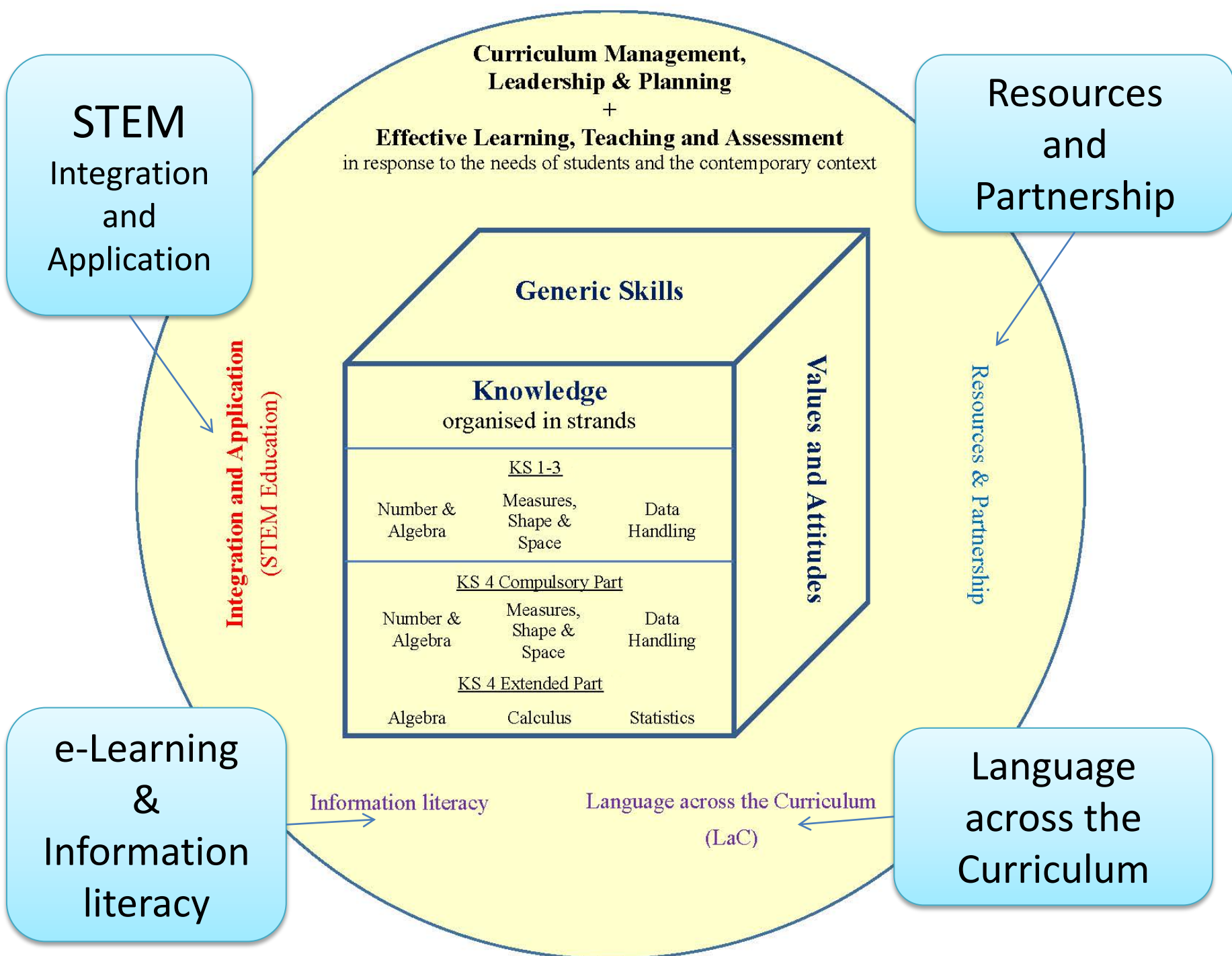
Updates in Mathematics



Holistic Review (P1 –S6)

Issues to be addressed

- vertical continuity/
progression across key stages
- support to other KLAs and subjects
- STEM education
- The learning and teaching of Data Handling
- other key emphases



Overall Aims and Learning Targets of Mathematics



**Curriculum Management,
Leadership & Planning**

+

Effective Learning, Teaching and Assessment
in response to the needs of students and the contemporary context

Generic Skills

Knowledge
organised in strands

KS 1-3

Number &
Algebra

Measures,
Shape &
Space

Data
Handling

KS 4 Compulsory Part

Number &
Algebra

Measures,
Shape &
Space

Data
Handling

KS 4 Extended Part

Algebra

Calculus

Statistics

Values and Attitudes

Resources & Partnership

Integration and Application
(STEM Education)

Information literacy

Language across the Curriculum

(LaC)

STEM education

- ▶ Equipping students to meet the **changes and challenges** in our society and around the world with **rapid economic, scientific and technological developments**
- ▶ Promoted through **Science, Technology and Mathematics Education**
- ▶ As stated in the 2015 Policy Address, EDB will
 - **renew and enrich the curricula and learning activities of Science, Technology and Mathematics,**
 - **enhance the training of teachers,**
- ▶ thereby allowing students to fully unleash their potential in **innovation**

STEM education

▶ Aim

- to strengthen the Science, Technology and Mathematics Education to **nurture diversified talents** in the science and technology fields for enhancing the **international competitiveness** of Hong Kong

STEM education

Objectives:

- ▶ To develop among students **a solid knowledge base** and to enhance their interests **in Science, Technology and Mathematics** for **further studies and careers** in meeting the changes and challenges in the contemporary world
- ▶ To strengthen students' ability to **integrate and apply knowledge and skills**, and to nurture students' creativity, collaboration and problem solving skills, as well as to foster their innovation and entrepreneurial spirit as required in the 21st century

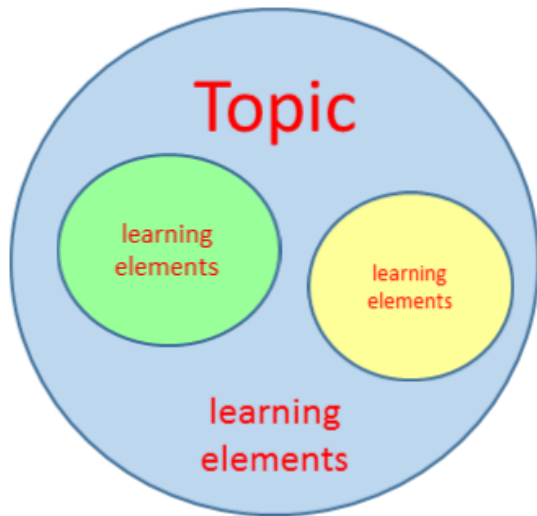
STEM education

Objectives:

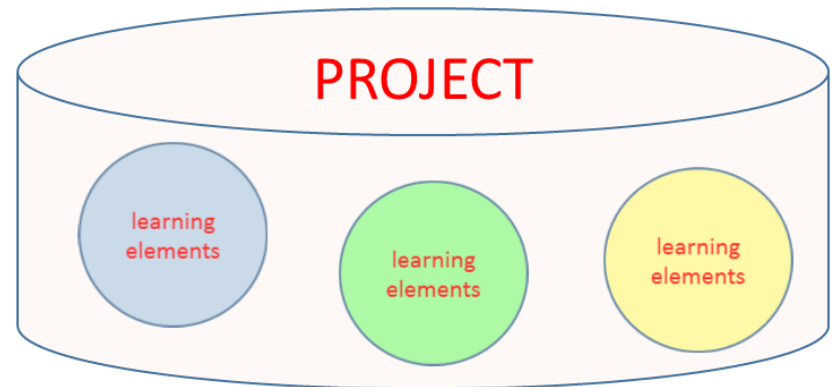
- ▶ To strengthen the professional capacity of and **collaboration among teachers** in schools and the **partnerships** with community stakeholders
- ▶ To nurture talents and develop experts in STEM areas so as to contribute to the **development of Hong Kong and our nation**

STEM education

- ▶ Approach One
Learning activities based on topics of a KLA



- ▶ Approach Two
Projects integrating relevant learning elements of different KLAs



Example 1 :
Topic
approach
(Junior Secondary)

Measurement by GPS Tracking Apps and Investigating the Errors of Measurement



Mathematics
Education

Estimation

Rate and
ratio

Science
Education

Measure-
ment

Using
tablet
computers

GPS
tracking
apps

Technology
Education

Example 1 :
Topic
approach
(Junior Secondary)

Measurement by GPS Tracking Apps and Investigating the Errors of Measurement



Generic Skills

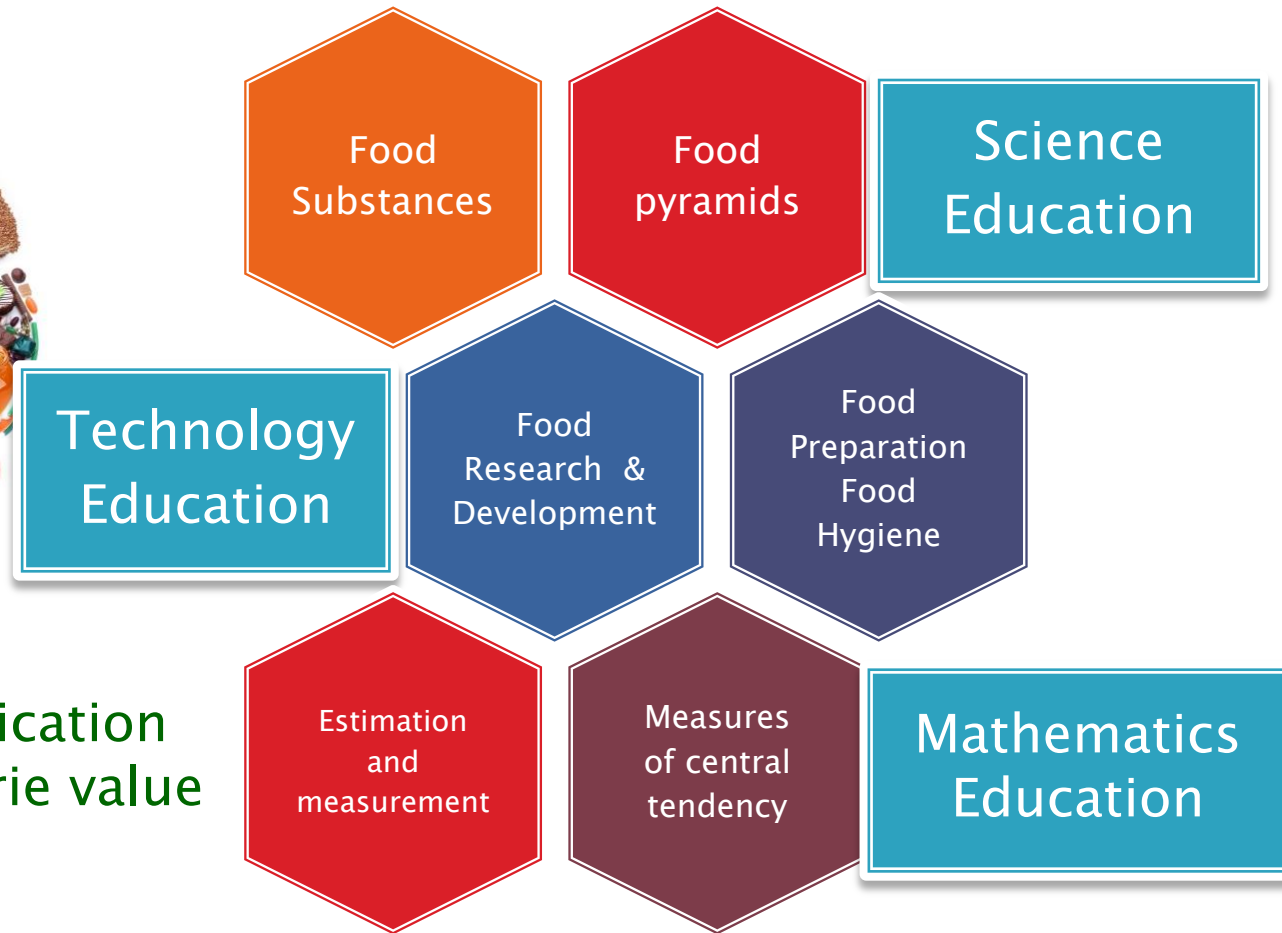
- ▶ Communication Skills
- ▶ Problem-solving Skills
- ▶ Information Technology Skills

Example 2 : Project approach (Junior Secondary)

Design a healthy diet menu for a school lunch box supplier

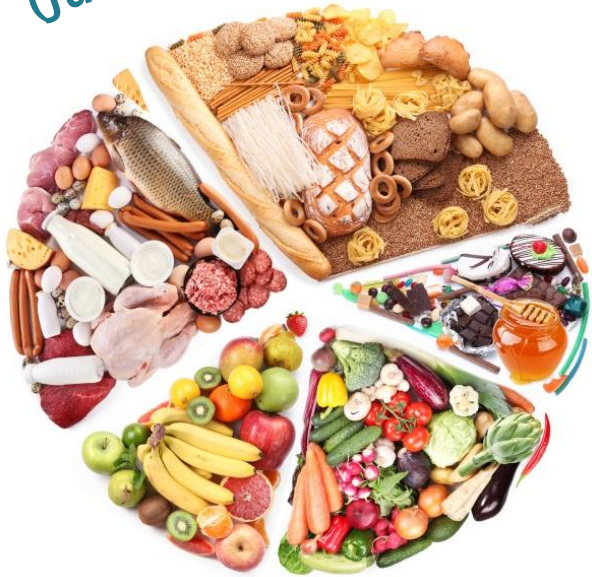


- Design menu
- Design mobile application for calculating calorie value
- Food research and development



Example 2 : Project approach (Junior Secondary)

Design a healthy diet menu for a school lunch box supplier



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Generic Skills

- ▶ Creativity
- ▶ Problem-solving Skills
- ▶ Collaboration skills

e-Learning

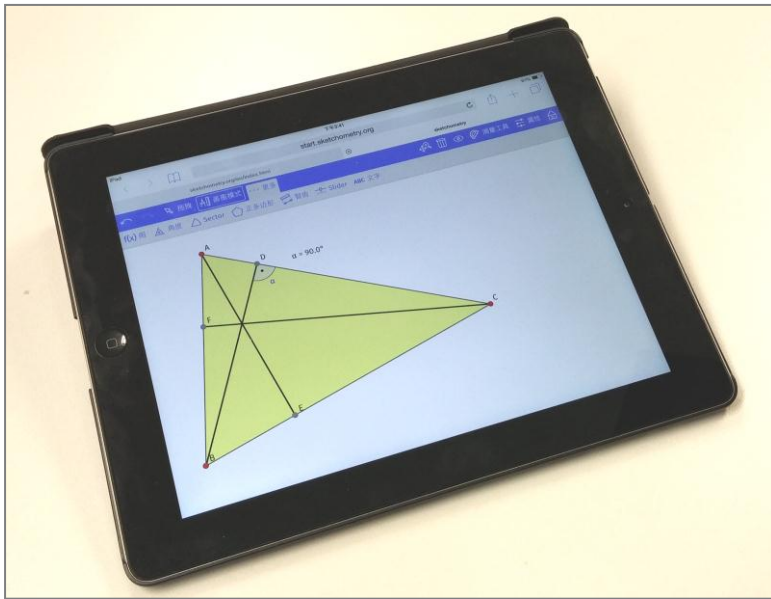
- ▶ Enhance learning and teaching effectiveness and develop students' necessary qualities for the 21st century
 - effective use of the IT environment (e.g. Wi-Fi infrastructure) to allow flexible use of e-resources, IT tools and mobile devices;
 - effective use of mathematics application software (e.g. graphing tools, virtual 3-D manipulatives and dynamic geometry software) for multiple representations of abstract concepts;

e-Learning

- ▶ Enhance learning and teaching effectiveness and develop students' necessary qualities for the 21st century
 - encouraging students to apply IT skills for inquiry and investigation (e.g. computation or graphing tools), presentation, critical thinking, information evaluation and knowledge management;
 - effective use of e-learning resources to develop students' creativity, collaboration and problem-solving skills as well as self-learning skills

Example : Centres of Triangles

Junior Secondary



Web-based dynamic geometry software

- ▶ Dynamic geometry software is used for **investigation of the properties of centres of triangles**, for presentation and for discussion
- ▶ Easy construction saves time for inquiry and discussion

Other elements of the ongoing renewal of school curriculum

- ▶ Other key emphases of ongoing curriculum renewal
 - Generic skills
 - Values Education
 - Language across the Curriculum
 - Information literacy

Other elements of the ongoing renewal of school curriculum

Generic skills

Basic Skills	Thinking Skills	Personal and Social Skills
Communication Skills	Critical Thinking Skills	Self-management Skills
Mathematical Skills*	Creativity	Self-learning Skills*
IT Skills	Problem-solving Skills	Collaboration Skills

* Numeracy Skills and Study Skills were used respectively in Learning to Learn: Life-long Learning and Whole-person Development (2001)

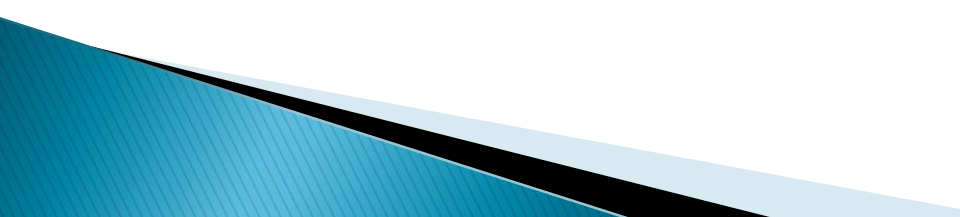
Other elements of the ongoing renewal of school curriculum

Values Education

- ▶ seven priority values and attitudes
 - reflect both Chinese and Western cultures/values
 - address students' and societal needs
 - of vital importance for students' whole-person development
- ▶ perseverance, respect for others, responsibility, national identity, commitment, integrity, and care for others

Other elements of the ongoing renewal of school curriculum

Values Education

- ▶ seven priority values and attitudes
 - ▶ Others: taking up challenges, open-mindedness, cautiousness
 - ▶ Open-ended questions;
short research project on history of math;
inquiry and investigation approach.
- 

Other elements of the ongoing renewal of school curriculum

Language across the Curriculum (LaC)

- ▶ **Literacy** refers to the ability to read and write effectively
- ▶ new literacy skills are needed to process and create **multimodal texts** (messages conveyed through different forms, e.g. text, diagrams, tables, etc.)

Other elements of the ongoing renewal of school curriculum

Language across the Curriculum (LaC)

- ▶ **Reading** in Mathematics helps
 - enhance students' interest in learning Math
 - develop skills of literacy
- ▶ The understanding on **daily-life applications** and **cultural aspects of mathematics** that acquired through reading
 - provides students with a more comprehensive conception of mathematics

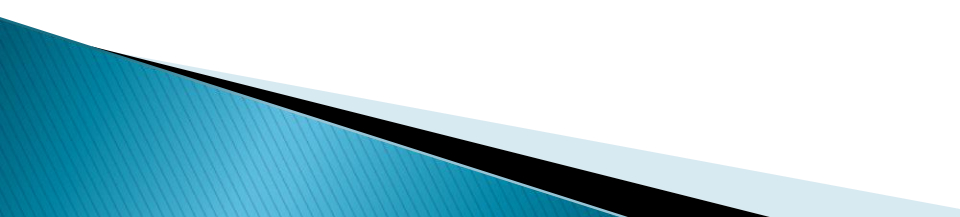
Other elements of the ongoing renewal of school curriculum

Information literacy

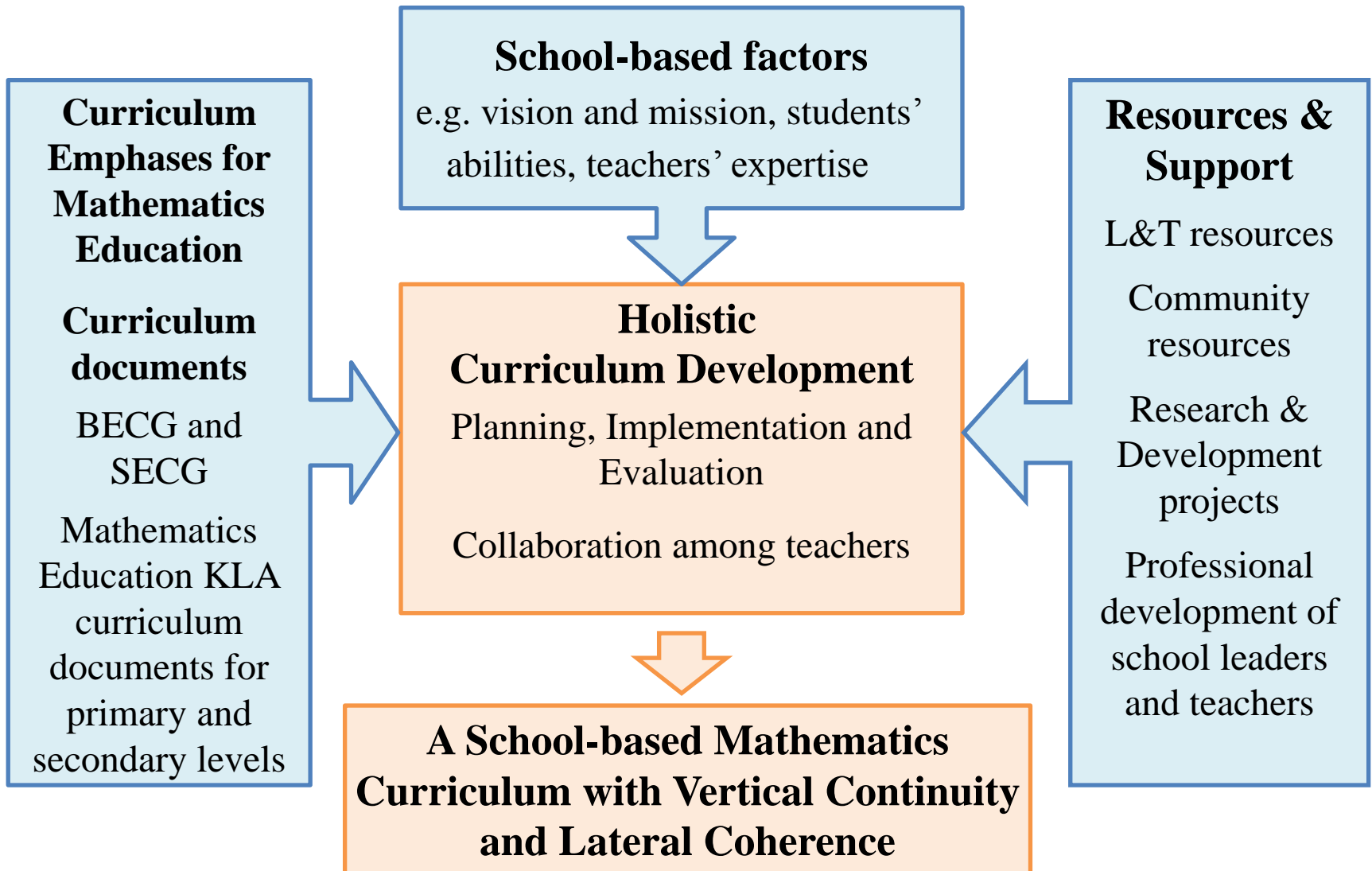
- ▶ **effective and ethical use of information**, e.g.
 - identify the need for information;
 - locate, evaluate, extract, organise and present information;
 - **create new ideas**;
 - cope with the dynamics in our information world; and
 - use information ethically and **refrain from immoral practices** such as cyber bullying and infringing intellectual property rights.

Other elements of the ongoing renewal of school curriculum

Information literacy

- ▶ Mathematics provides **authentic contexts** for students to apply the skills
 - ▶ Learning and teaching of topics on data handling and STEM-related project involve **data collection, organisation, analysis, interpretation and reporting**, which are essential skills related to information literacy
- 

Curriculum Planning



Assessment

- ▶ Assessment for different purposes
 - Assessment for learning
 - Assessment as learning
- ▶ Basic Competency Assessment (BCA)
- ▶ Learning Progression Framework (LPF)
 - provides a common scale and language for teachers to describe students' performance and progress in Mathematics learning
- ▶ Student Assessment Repository (STAR)

Assessment

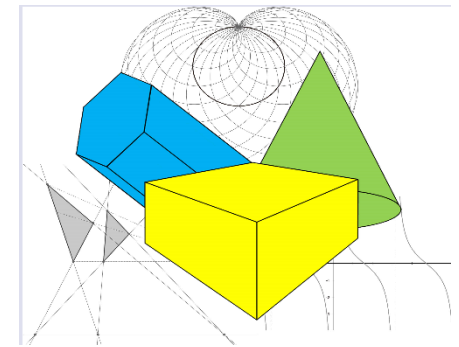
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- ▶ Student Assessment Repository (STAR)
 - an **online assessment bank** to enhance teachers' assessment literacy and improve students' learning by means of technology

Supporting Strategies : Learning and teaching resources

- ✓ Traditional L&T resources
- ✓ L&T resources on the web
 - One-stop Portal for Learning and Teaching Resources (www.hkedcity.net/edbosp)



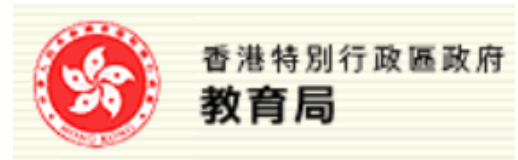
- Mathematics Education KLA (www.edb.gov.hk/cd/maths)



- ✓ Examples for key emphases

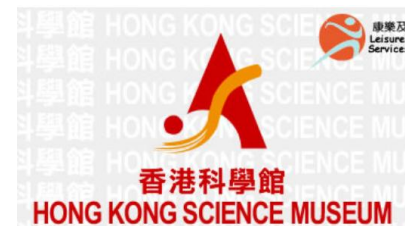
Supporting Strategies : Partnership

- ▶ School-based Curriculum Development Section
- ▶ Regional Education Offices
- ▶ Tertiary institutions and professional organisations



Supporting Strategies : Partnership

- ▶ STEM education



- ▶ Other government departments

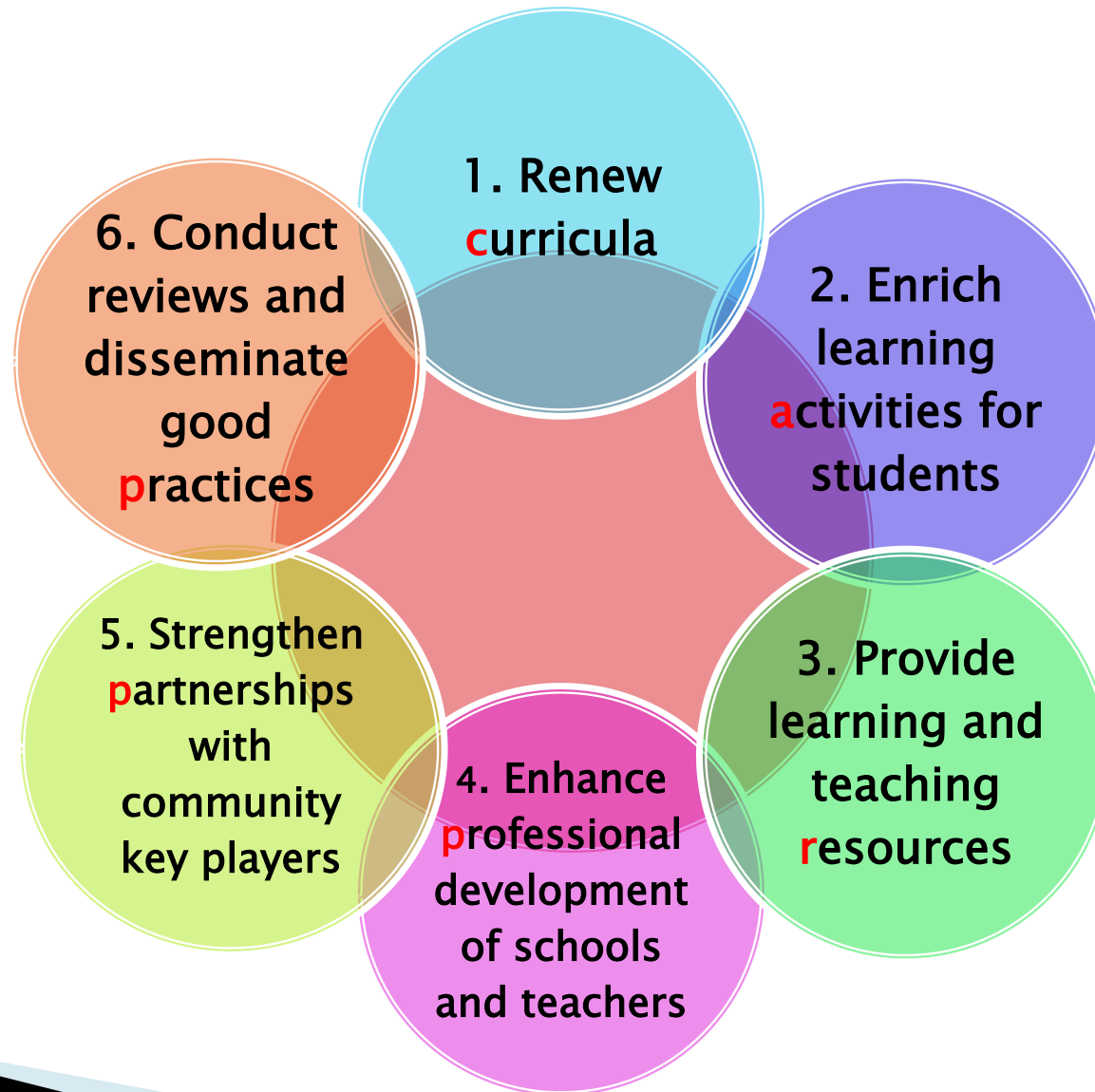


Supporting Strategies : Professional Development

- ▶ Support the ongoing curriculum renewal
 - Curriculum planning and learning and teaching strategies for promoting STEM
 - Effective use of e-resources
 - Generic skills
 - Values education
 - Catering for learner diversity



Strategies for promoting STEM Education



Supporting Strategies

- ▶ **Enrich learning activities for students**
 - learning activities with themes on **application of mathematics**, e.g. project learning on optimizing the nutrition of fast-food combos by using linear programming and information technology
- ▶ **Enhance professional development of schools and teachers**
 - Curriculum planning
 - Learning and teaching
 - Enriching knowledge

Frequently Asked Questions

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

- ▶ Focusing on STEM education and e-learning in **holistic curriculum planning** for, deepening Language across the Curriculum and sustaining the achievements of the curriculum reform
- ▶ Enriching learning and teaching activities, such as **project learning, mathematical modeling, problem-based learning and reading**

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

- ▶ **Effective use of lesson time** with infusion of STEM-related learning and teaching 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 available for schools?

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

Summary of Key Updates

- **Holistic curriculum review** for enhancing the progression across key stages and supports to other KLAs and subjects, and enhancing the learning and teaching of Data Handling
- Promoting **STEM education**
- Recommending the approaches of strengthening the ability to **integrate and apply knowledge and skills** within and across KLAs
- Updating other key emphases of ongoing curriculum renewal, such as **e-learning**, generic skills, values education, LaC and information literacy

Thank You!

