

# **Excellence Indicators for Teaching Practices for the Mathematics and Science Education Key Learning Areas**

## **Foreword**

The *Excellence Indicators for Teaching Practices for the Mathematics and Science Education Key Learning Areas* is worked out as a reference for the assessment of the Chief Executive's Award for Teaching Excellence (ATE) (2005-2006).

When drafting the indicators, reference has been made to various important sources, both local and overseas (Please refer to the Appendix attached). Among the major references are *Towards a Learning Profession: The Teacher Competencies Framework and the Continuing Professional Development of Teachers* (Advisory Committee on Teacher Education and Qualifications, 2003) and *Performance Indicators for Hong Kong Schools* (Education Department, Quality Assurance Division, 2002). Moreover, we have considered the complex nature of teachers' work and structured the Indicators to reflect the diverse patterns of teachers' competencies.

For this Award, teaching excellence means teaching practices that :

- (a) are **innovative** with **proven effectiveness** to arouse students' **motivation in the subject** and/or to help students achieve **desired learning outcomes**; or  
are **creatively adapted** from exemplary teaching practices from elsewhere to **suit the local (i.e. school-based and/or student-based) context** with **proven effectiveness** in enhancing students' learning outcomes;
- (b) are based on a **coherent conceptual framework**, showing **reflective practices**;
- (c) are **inspiring** and **can be shared** with colleagues to improve the quality of education; and
- (d) can develop students' ability and skills to solve problems and make inquiries in a **logical, creative, critical and mathematical/scientific way**; and appreciation of the wonders of Mathematics/Science.

The indicators are categorized into five domains, namely, (1) Professional Competence, (2) Student Development, (3) Commitment to the Profession and Community, (4) Professionalism and (5) School Development. The focus of the first two domains is on recognizing teaching excellence and the others are on fostering professional development. As the ATE does not aim to identify all-round teachers, the Indicators should be conceived as evidence, but not a rigid model, of excellence in the teaching of Mathematics and Science.

Apart from being an assessment instrument for the ATE, the indicators also highlight the qualities of accomplished Mathematics / Science teachers. We hope that this will help pursue excellence in the teaching profession.

All awardees are expected to possess the fundamental professional qualities of a teacher such as professionalism, as well as love and care for students. Recognising that teaching practices cannot be separated into discrete areas, we will adopt a holistic approach based on professional knowledge and judgment in assessing the nominations. However, as the focus of the ATE is on Learning and Teaching, we are looking for exemplary and effective teaching practices that are inspiring and can be shared.

For group nominations, effective team work which entails the contribution of each group member, the interactions among group members, and how the combined efforts of the group have contributed to the described outcomes will also be assessed.

**The Assessment Working Group  
Chief Executive's Award for Teaching Excellence (2005-2006)  
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# Excellence Indicators for Teaching Practices for the Mathematics and Science Education Key Learning Areas

## 1. Professional Competence Domain

Area	Performance Indicator	Evidence of Excellence
Curriculum	1.1 Curriculum Planning and Organization	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• demonstrate leadership in developing a coherent, systematic and flexible school-based curriculum framework which is well articulated across the levels for the effective learning of Mathematics/Science, and with appropriate adaptation to cater for learner differences/students with special educational needs</li> <li>• demonstrate leadership in formulating strategic curriculum development plans with clearly defined goals to facilitate students in the life-long learning of Mathematics/Science and whole-person development</li> <li>• take into account current emphases of the subject and demonstrate the ability to put them into practice</li> <li>• incorporate effectively the elements of the Four Key Tasks<sup>1</sup> into curriculum planning to develop students' generic skills<sup>2</sup>, values and attitudes, and to ensure students' broad and balanced development in Mathematics/Science education</li> <li>• integrate with other Key Learning Areas<sup>3</sup> to provide students with a holistic context for learning</li> <li>• introduce effectively new ideas and practices, based on contemporary education or learning theories, to enhance and promote the learning of Mathematics/Science</li> <li>• plan and organize diversified co-curricular activities to complement the formal Mathematics/Science curriculum and promote life-wide learning<sup>4</sup></li> <li>• plan and promote effectively the awareness of and concern for safety in practical work in the implementation of the Mathematics/Science curriculum</li> <li>• allocate effectively learning time to cater for students' learning needs, enrich their learning experiences,</li> </ul>

<sup>1</sup> According to *Learning to Learn -- the Life-long Learning and Whole-person Development* issued by the CDC in 2001, the Four Key Tasks are: moral and civic education, reading to learn, project learning and information technology for interactive learning.

<sup>2</sup> According to *Learning to Learn -- the Life-long Learning and Whole-person Development* issued by the CDC in 2001, the generic skills include: collaboration skills, communication skills, creativity, critical thinking skills, IT skills, numeracy skills, problem-solving skills, self-management skills and study skills.

<sup>3</sup> According to *Learning to Learn -- the Life-long Learning and Whole-person Development* issued by the CDC in 2001, the Key Learning Areas include: Chinese Language Education, English Language Education, Mathematics Education, Personal, Social & Humanities Education, Science Education, Technology Education, Arts Education, and Physical Education..

<sup>4</sup> According to *Learning to Learn -- the Life-long Learning and Whole-person Development* issued by the CDC in 2001, life-wide learning refers to learning in different environments: in the classroom, school, home, community and work place. The learning experiences gained in these different environments complement each other.

Area	Performance Indicator	Evidence of Excellence
		and allow a good use of facilities and resources
	1.2 Curriculum Management	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• participate actively in curriculum decisions and exchange ideas/practices on curriculum matters with members of the panel/school</li> <li>• communicate and collaborate effectively with stakeholders to promote the learning of Mathematics/Science</li> <li>• participate actively in the evaluation of curriculum implementation and conduct concrete follow-ups</li> <li>• record successful curriculum implementation and share with stakeholders</li> </ul>
Teaching	1.3 Strategies and Skills	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• set appropriate learning objectives for lessons in accordance with the Learning Targets of the Mathematics/Science subjects, organize and plan effectively the teaching work to ensure students' attainment of the Learning Targets</li> <li>• adopt a student-centred teaching strategy</li> <li>• attend to students' learning difficulties and misconceptions in lesson planning</li> <li>• use a variety of strategies to provide students with various learning experiences so as to help students construct their knowledge effectively</li> <li>• design learning activities that are related to the daily lives of students</li> <li>• adapt creatively innovative and effective teaching strategies that enhance students' interests and learning outcomes and promote the development of students' investigation and problem-solving skills</li> <li>• use effectively teaching resources in facilitating understanding of content and pursuing mathematical/scientific investigations</li> <li>• demonstrate good classroom performance skills</li> <li>• make good use of questioning and feedback techniques</li> </ul>

Area	Performance Indicator	Evidence of Excellence
	1.4 Professional Knowledge and Attitude	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• demonstrate the passion for Mathematics/Science and the teaching of the relevant subject</li> <li>• master the subject knowledge and skills</li> <li>• use effectively pedagogical content knowledge</li> <li>• be a reflective practitioner to strive for improvement</li> <li>• keep up-to-date with contemporary knowledge and skills</li> <li>• assume different roles of a teacher varying from a transmitter of knowledge to resource person, facilitator, consultant, counsellor, and assessor</li> <li>• show genuine care for students</li> <li>• build up trust and rapport with students</li> <li>• recognize and value students' achievement and potential</li> <li>• create a harmonious and open environment for learning</li> </ul>
Performance Assessment	1.5 Assessment Planning and Implementation	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• formulate or assist in formulating a policy on assessment according to the Mathematics/Science curriculum goals, school needs and the principle of striking a balance between “assessment for learning” and “assessment of learning”</li> <li>• prepare success criteria with reference to the specific learning outcomes to judge students’ performance and to evaluate the effectiveness of the learning and teaching strategies employed</li> <li>• devise a variety of assessments to nurture students’ learning and consolidate learning outcomes</li> <li>• communicate with stakeholders on the success criteria and assessment strategies in order to build mutual understanding of the achievement standards and ways to improve</li> <li>• provide students with opportunities for reflection through peer assessment and self-assessment</li> <li>• give timely and useful feedback with appropriate encouragement, and provide students with the direction for improvement</li> <li>• review regularly the various assessment modes and align them with the current curriculum objectives, to sum up timely effectiveness and inadequacies, and ensure early follow-ups</li> </ul>
	1.6 Use of Assessment Information	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• use systematically recorded assessment information to diagnose students’ learning and evaluate the effectiveness of teaching and learning strategies so as to strive for improvement</li> </ul>

## 2. Student Development Domain

Area	Performance Indicator	Evidence of Excellence
Student Development	2.1 Attitude	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• encourage students to develop upon their strengths, adopt a proactive attitude towards learning and pursue excellence</li> <li>• make positive influence on students in life-long learning, whole-person development and the development of generic skills</li> <li>• encourage students to respect each other, work in collaboration and share ideas</li> <li>• develop students' curiosity, interests, confidence and an inquiry attitude in learning Mathematics/Science</li> <li>• develop students' capability of appreciating the aesthetic nature and cultural aspects of Mathematics/Science</li> </ul>
	2.2 Knowledge & Skills	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• help students learn Mathematics/Science with understanding and actively construct new knowledge from experience and prior knowledge</li> <li>• help student overcome learning difficulties and correct misconceptions</li> <li>• develop students' ability and skills to solve problems and make inquiries in a logical, creative, critical and mathematical/scientific way</li> <li>• help students understand their own abilities, set targets for advancement and develop the capacity of self-learning</li> <li>• help students capitalize on their learning style to bring about effective learning</li> <li>• engage students intellectually with mathematical/scientific ideas</li> <li>• familiarize students' with the language of Mathematics/Science and equip them with the skills to communicate ideas in Mathematics/Science-related contexts</li> <li>• develop students' ability to manipulate numbers, symbols and other mathematical/scientific objects</li> <li>• develop students' ability to handle mathematical manipulatives/laboratory equipment effectively</li> <li>• develop students' number sense, spatial sense and a sense of measurement</li> <li>• develop students' ability to make informed judgment based on evidence</li> <li>• develop students' ability to recognize the usefulness and limitations of Mathematics/Science and the interconnections with technology and society</li> <li>• develop students' ability to apply their knowledge of Mathematics/Science to their daily life and in new situations</li> </ul>

### 3. Commitment to the Profession and Community Domain

Area	Performance Indicator	Evidence of Excellence
Commitment to the Profession and Community	3.1 Contribution towards the Profession and Community	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• provide active support to the teaching profession and the community, such as participation in and contribution to professional sharing activities, dissemination of good practices, and involvement in professional teacher association organizational work, community services or voluntary work</li> <li>• produce exemplary teaching materials, involve in or contribute to educational research, or contribute articles on teaching-related topics</li> <li>• provide mentorship for novice teachers</li> </ul>

### 4. Professionalism Domain

Area	Performance Indicator	Evidence of Excellence
Professionalism	4.1 Professional Development and Self-improvement	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• pursue continuing self-improvement and professional development</li> <li>• keep abreast of and be responsive to current development in Mathematics/Science, Mathematics/Science Education and education practices and policies</li> <li>• give support to other teachers and promote collaboration among teachers on teaching practices for continuing personal and professional development</li> <li>• set himself/herself as a role model</li> </ul>

## 5. School Development Domain

Area	Performance Indicator	Evidence of Excellence
School Development and Collaboration	5.1 Support to School Development	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• design school-based activities for Mathematics/Science Education</li> <li>• encourage students to actively participate in inter-school and public activities/competitions that are relevant to Mathematics/Science</li> <li>• contribute to school development within/beyond the Mathematics/Science scope in contexts of interest and relevance to the school</li> <li>• take the initiative to coordinate closely with colleagues across departments with a view to focusing energy on continuous school improvement</li> </ul>
	5.2 Collaboration with Stakeholders	<p>The teacher is able to :</p> <ul style="list-style-type: none"> <li>• inspire peers and colleagues to collaborate for improvement of learning and teaching</li> <li>• establish effective communication with stakeholders to support students' learning</li> </ul>



## REFERENCES

Advisory Committee on Teacher Education and Qualifications. (2003). *Towards a Learning Profession: The Teacher Competencies Framework and the Continuing Professional Development of Teachers*. Hong Kong: Government Logistics Department.

[http://www.emb.org.hk/EDNEWHP/teacher/cdp/English/Eng\\_Teacher/doc.htm](http://www.emb.org.hk/EDNEWHP/teacher/cdp/English/Eng_Teacher/doc.htm)

Australian Science Teachers Association (ASTA). (2002). *National Professional Standards for Highly Accomplished Teachers of Science*. Australia: ASTA and Monash University.

<http://www.asta.edu.au/freestyler/gui/files//professional%20standards.pdf>

Curriculum Development Council. (1991). *Syllabuses for Secondary Schools Mathematics and Statistics (Advanced Supplementary Level)*. Hong Kong: Printing Department.

<http://www.emb.gov.hk/index.aspx?nodeID=4903&langno=1>

Curriculum Development Council. (1992). *Syllabuses for Secondary Schools Applied Mathematics - Advanced Level*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/maths/en/curr\\_syll/AL\\_AppMath%20Syl\\_e/cover.htm](http://cd1.emb.hkedcity.net/cd/maths/en/curr_syll/AL_AppMath%20Syl_e/cover.htm)

Curriculum Development Council. (1998). *Syllabuses for Secondary Schools – Science (Secondary 1-3)*. Hong Kong: Printing Department.

[http://resources.emb.gov.hk/cd/science/en/syllabuses/science\\_s1-3/synopses/is\\_syll\\_e.zip](http://resources.emb.gov.hk/cd/science/en/syllabuses/science_s1-3/synopses/is_syll_e.zip)

Curriculum Development Council. (1998). *Syllabuses for Secondary Schools Applied Mathematics - Advanced Supplementary Level*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/maths/en/curr\\_syll/AS\\_AppMaths%20Syl\\_e/cover\\_e.htm](http://cd1.emb.hkedcity.net/cd/maths/en/curr_syll/AS_AppMaths%20Syl_e/cover_e.htm)

Curriculum Development Council. (1999). *Syllabuses for Secondary Schools – Mathematics: Secondary 1 - 5*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/maths/en/curr\\_syll/Sec%20MathSyll\(new\)\\_e/newsyll.htm](http://cd1.emb.hkedcity.net/cd/maths/en/curr_syll/Sec%20MathSyll(new)_e/newsyll.htm)

Curriculum Development Council. (2000). *Mathematics Education Key Learning Area – Mathematics Curriculum Guide (P1 – P6)*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/maths/en/curr\\_syll/Pri%20MathSyl\(new\)\\_e/Index%20pri%20math\\_e.htm](http://cd1.emb.hkedcity.net/cd/maths/en/curr_syll/Pri%20MathSyl(new)_e/Index%20pri%20math_e.htm)

Curriculum Development Council. (2001). *Learning to Learn – Life-long Learning and Whole-person Development*. Hong Kong: Printing Department.

<http://www.emb.gov.hk/index.aspx?langno=1&nodeID=4049>

Curriculum Development Council. (2001). *Mathematics Education Key Learning Area – Additional Mathematics Curriculum Guide (S4-S5)*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/maths/en/curr\\_syll/AMath\\_E/Math\\_e.htm](http://cd1.emb.hkedcity.net/cd/maths/en/curr_syll/AMath_E/Math_e.htm)

Curriculum Development Council. (2002). *General Studies for Primary Schools Curriculum Guide (Primary 1 – Primary 6)*. Hong Kong: Printing Department.

[http://cd.emb.gov.hk/kla\\_guide//GS\\_HTML/index.htm](http://cd.emb.gov.hk/kla_guide//GS_HTML/index.htm)

Curriculum Development Council. (2002). *Mathematics Education – Key Learning Area Curriculum Guide (Primary 1 – Secondary 3)*. Hong Kong: Printing Department.

[http://www.emb.gov.hk/FileManager/EN/Content\\_3120/Main.pdf](http://www.emb.gov.hk/FileManager/EN/Content_3120/Main.pdf)

Curriculum Development Council. (2002). *Science Education Key Learning Area – Biology Curriculum and Assessment Guide (Advanced Level)*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/science/en/syllabuses/biology/synopses/al-bio\\_e\\_2002.pdf](http://cd1.emb.hkedcity.net/cd/science/en/syllabuses/biology/synopses/al-bio_e_2002.pdf)

Curriculum Development Council. (2002). *Science Education Key Learning Area – Biology Curriculum Guide (Secondary 4-5)*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/science/en/syllabuses/biology/synopses/s4-5bio\\_e.pdf](http://cd1.emb.hkedcity.net/cd/science/en/syllabuses/biology/synopses/s4-5bio_e.pdf)

Curriculum Development Council. (2002). *Science Education – Key Learning Area Curriculum Guide (Primary1 – Secondary 3)*. Hong Kong: Printing Department.

[http://www.emb.gov.hk/FileManager/EN/Content\\_2855/sckla-e.pdf](http://www.emb.gov.hk/FileManager/EN/Content_2855/sckla-e.pdf)

Curriculum Development Council. (2002). *Science Education Key Learning Area – Chemistry Curriculum and Assessment Guide (Advanced Level)*. Hong Kong: Printing Department.

[http://www.emb.gov.hk/FileManager/EN/Content\\_2855/07-alchem-e.pdf](http://www.emb.gov.hk/FileManager/EN/Content_2855/07-alchem-e.pdf)

Curriculum Development Council. (2002). *Science Education Key Learning Area – Chemistry Curriculum and Assessment Guide (Advanced Supplementary Level)*. Hong Kong: Printing Department.

[http://www.emb.gov.hk/FileManager/EN/Content\\_2855/07-aslchem-e.pdf](http://www.emb.gov.hk/FileManager/EN/Content_2855/07-aslchem-e.pdf)

Curriculum Development Council. (2002). *Science Education Key Learning Area – Chemistry Curriculum Guide (Secondary 4-5)*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/science/en/syllabuses/chemistry/synopses/chem\\_2002e.pdf](http://cd1.emb.hkedcity.net/cd/science/en/syllabuses/chemistry/synopses/chem_2002e.pdf)

Curriculum Development Council. (2002). *Science Education Key Learning Area – Physics Curriculum and Assessment Guide (Advanced Level)*. Hong Kong: Printing Department.

[http://www.emb.gov.hk/FileManager/EN/Content\\_2855/al-2007e.pdf](http://www.emb.gov.hk/FileManager/EN/Content_2855/al-2007e.pdf)

Curriculum Development Council. (2002). *Science Education Key Learning Area – Physics Curriculum and Assessment Guide (Advanced Supplementary Level)*. Hong Kong: Printing Department.

[http://www.emb.gov.hk/FileManager/EN/Content\\_2855/as%202007e.pdf](http://www.emb.gov.hk/FileManager/EN/Content_2855/as%202007e.pdf)

Curriculum Development Council. (2002). *Science Education Key Learning Area – Physics Curriculum Guide (Secondary 4-5)*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/science/en/syllabuses/physics/synopses/phy\\_cg2002e.pdf](http://cd1.emb.hkedcity.net/cd/science/en/syllabuses/physics/synopses/phy_cg2002e.pdf)

Curriculum Development Council. (2004). *Mathematics Education Key Learning Area – Pure Mathematics Curriculum and Assessment Guide (Advanced Level)*. Hong Kong: Printing Department.

[http://cd1.emb.hkedcity.net/cd/maths/en/curr\\_syll/puremaths\\_currassguide\\_e/cover\\_e.htm](http://cd1.emb.hkedcity.net/cd/maths/en/curr_syll/puremaths_currassguide_e/cover_e.htm)

Education and Manpower Bureau. (2005). *Chief Executive Award for Teaching Excellence (2005-2006): Nomination Guidelines and Form*. Hong Kong: Education and Manpower Bureau, and Quality Education Fund.

[http://qef.org.hk/ate/english/docs/form\\_e.pdf](http://qef.org.hk/ate/english/docs/form_e.pdf)

Education Department, Quality Assurance Division. (2002). *Performance Indicators for Hong Kong Schools: Evidence of Performance (For Secondary, Primary and Special Schools)*.

<http://www.emb.gov.hk/index.aspx?nodeid=670&langno=1>

Fenwick, G. (1992). *Your School Experience Supervision*. London: New Education Press.

National Academy of Sciences. (2005). *National Science Education Standards*. Washington, D. C.: National Academy Press.

<http://www.nap.edu/catalog/4962.html>

National Council of Teachers of Mathematics. (2000). *Executive Summary: Principles and Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics.

[http://www.nctm.org/standards/12752\\_exec\\_pssm.pdf](http://www.nctm.org/standards/12752_exec_pssm.pdf)

National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics.

National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics: An Overview*. Reston, VA: National Council of Teachers of Mathematics.

National Science Foundation Directorate for Education and Human Resources, Division of Elementary, Secondary, and Informal Education. (2005). *Presidential Awards for Excellence in Mathematics & Science Teaching – 2006 Application Packet*. U.S.A.: National Science Foundation.

<http://www.paemst.org/applicationselection.cfm>

Ofsted (Office for Standards in Education). (2005). *Every Child Matters: Framework for the Inspection of Schools in England from September 2005*.

<http://www.ofsted.gov.uk/publications/index.cfm?fuseaction=pubs.displayfile&id=3861&type=doc>

Selkirk, K. (1984). *Teaching Mathematics*. Hong Kong: Macmillan Education.

Stimpson, P., Lopez-Real, F., Bunton, D., Chan, D. W. K., Sivan, A., Williams, M. (2000). *Better Supervision, Better Teaching: A Handbook for Teaching Practice Supervisors*. Hong Kong: Hong Kong University Press.

The Australian Association of Mathematics Teachers. (2002). *Standards for Excellence in Teaching Mathematics in Australian Schools*. Adelaide, South Australia: The Australian Association of Mathematics Teachers.

<http://www.aamt.edu.au/standards/standxtm.pdf>