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

Mathematics Education
KLA Curriculum (Primary)

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 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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  - 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

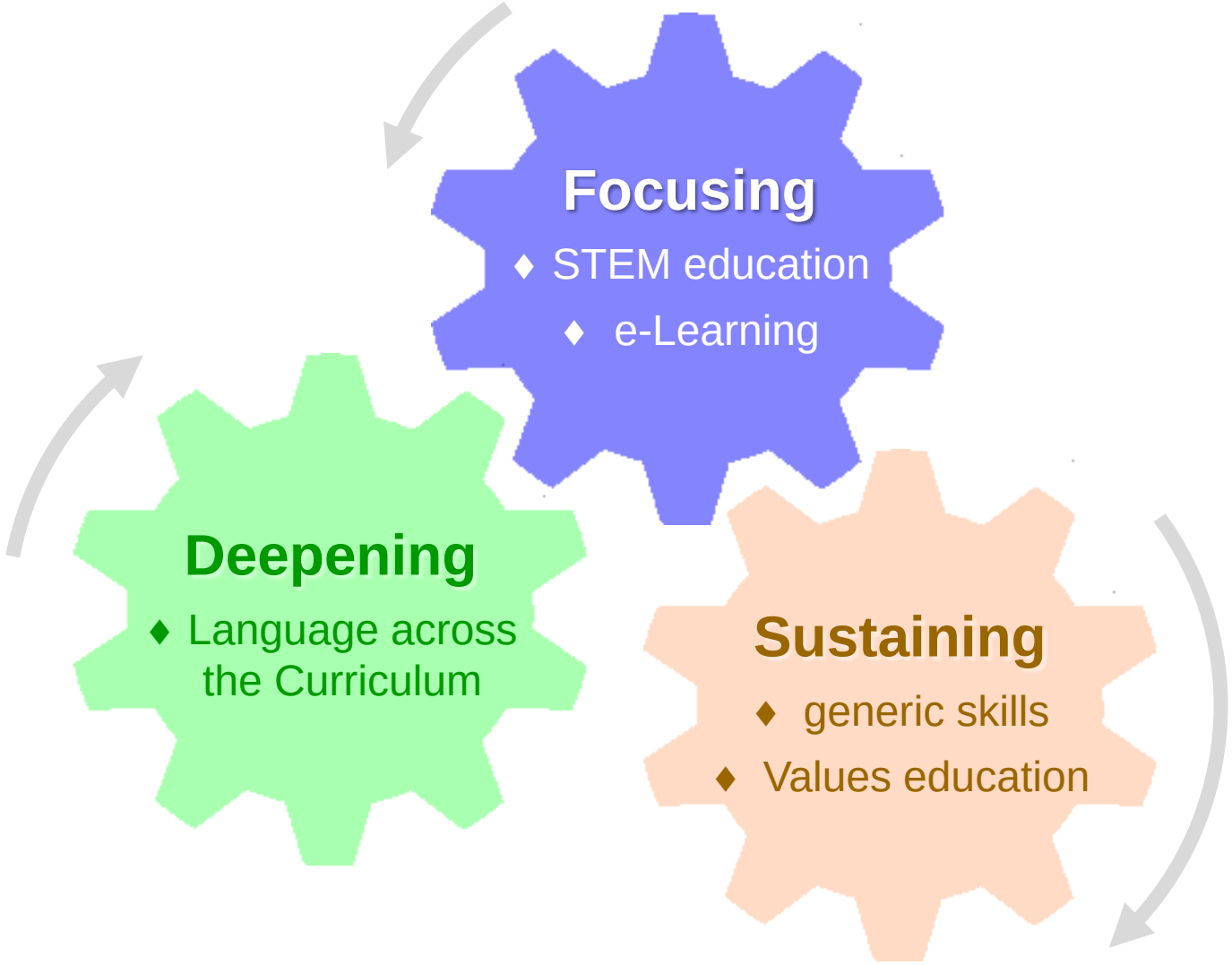
Ongoing curriculum renewal

- *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. 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

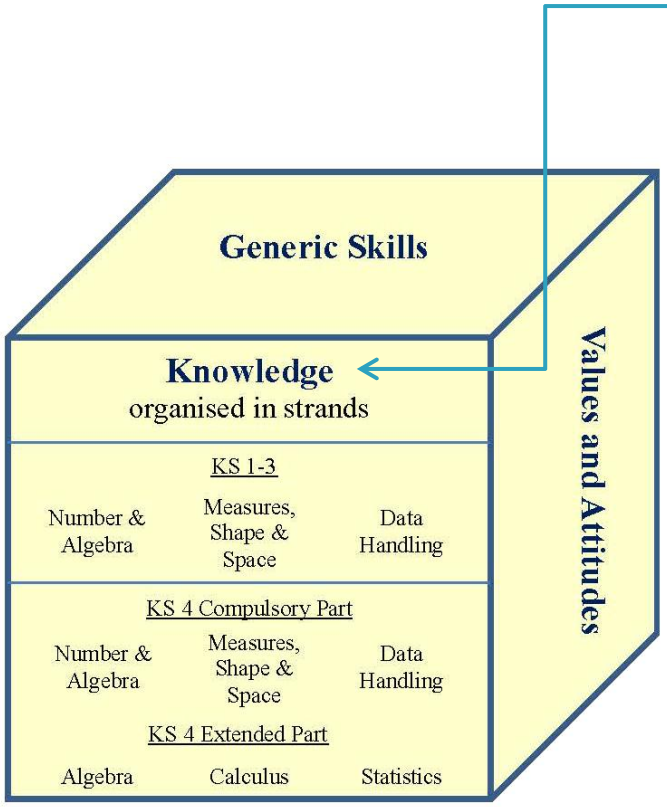
Updates in Mathematics: Aims

(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



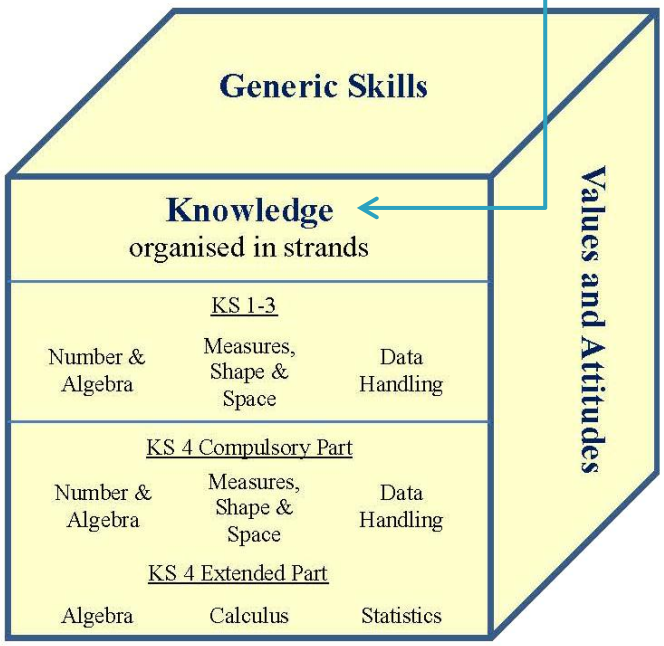
- The framework and content undergo multi-stage review
- Recommendations of the NAS Medium-term Review (June 2015) (Senior secondary):

– 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

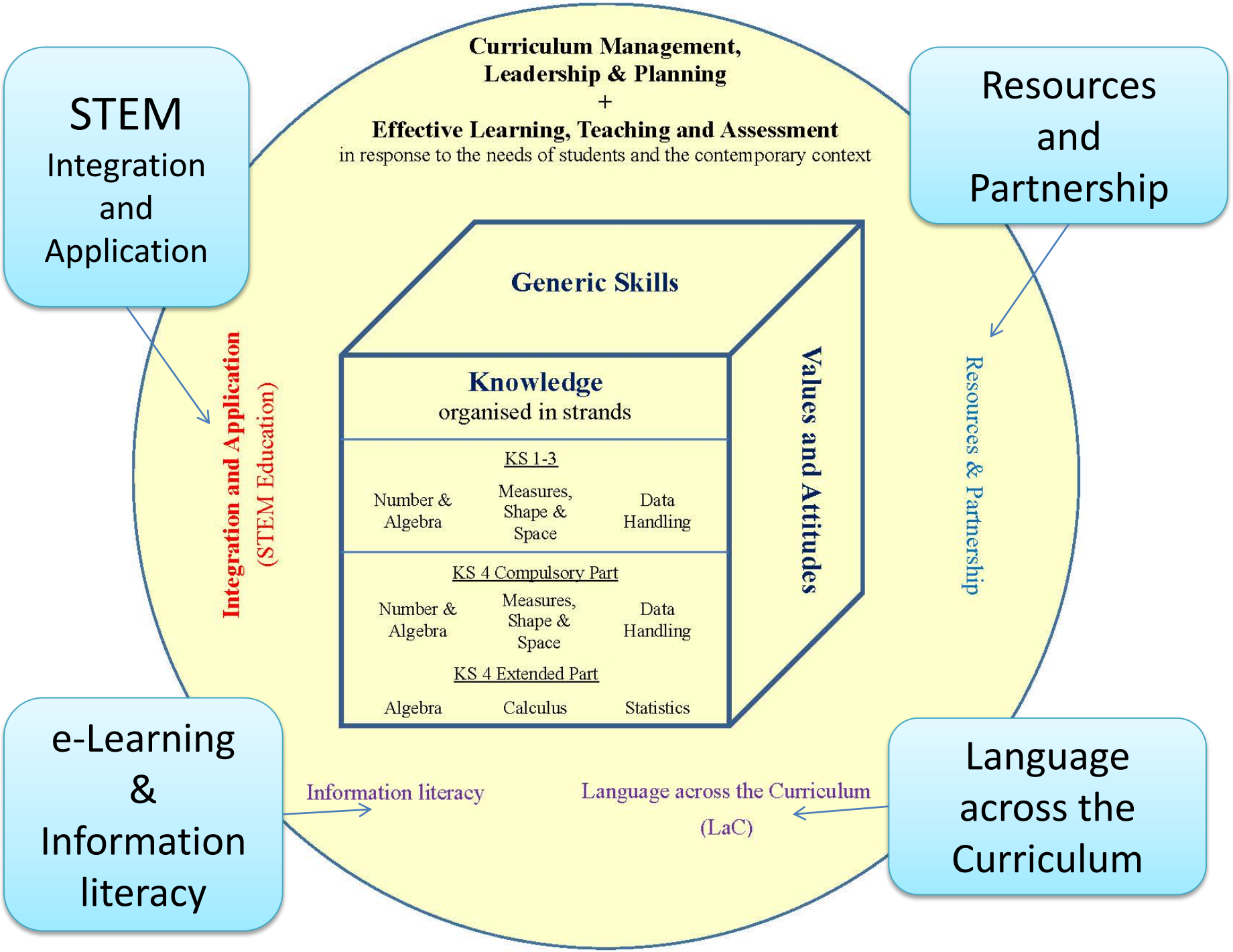
Updates in Mathematics

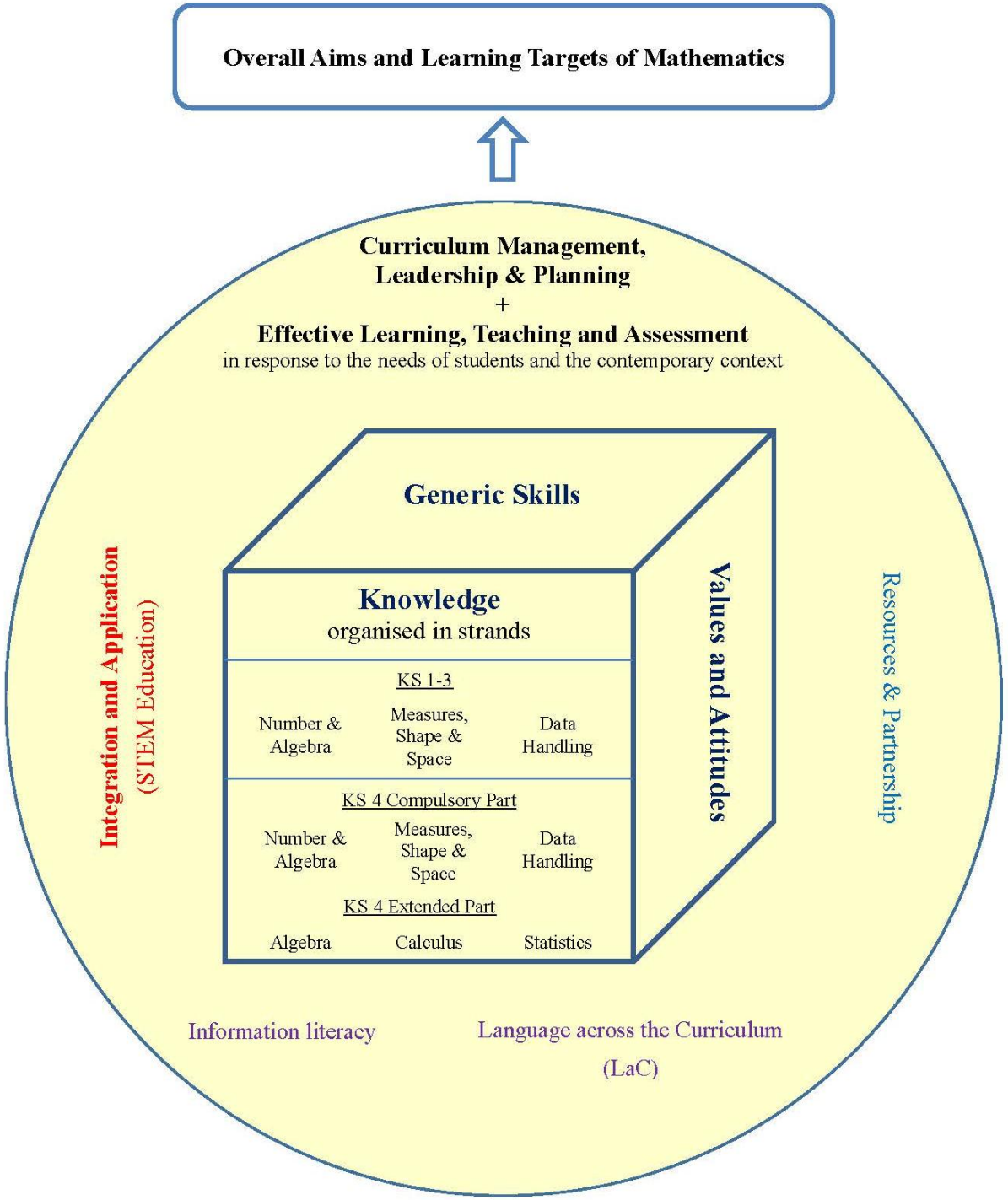


Holistic Review (P1–S6)

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


Curriculum Management, Leadership & Planning
+
Effective Learning, Teaching and Assessment
in response to the needs of students and the contemporary context
STEM Integration and Application
Resources and Partnership
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
Integration and Application
(STEM Education)
Resources & Partnership
e-Learning & Information literacy
Information literacy
Language across the Curriculum
(LaC)
Language across the Curriculum


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
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Values and Attitudes
Integration and Application
(STEM Education)
Resources & Partnership
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

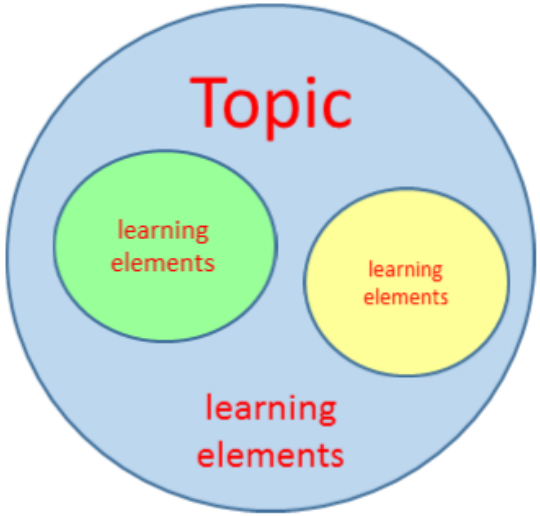
STEM education

Objectives:

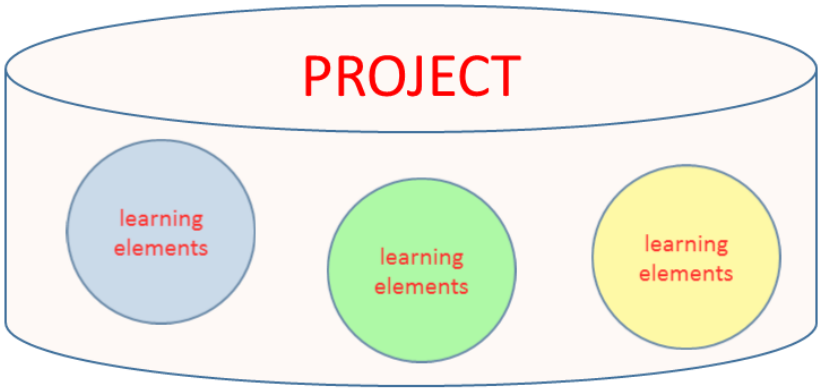
- To strengthen the professional capacity of and collaboration among teachers in schools and the partnerships with community stakeholders
- To nurture talents and develop experts in STEM areas so as to contribute to the development of Hong Kong and our nation

STEM education

- Approach One
  Learning activities based on topics of a KLA

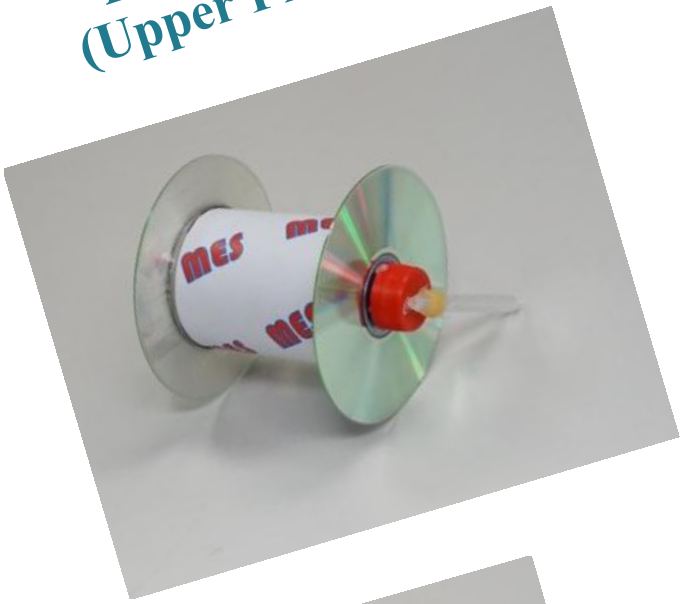


- Approach Two
  Projects integrating relevant learning elements of different KLAs



Example 1 : Topic approach (Upper Primary)

Rubber Band Powered Car



energy

Design and build models

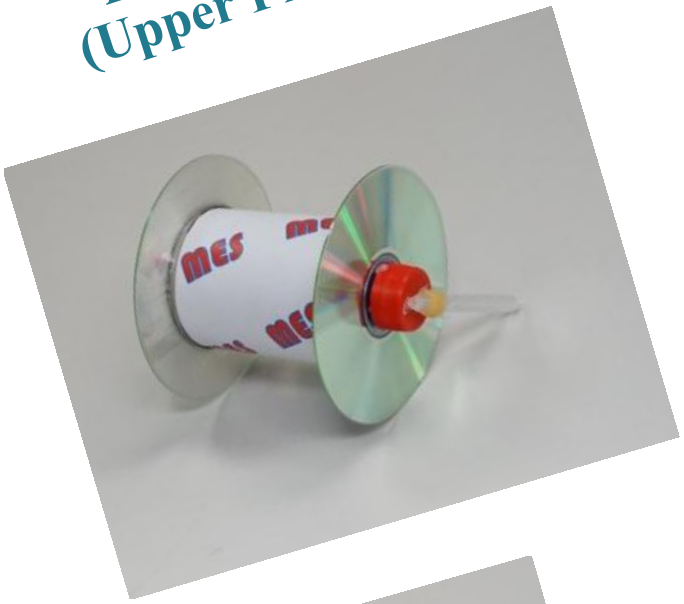
General Studies

Speed

Mathematics

Example 1 : Topic approach (Upper Primary)

Rubber Band Powered Car



Generic Skills:

- Communication Skills
- Problem-solving Skills
- Collaboration Skills

Example 2 : Project approach (Upper Primary)

Design a healthy diet menu for a school lunch box supplier

- Food hygiene and preservation
- Food and nutrition
- General Studies
- Mathematics
- Estimate and measure
- Collect and organise data
- Construct and discuss graphs

Example 2 : Project approach (Upper Primary)

Design a healthy diet menu for a school lunch box supplier

Generic Skills:

- Communication Skills
- Problem-solving Skills
- Collaboration Skills

e-Learning

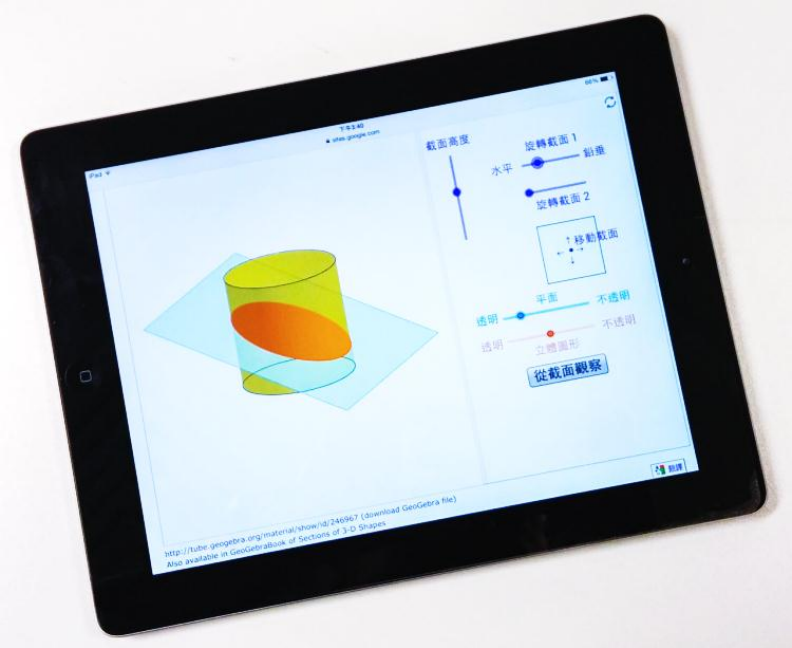
- Enhance learning and teaching effectiveness and develop students' necessary qualities for the 21st century
  - effective use of the IT environment (e.g. Wi-Fi infrastructure) to allow flexible use of e-resources, IT tools and mobile devices;
  - effective use of mathematics application software (e.g.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

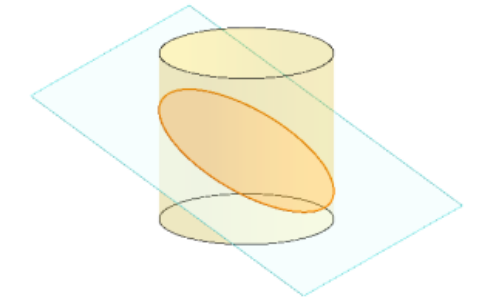
e-Learning

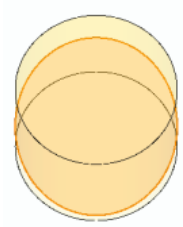
- Enhance learning and teaching effectiveness and develop students' necessary qualities for the 21st century
  - encouraging students to apply IT skills for inquiry and investigation (e.g. computation or graphing tools), presentation, critical thinking, information evaluation and knowledge management;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

Example: Sections of 3-D Shapes

Upper Primary







- Students discuss and suggest sections formed by different ways of cutting through observing models of 3-D shapes
- Students use dynamic geometry software to verify their answers

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;
  problem-based learning.

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

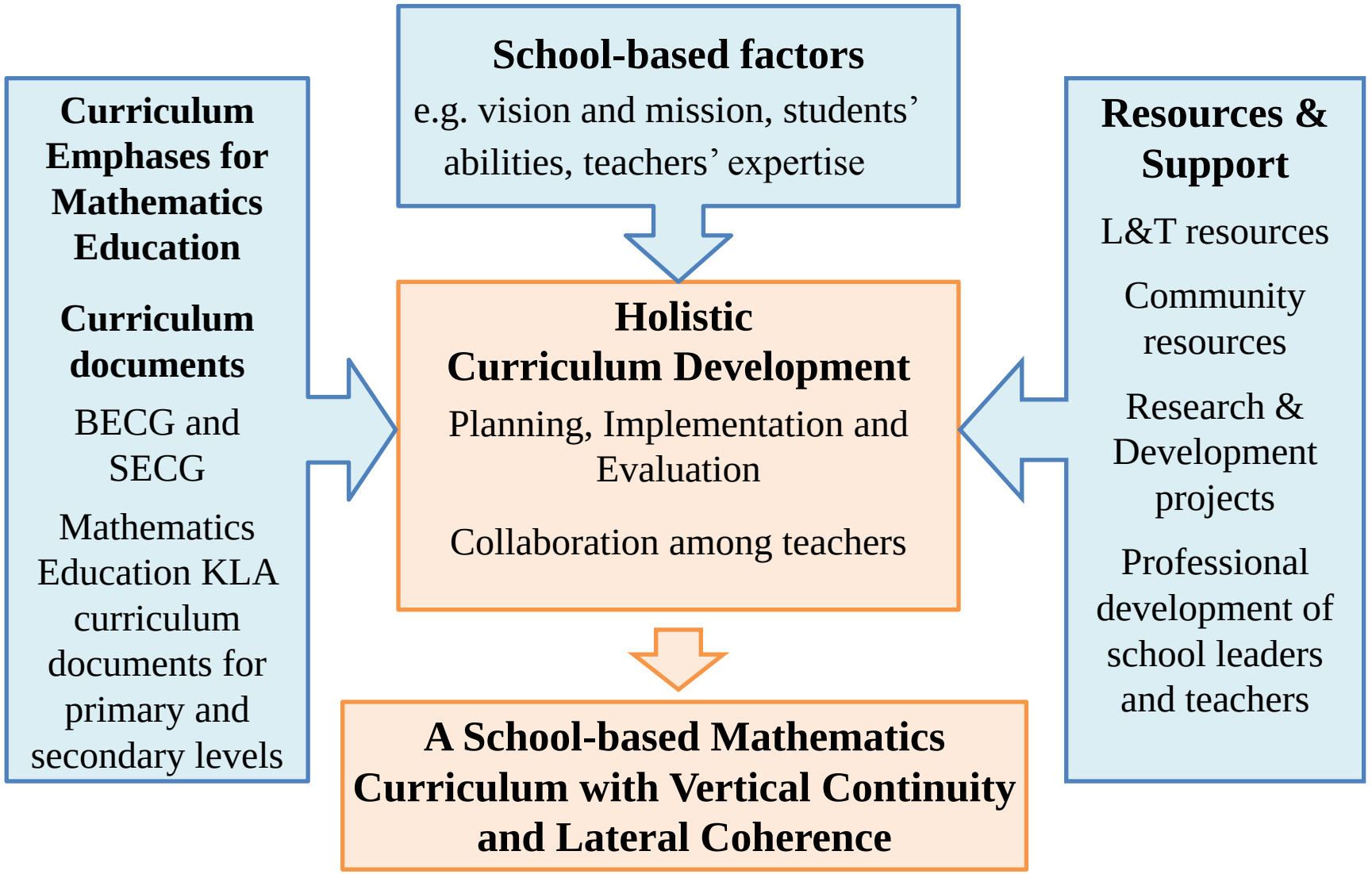
- effective and ethical use of information, e.g.
  - identify the need for information;
  - locate, evaluate, extract, organise and present information;
  - **create new ideas**;
  - cope with the dynamics in our information world; and
  - use information ethically and **refrain from immoral practices** 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)

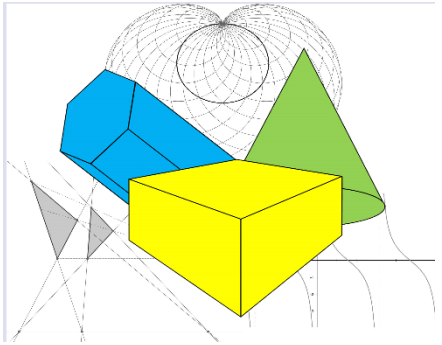
Assessment

- Assessment for different purposes
  - Assessment for learning
  - Assessment as learning
- Basic Competency Assessment (BCA)
- Learning Progression Framework (LPF)
- 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

香港特別行政區政府
教育局

- Tertiary institutions and professional organisations

Supporting Strategies : Partnership

- STEM education

HKSTP 香港科技園

SMS

香港科學館 HONG KONG SCIENCE MUSEUM

- Other government departments

政府統計處 Census and Statistics Department

漁農自然護理署 Agriculture, Fisheries and Conservation Department

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. using appropriate strategies to investigate and using suitable graphs to present temperature change in a day
- **Enhance professional development of schools and teachers**
  - Curriculum planning
  - Learning and teaching

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!