The Southeast Asia Regional Standards for Science Teachers (SEARS-ST) Project

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Chapter 1

Introduction to the Southeast Asia Regional Standards for Science Teachers (SEARS-ST) Project

Overview and Goal

Teachers and their development of teaching must be at the heart of any plan to improve educational systems. Hence, a framework and standards to support and improve the quality of science teachers is important for enhancing the standard of science education. *Standards* are statements of expectations of what the teachers should know and be able to do.

The goal of the Southeast Asia Regional Standards for Science Teachers (SEARS-ST) is to document a set of standards that describes the qualities, skills and attributes that science teachers in the SEAMEO region should attain. The formulation of SEARS-ST is an effort towards improvement in science education in Southeast Asia.

The SEARS-ST outlines statements about science teachers' professionalism specifically the characteristics and attributes of science teachers which are important to the Southeast Asian region.

This document contains four main 'Dimensions' that are articulated and formally outlined as a set of comprehensive 'Elements' essential for all science teachers. The intention is that these will be further elaborated through country specific 'Descriptors' by respective educators in the SEAMEO Member Countries. The SEARS-ST could also be further adapted by countries to suit their particular needs or contexts.

The Purpose

The central purpose of SEARS-ST is to set the standard that all science teachers should acquire to improve the quality of teaching and learning.

The SEARS-ST serves as a guide in the following ways:

1. To assist science teachers' own personal growth and professional development.
2. To aid the preparation of teacher education programmes for both pre-service and in-service teachers.
3. To provide benchmarks and aspirational goals for relevant educational agencies in formulating policies to improve the quality of science teachers and science teaching.

Definition of Key Terms

The ***Dimensions*** represent the main areas of teacher quality. These are an overarching structure to the standards. While they bring focus to the main areas of teacher quality to be discussed separately, they are not mutually exclusive, as some aspects of quality teaching may involve more than one dimension.

The ***Components*** are sub-categories or units that help to describe the dimensions. They articulate what teachers are expected to know and do. These 'components' and their

respective ‘elements’ are based on previous work and analysis of existing evidence and contemporary practice by teachers throughout the SEAMEO region.

The ***Elements*** are sub-categories of knowledge and skills specific to each component. The elements further break down the components into more specific aspects of the contemporary practice by teachers or educators and provide an opportunity for evaluators to offer detailed feedback that serves as a roadmap for improvement. Their development includes a synthesis of the descriptions of teachers’ knowledge, practice, professional engagement and desirable qualities.

The ***Descriptors*** provide greater specificity in terms of how Elements could be applied within local cultural and educational contexts of SEAMEO countries. Each SEAMEO country may construct their own descriptors which will articulate how the standards and indicators are operationalised in their respective countries.

Chapter 2

The Methodology of Development Processes

Implementation Procedure and Methodology

The implementation procedure for the development of SEARS-ST involved mainly participatory inquiry approach supported by Blended Learning (BL). Various documents related to professional standards for teachers were also referred, including AITSL (2014), Bahagian Pendidikan Guru (2011), Ministry of Education (2012), NSTA (2016), SEAMEO (2015), SEAMEO INNOTECH (2010), to name a few.

The drafting of SEARS-ST document was done through a series of planning meetings and development workshops as outlined below. One of the purposes of these events was to draw on insights that could benefit other SEAMEO Member Countries that may want to formulate their own local descriptors. These insights were captured through the interactive discussions that occurred among participants during the SEARS-ST workshops as well as the second colloquium that was supported by blended learning tools available in the Internet.

Schedule of Development Activities

The first SEARS-ST workshop was conducted from 20–22 January 2014 with input by consultants from United Kingdom (UK) and New Zealand (NZ) as well as experts or specialists from Indonesia, Malaysia, Philippines and Thailand. The outcome was a SEARS-ST draft. The second SEARS-ST workshop was held from 16–18 June 2014 with input by consultants from UK and NZ as well as country experts and specialists from 8 SEAMEO Member Countries (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Vietnam). SEARS-ST is targeted to be produced and endorsed at the SEAMEO High Officials Meeting (HOM) in November 2014 as an official documentation that addresses Science Teachers Standards that is encouraged to be adopted in the 11 SEAMEO Countries.

Guiding Questions Used for the Preparation of Report Presented by Country Delegates

Prior to the actual day of the regional workshops, the delegates or experts from the 11 SEAMEO Member Countries were asked advance questions for a rich and meaningful discussion such as the following:

(1) How is the quality of science teachers and science teaching evaluated in your country? Please enclose official documents (if any).

(2) To what extent is SEARS-ST useful in your own context? How would you use this SEARS-ST in your country?

(3) Which components are important for the development of science teacher quality in your country? Please suggest any 'local descriptor' in your context with reference to SEARS-ST.

(4) Are there any areas that you think the SEARS-ST document has not been addressed in sufficient details? Please identify the components of SEARS-ST that need further

improvement. You are advised to consult your colleagues regarding the aforementioned aspects.

The first draft of the SEARS-ST that was developed at the first workshop was reviewed and deliberated in detail during the second workshop, with each Country Expert providing in-depth feedback based on the context of their respective countries after their presentation of country reports (as elaborated in the subsequent Chapters 3 to 10). The SEARS-ST document was then revised to better reflect the context of the SEAMEO region. The completed SEARS-ST document is presented in Chapter 11.

Chapter 3
Brunei Darussalam Country Report
Quality of Science Teachers in Brunei Darussalam

by

Mr. Shamsulbahri Muhammad, Senior Education Officer, Department of Curriculum Development, MOE Brunei Darussalam

Mr. See Sin Tiong, Specialist Inspector, Department of Schools Inspectorate, MOE Brunei Darussalam

The Department of Schools Inspectorate, Ministry of Education is responsible for evaluation of schools and centres for education. The roles and functions of Schools Inspectorate Department are as follows:

- Evaluator & Monitor: to evaluate and monitor the quality of education.
- Provide Reports: to report on the latest status on quality and standard of education observed.
- Quality Assuror: to develop internationally benchmarked evaluation procedures and criteria to meet Ministry of Education's standard, and use these in evaluating schools.
- Strategic Partner: to provide strategic partnerships between Schools' Inspectorate, schools and other stakeholders, which focus on raising schools' effectiveness and improvement.
- Advisor: to advise, facilitate and disseminate best practices through observation, professional development and research, etc.

The general Lesson Observation Form contains the following aspects (Table 1 to 3).

Table 1
Teaching Focus

1	Professional Teaching Practices
	1.1 Planning and preparation
	a) Lesson plans are complete with learning objectives, teaching strategies and assessment methods. These are aligned with the current syllabus and scheme of work.
	b) The teacher follows the school's policy on assessment.
	1.2 Classroom management
	a) Classroom routine and procedures are well structured and established.
	b) Teacher's rapport with students is good.
	1.3 Time management
	a) The teacher is punctual to class.
	b) Teacher utilises lesson time effectively.
	1.4 Learning and Teaching Resources
	a) Use of whiteboard is neat and well-organised.

	b) The teacher regularly uses a variety of appropriate resources to support effective learning objectives.
	1.5 Pedagogy Practice
	a) Teaching methods are innovative and imaginative, creating a high level of student motivation and interest.
	b) The questioning techniques and types of questions used by the teacher facilitates a good understanding and thinking skills by students to promote learning.
	c) Teaching is student-centred. A variety of strategies are used to match students' needs and abilities.
	d) The teacher has a broad knowledge of the subject content.
	e) Teacher's communication is clear and effective (audible, intonation and gestures).

Table 2
Learning Focus

2	Learning Quality
	2.1 Students' Learning Experience
	Students are motivated and show good levels of interest to learn.
	2.2 Students' Self Efficiency
	Students show initiative and confidence in doing the given tasks.
	2.3 Students' Engagement
	Students are active and eager to participate in the learning activities.
	2.4 Students' Knowledge and Skills
	a) Students are able to apply acquired knowledge and skills to various fields of studies.
	b) Practice of MIB values by students is clearly visible.
	c) Students use appropriate resources independently to complete their assignments and show creativity in their work.
	2.5 Students' ICT Skills
	Students are competent in using ICT for learning and produce good work independently.
	2.6 Students' Work Quality
	a) The students produce quality work which meets the requirements of some of the learning objectives.
	b) Students use correct oral language with clear pronunciation and intonation. They write well with correct grammar (according to their level or age-group).

Table 3
Students' Learning Outcomes

3	Assessment of Students' work
	There is good overall school-based assessment attainment and there is evidence the teacher employs SBAfL principles.
	Formative assessment strategies are clearly evident and supplement summative assessment.

	The students' written work is marked regularly and conscientiously, highlighting strengths and weaknesses.
	Adequate classwork is set to identify the type of remedial help required to enhance learning.
	An adequate amount of homework is set and marked.
	Students' corrections are checked and monitored.
	Students receive verbal and written comments on the quality of their work.
	The student's progress is recorded and monitored consistently to provide an overview of student's achievement.
	Students produce quality work.
	Students are acquiring the ability to write accurately and fluently.

I. How is the quality of science teachers and science teaching evaluated in your country? --

1. Qualifications, teaching experience, subject specializations.
2. Experiences in teaching.
3. Subject specialization and content knowledge (e.g. Physics/Chemistry/Biology/ General Science, etc.).
4. Pedagogy skills.
5. Students' learning quality.
6. Students' academic performance (school based assessment and external examination).
7. Teachers' participation and achievement in any school extra-curricular activities.

II. Could you identify the aspects of quality science teaching that require further exploration and support?

The following are aspects of quality of science teaching which require further exploration and support identified by 4 Science Specialist Inspectors from the Department of Schools Inspectorate, Ministry of Education, Brunei Darussalam. These are based on lesson observations, written work, examination, teacher dialogues, interviews and one-to-one teacher-inspector feedback/discussion sessions:

i) Pedagogy skills particularly effective science learning through "inquiry-based approach" (e.g. Group work / communication / design experiments / questioning skills / high order thinking skills, etc.)
ii) Assessment techniques and skills need further exploration (e.g. formative assessment strategy, diagnostic assessment techniques and skills, differentiated assessment strategy and designing differentiated assessment tasks).
iii) Formative assessment practices are generally lacking in science classroom, this may due to teacher lacking in verbal questioning skills.
iv) Some teachers' lacking in English and Science language proficiency.
v) Teacher self-reflection is not yet a culture in most science teaching practices.
vi) Effective use of ICT for learning and developing students' research skills and independent learning etc.

From the Curriculum Development Department's perspective, aspects of quality science teaching that require further exploration and support are as follows:

i) Teachers' knowledge of Science

Teachers need to have a comprehensive worldview of Science as it affects their attitudes towards Science. Having a deep understanding of the nature of science and seeing its interconnectedness with other disciplines is crucial as this has a direct impact on how their students will be taught.

ii) Implementing science inquiry-oriented lessons 'effectively'

A majority of our primary and secondary teachers still need to learn to adopt scientific inquiry approaches effectively in the classroom. This includes designing activities that are student-centred allowing room for constructive interaction among students, proper time and class management.

iii) Adopting Assessment for Learning (AfL) classroom practice

Years 4, 5 and 6 science teachers have undergone AfL in-service training workshops since last year. The concept of AfL along with its AfL approaches are still new to them. Teachers need more time to explore the different AfL strategies, learn to vary the different assessment tools and adopt it within the context of their classroom.

The concept of AfL has been emphasised to the secondary science teachers in 2010. This year, small group training under the AfL Enrichment Training Programme which focuses on AfL classroom implementation is carried out. At present, they are in the process of learning to embed AfL practice 'effectively' in their classroom.

Another aspect of science assessment to explore would be getting teachers to design valid and reliable assessment tools to promote student learning.

iv) Teachers as researchers

There is a need for science teachers to be autonomous in enhancing quality teaching as part of their professional development. Science teachers need to take on the role of a researcher and inculcate the practice of conducting action research in the classroom. Findings to promote students' learning in science can then be shared via peer coaching/reflective practice within school and among schools.

III. Brunei Teachers' Standards (BTS)

The Ministry of Education is currently developing the Brunei Teachers' Standards (BTS) aimed to improve the quality of primary and secondary education including technical education and to ensure that all teachers are fully certified and qualified to teach in government and non-government schools and higher institutions. The BTS is formulated in response to His Majesty's 'Titah' (speech) and to uphold the continuous efforts of the Ministry of Education in providing quality education.

At present, the Department of School Inspectorate, with the collaboration of the Department of Schools and Human Resource Development Section have enlisted expertise / consultant to prepare a framework and instruments for BTS. The outcomes of the implementation of BTS will produce qualified assessors and all teachers in Brunei Darussalam will be benchmarked according to international standards.

Chapter 4
Cambodia Country Report

The Quality of Science Teacher Evaluation in the Kingdom of Cambodia

by Mr. Mam Chansean, Biology Trainer of National Institute of Education (MoEYS)

I. Introduction

The Kingdom of Cambodia shares the border with Vietnam, Laos, and Thailand. Education in Cambodia was highly developed during the 1950s and 1960s. However, the education became worse and worse since 1970s because the country experienced a long civil war. The worst period for the education was between 1975 and 1979 when the education system in the whole country was destroyed; nearly all educated people were killed and died because of starvation and hard work during that period of the **Pol Pot** regime. After the nightmare regime was defeated in January 1979, the education system was rebuilt and developed gradually with very limited human and material resources. The Ministry of Education as well as the Government decided to rebuild the education system by "the first learner teaches late learner" and "the person has more knowledge teaches the person has less knowledge." However, the Government has tried its best to develop the quality of teachers and improve the teacher selection method.

At the present, Cambodia has specific criteria for recruiting teachers at different levels such as the following:

(1) *Pre-school teachers*: The candidates applying for pre-school teacher must at least finish 12^{th} grade. After they passed the entrance exam, they study in a pre-school teacher training college for 2 years including practicum.
(2) *Primary school teachers*: The candidates applying for primary school teacher must finish12^{th} grade and have to receive training for 2 years in Provincial Teacher Training Colleagues (PTTCs) after passing the entrance exam.
(3) *Lower secondary school teachers*: In order to be a lower secondary school teacher, the candidates must hold at least Upper Secondary School Certificate and have to study in Regional Teacher Training Centres (RTTCs) for 2 years including practicum after passing the entranced exam.
(4) *Upper secondary school teachers*: There is only one institute which produces upper secondary school teachers, i.e. National Institute of Education (NIE). The applicants must hold at least a bachelor's degree in order to apply for the entrance exam to study in NIE for one year including the practicum.

All trainees are evaluated by two evaluators, a homeroom teacher in the practicum school and the trainer from the teacher training institution. Both evaluators observe the trainee's teaching in their classroom.

II. Quality of science teachers and science teaching evaluation

1. Trainee Evaluation

The evaluation criteria for evaluating trainees in their practicum are set formally by the Ministry of Education Youth and Sport (MoEYS) and there is no difference between social science and science. The trainees are evaluated based on their preparation for their teaching

such as lesson plan, teaching materials and their activities during teaching. The evaluation criteria for evaluating trainees in NIE are formally set as the following:

1. ***Lesson Plan***: In the lesson plan the evaluators must evaluate on (1) Lesson objective determination, (2) Lesson content determination, (3) Teaching period determination, (4) Teaching materials selection, (5) Order of student and teacher activities, and (6) The lesson plan arrangement.
2. ***Teaching and Learning Processes***: The evaluators observe on (1) Previous lesson review, (2) Showing lesson objective to students in advance, (3) Students' activities and teacher's activities, (4) Encourage students' thinking, (5) Time management in teaching, (6) Student encouragement, (7) Teacher's feedback to correct students' misunderstanding, (8) Teacher's behavior during teaching, (9) Ending lesson, and (10) Lesson objective achievement.
3. ***Class management***: The evaluators observe the trainees (teachers) on (1) The interaction from teacher to students, (2) The interaction from students to teacher, (3) The communication between students, (4) Students' individual or/and group work, (5) The arrangement of tables, chairs, and other materials in the classroom, (6) The control of discipline and hygiene in the classroom, (7) The use of administrative books and others, and (8) The management of activities in school.
4. ***Professional work motivation***: The evaluators observe the trainee's performance on the following: (1) The trainee's responsibilities to their work such as preparing lesson in advance before teaching, (2) Make and keep relationship between school administrators, students' parents, and community, (3) Treat students equally, value students' work, and provide the value for individual student, and (4) Research for strengthening their own capacities, self-evaluation, and accept feedback in order to improve the performance.

Even though the evaluation rubrics are the same for social science and science teaching, the activities in *teaching and learning process* is different from each other. In science teaching, teacher prepares activities for students to acquire the knowledge by themselves through discussion or through experiments. Inquiry-based learning is emphasised in science teaching in NIE.

2. Science Teacher Evaluation

Science teachers are evaluated by their principal, provincial inspectors, and national level inspectors from MoEYS. The evaluation tools are also the same for social science and science, and the provincial level inspectors generally adapt the tools prepared by the inspectors at national level.

2.1 Inspection Processes

The inspection processes are divided into three stages: (1) *Before inspection*: the inspectors are required to inform school in advance about the date and the time of inspection, (2) *During inspection*: inspectors are required to follow the regulations such as sitting behind the students in good position in order to observe the class properly, avoiding disturbing the students, avoiding criticising the teacher during teaching, recording good points and improvement points in teaching and learning, and providing feedback to the teacher after class observation, and (3) *After inspection*: inspectors are required to write a report to provincial office of education and MoEYS.

2.2 Evaluation criteria

The tool for class observation in secondary school inspection includes the following criteria:

1. ***Lesson plan***: Inspectors check on (1) Lesson plan book, (2) Lesson objective, (3) Lesson content, (4) Teaching period, and (5) Teaching materials.
2. ***Teaching processes***: Inspectors observe on (1) Student- centered approaches implementation, (2) Lesson review, (3) Teacher's activities, (4) Students' activities, (5) Brainstorm questions, use of materials , (6) Objective achievement, (7) Students' record, (8) Lesson end, (9) Time allocation, (10) Curriculum implementation, (11) Students' handbooks, (12) Number of reference books, (13) Teacher's behavior, and (14) Students' behavior.
3. ***Class management***: Inspectors observe on (1) Class decoration, (2) Various exhibition documents, (3) Class hygiene, (4) Table arrangement, and (5) Furniture.
4. ***Class administration***: Inspectors observe on (1) Attendance lists, (2) Score record list, and (3) Lesson record lists.
5. ***Teacher administration***: Inspectors observe on (1) Administrative books, (2) Score record book, and (3) Technical meeting book.
6. ***Conclusion***: Inspectors provide common evaluation ideas and the improvement points.

Lesson plan preparation and teaching processes are the main criteria to evaluate the quality of teacher and their teaching. In teaching processes, inspectors mainly focus on teacher's implementation on 5 steps in their teaching: class administration, lesson review, daily lesson, lesson evaluation, and homework and the inspectors also emphasise on student-centered approaches implementation.

3. Science Teacher Evaluation by STEPSAM2

Secondary School Teacher Education Project on Science and Mathematics (STEPSAM) was a famous JICA project to support upper secondary school teachers in science and mathematics in Cambodia from year 2000 to 2004. In 2007 JICA started a new project called STEPSAM 2 targeted to improve the quality of science teaching in all teacher training institutions and some lower secondary schools in Cambodia. The criteria invented by the project to evaluate the quality of science teaching are as follows:

1. ***Relationship between the lesson objectives and learners' outputs***: In this part, inspectors evaluate by focusing on: (1) *Are objectives specific and clear?*, and (2) *How strong are the relations between lesson contents and lesson objectives?*
2. ***Science learning processes****:I*nspectors focus on *whether scientific methods were used in teaching and learning processes?*
3. ***Learning opportunity****:I*nspection is focused on "*do students learn actively by themselves?"*
4. ***Good points****:T*he inspectors are required to draw concrete example from the lesson.
5. ***Point necessary to improve****:* The inspectors are required to specify particular points and provide alternative suggestions.

The evaluation tool invented by STEPSAM 2 focuses mainly on students' learning processes rather than teacher's behavior or activities. It is found that the quality of science teaching in PTTCs, RTTCs, and some Lower Secondary Schools improved through the project. Through these evaluation criteria, the inspectors and other participants including the teacher who taught discussed only how to improve science lesson in the reflection discussion after class observation.

III. Further Exploration and Support Requirement

In order to ensure the quality of teaching, each teacher must have two main aspects: content knowledge and teaching strategies. Through base line survey conducted by STEPSAM 2, result has shown that science trainers, science teachers, and students in Cambodia are not good at science content knowledge yet.

1. Science Content Knowledge

1.1 *Basic knowledge and skills on science*
Base line survey indicated that science trainers and trainees at RTTCs and PTTCs, and also science teachers at primary and lower secondary schools are good at Factual Knowledge, but they are not good at Reasoning and Analysis on science phenomena yet. (STEPSAM 2 base line survey report 2009).

1.2 *Application of scientific knowledge*
The trainers, trainees, and teachers at primary and lower secondary schools are not good on the use of *scientific knowledge* to understand the natural world and to improve their daily life. All of them got an average score lower than 50%. (STEPSAM 2 base line survey report 2009)

1.3. *Science process skills*
Through the survey, trainers and trainees are fairly good at designing experiments and interpreting data, but teachers at primary and lower secondary schools are not good at experiments.(STEPSAM 2 base line survey report 2009)

2. Teaching Strategies

Class observation, analysis in STEPSAM 2 project and the class observation in practicum showed that most of science teachers in Cambodia are still limited in the implementation of student- centered approaches as well as inquiry-based lesson. Some science teachers mainly follow textbooks and less practicals.

As a conclusion, science teachers and trainers in Cambodia need to improve their content knowledge and teaching strategies in order to ensure the quality of science teaching.

Chapter 5
Indonesia Country Report

The Quality of Science Teachers in Indonesia

By Mr. Kandi Do, ex-Head of ICT and Network, SEAMEO QITEP Science

Indonesia already has a standard of teacher competence in all subjects and levels of education including competency standards for science teachers. This teacher's competency standard is developed in full from four main competencies, namely; pedagogic, personality, social, and professional competence. These four competencies are integrated in teacher performance. Teacher competency standards include the core competencies of teachers developed into the competence of kindergarten teachers, elementary school teachers, and subject teachers at elementary, junior high school, high school, and vocational schools.

The following are the core competencies of teachers for all levels and all subjects.
Pedagogical competences include:

1. Mastering the characteristics of learners from the physical, moral, spiritual, social, cultural, emotional, and intellectual aspects.
2. Mastering the theories and principles of learning.
3. Develop a curriculum related to the subject of teaching.
4. Educative learning activities.
5. Utilising information and communication technology for the benefit of learning.
6. Facilitate the development of potential learners to actualise various potentials.
7. Communication with the student.
8. Conduct assessment and evaluation of learning processes and outcomes.
9. Utilising assessment and evaluation results for learning purposes.
10. Take reflective action to improve the quality of learning.

Personal competences include:

1. Acts in accordance with the norms of religion, legal, social, and national culture of Indonesia.
2. Showing yourself as an honest person, noble character, and role model for learners and society.
3. Showing yourself as a steady, stable, mature, wise, and authoritative person.
4. Has the work ethics, high level of responsibility and a sense of pride in being a teacher.
5. Uphold the code of ethics of the teaching profession.

Social competences include:

1. Be inclusive, acts objectively and not discriminatory.
2. Communicates with fellow teachers, educators, parents of students, and the community.
3. Adaptable in place of duty throughout the territory of the Republic of Indonesia which has a socio-cultural diversity.

Professional competences include:

1. Mastery of concepts structures and scientific mind set which support the subject matter.
2. Master the standard of competence and basic competencies of teaching subjects.
3. Develop creative learning materials.
4. Develop profession through reflective action.

5. Utilising information and communication technology to develop themselves.

Professional competency point 1: Mastering the material, structure, concept and mindset of scientific support of teaching subjects, described in more detail for each subject teachers. The following example is the Teacher Competence of science subjects in junior high school:

- understand the concepts, laws, and theories of science and its application flexibly.
- understand the process of thinking science in learning natural processes and phenomena
- using symbolic language in describing natural processes and phenomena.
- understanding relationships between different branches of science, and the relationship of science to mathematics and technology.
- reasoning qualitatively and quantitatively about simple natural processes and laws.
- apply the concepts, laws, and theories of science to explain various natural phenomena.
- explain the application of the laws of science in technology especially those that can be found in everyday life.
- understand the scope and depth of school science.
- creative and innovative in the application and development of science.
- master the principles and theories of management and safety/learning in the school science laboratory.
- use measuring tools, props, calculators, and computer software to improve science learning in the classroom, the laboratory.
- design science experiments for learning or research purposes.
- carry out science experiments the right way.
- understand the historical development of science and the underlying thoughts.

All the four main competences which a teacher should possess can be standardised, especially the personal and social competences. Both competences are monitored by supervisors and principals in each school. Meanwhile, the pedagogy competence aspects, such as planning, implementation and assessment of teaching, are tested with Teacher Performance Appraisal system (PK Guru). Based on the Regulation of the Minister of State for Administrative and Bureaucratic Reform Number 16 year 2009, PK Guru is an assessment of the teacher activities on each item of their main tasks in order to develop their career, rank and position.

PK Guru system is an assessment system designed to identify teachers' ability in implementing their tasks through measurement of the mastery of the competences

Generally, PK Guru has two main functions as follows:

1. To assess the ability of teachers in implementing all the competencies and skills required in the learning process, guiding, or the implementation of additional tasks that are relevant to the functions of the school / madrasah. Thus, the teachers' performance represents their strengths and weaknesses, which will be identified and interpreted as a need analysis or auditing skills for every teacher, and can be used as a basis for planning Continuous Professional Development (CPD).
2. To calculate the number of credits earned by the teacher for the teaching performance, coaching, or the implementation of additional tasks that are relevant to the functions of the school/madrasah in a certain year. Performance assessments are conducted annually as part of the process of career development for promotion and functional positions.

Teacher Performance Appraisal system (PK Guru) and Continuous Professional Development (CPD) are implemented regularly every year. It is started with formative evaluation in the beginning of the year and summative evaluation at the end of the year.

Assessment for professional competences and knowledge about pedagogy are evaluated by Teacher Competence Test (TCT). It includes the mastery of subject matter and comprehension about curriculum, teaching and learning, also the teaching evaluation. Teacher competency test is conducted every year with minimum achievement criteria to allow teachers to continue to grow. For the year 2016 and 2018 the minimum achievement criteria for teacher competency test are at 65 and 80 respectively while for teacher performance appraisal is the same at 75.

Teachers who have competency test results below the minimum achievement criteria are required to follow The Learner Teacher Program" so that better test results are expected in next year. ..

Based on 2016 test results, data showed that the national average is of 64.92. This value is still slightly below the criteria of minimum achievement but has increased compared to the minimum achievement criteria in 2015. The competency test results are pedagogical competency = 63.79 and professional competence = 66.05.

Those data represent 15.82% teachers all over Indonesia (from total of 2,699,.516 teachers), ranging from kindergarten to high school level. The number of participants who have attended the learner teacher program is 427,189 out of 2,699,516 teachers.

There are factors causing the low quality of science teachers in Indonesia, such as teacher's qualification. For example in 2015, there are still 738,682 undergraduate teachers from a total of 2,922,826 teachers.

There are a lot of teachers who teach subject matter which are unsuitable with their academic background (mismatch). In order to overcome this problem, the Indonesian government released a regulation which stated that teachers must have an academic diploma qualification minimum of first degree certificate, based on the subject matter that they teach. And the certificates must be acquired from an accredited study programme.

Besides the academic qualification, another factor affecting to the low competence of the science teachers is the lack of trained teachers. This is why the Indonesian government encourages training for teachers, such as the continuous professional development (CPD).

In the context of Indonesia, CPD is implemented based on the teachers' needs to achieve professional competence standard and/ or improve their competences which relates to their credit points for promotion on their position.

The CPD programme is aimed to minimise the gap between cognitive, skill, social and personal competences with the future demands related to the teachers' profession. This activity is developed based on the teachers' performance as the realisation of the Teachers' Performance Assessment (TPA) result which is also supported by the result of their self-evaluation. For teachers who have competences below the standard, or in other term is "having a low performance", they must follow the CPD programme oriented for achieving the standard. Meanwhile, for teachers who already achieved the standard competences, the CPD programme is directed to the profession improvement thus can fulfil the future demands in implementing their tasks to give quality learning for their students.

CPD includes three things, which are self-development, scientific publications, and innovative works. The self-development activity includes trainings and collective

workgroup to achieve and improve teachers' professional competence which covers: pedagogical, personal, social and professional competence as mandated in the Law Number 20, Year 2003 about the National Education System.

Scientific publications include scientific writings published to the society as a contribution in enhancing the quality of learning in school and the development of education in general.

Innovative works include the improvement works, modifications or new inventions as a contribution in enhancing the quality of learning in school and the development of education, science, technology, and arts.

CPD is for in-service teachers, meanwhile pre-service teachers must follow induction programme for 1 to 2 years. Induction programme is an orientation, training, development and practice in learning or guidance/ counselling in schools. Induction programme for pre-service teachers is a teaching-oriented process in a certain education level, and become a professional learning in the work place during the first year of teaching and is an early stage in the Continuous Professional Development of a teacher.

Induction programmes are designed systematically and planned based on the concept of cooperation between novice teachers, school counselors, colleagues, principals, and supervisors with professional learning approach.

The purpose of the induction programme is to guide the novice teachers in order to adapt to the work climate and culture of schools/madrasah and carrying out professional work as a teacher in the school/madrasah.

Various programmes continue to be made by the government to increase the competence and professionalism of teachers. The government's efforts would be supported by public, private and cooperation with foreign countries. Until now, teachers especially science teachers still need to improve their competence related to the subject matter and learning. Learning in Indonesia in general is still dominated by traditional learning, while the new curriculum demands that curriculum 2013 requires teachers to use a scientific approach in teaching, especially the teaching of science. For them, it still requires an improved understanding of science, especially in terms of approaches, techniques, models and methods of teaching science that leads to the student-centered learning and a deeper understanding of the learning assessment. Due to the large number of schools and the limited budget, the means and tools of science learning also remain a problem. Thus, teachers need to increase the understanding and skill in utilising learning resources around them. Teachers need trainings on how to develop a simple practical tool that uses cheap materials which are easily found in the environment. Additionally, teachers need directions in science teaching based on local wisdom.

Chapter 6
Lao PDR Country Report

Quality of Science Teachers and Science Teaching

by Dr. Thongloon Vilaythong, Faculty of Science, National University of Laos, Lao PDR

Overview

Ministry of Education Lao PDR Overview

Figure 1. Universities in Lao PDR.

- 8 Teacher Training Colleges
- 4 Other vocational institutes

Table 4 shows the types of teachers.

Table 4

Types of Teachers

1	Upper secondary school teacher (Dept. of Education)
2	Lower secondary school teacher (Dept. of Education and teacher training college)
3	Primary school teacher (Dept. of Education and teacher training college)
4	Pre-school teacher (Teacher training colleges and vocational institutes)
5	Nursery school teacher (Teacher training colleges and vocational institutes)

What are teachers' quality?

- The education quality was discussed since 2008 though the implementation began in 2003.

Table 5
Draft Teacher Competency

Component	Elements
1. Enhancing ethical and moral values	•Commit to national ideology
	•Educate the learners to follow the law and school rule
	•Respect cultural diversity
	•Abide by the code of conduct of teachers
	•Respect Lao traditions and customs
	•Inculcate moral values to students
	•Train students to be responsible
	•Educate solidarity, interpersonal skills, diversity and culture
	•Develop self-confidence among students

Component	Elements
2. Preparing appropriate lesson plans	•Understand course outline
	•Write long-term plans for teaching
	•Formulate specific learning objectives incorporating knowledge, skills, attitudes and values
	•Assess existing learning needs and environment
	•Use of learners assessment in lesson planning
	•Prepare lesson plan based on syllabus and time frame
	•Consider diversity in lesson planning
	•Select the right methodologies according to subject areas and learners' level
	•Prepare and produce learning materials

3. Facilitating learning of learners	•Develop knowledge on subject matter
	•Motivate students using appropriate technology
	•Promote students' participation in class
	•Use appropriate questioning techniques
	•Use appropriate and variety of questioning techniques
	•Use local context in teaching
	•Communicate at learners' level
	•Provide guidance to students

Component	Elements
4. Creating a conducive learning environment	• Manage classroom
	• Create a safe learning environment inside and outside the school
	• Foster solidarity, caring, collaboration and respect
	• Create an appropriate learning environment
	• Create a clean learning environment inside and outside the school
	• Create positive good atmosphere inside and outside the school
	• Encourage and promote students' participation in learning
	• Promote standard of hygiene, rules and good nutrition among students
	• Organise extra-curricular activities
5. Embracing diversity of learners and enhancing students' equalities	•Seek and acknowledge individual learning needs
	• Embrace diversity of learners (gender, ethnic group, disadvantaged groups)
	•Support and assist learners with special needs
	•Give opportunity for learners' equal participation
	•Exhibit fairness in dealing with students
	•Enhance learning for students who are advanced
6. Evaluating students' learning outcomes	•Prepare appropriate assessment tools
	•Use assessment techniques
	•Record students' behavior continuously inside and outside the classroom
	•Develop formative and summative assessment
	•Evaluate students' portfolio

Component	Elements
	•Seek and learn new knowledge from different sources

7. Enhancing professional development	•Promote, study and research in order to develop oneself continuously in a changing world
	•Exchange and share experiences of subject knowledge
	•Conduct classroom action research
	•Upgrade one's knowledge of ICT
	•Upgrade one's knowledge of English and other foreign language
	•Mentor new teachers
	•Develop one's portfolio
8. Networking with stakeholders	• Disseminate educational strategy documents to the community
	• Establish professional networking with teachers in other schools
	• Share responsibility of educating students with the Village Education Committee and parents
	• Exchange knowledge with the community to improve teaching
	• Identify local human resources from the community
	• Develop a plan for improving teaching and learning
	• Develop a school development plan with the community
	• Participate in community activities
	• Learn the traditions of local areas
	• Learn the local language

How is the quality of science teachers and science teaching evaluated in Lao PDR?

- First time the evaluations were done in the Faculty of Science (NUOL) and Faculty of Economic Management in 2013.
- The AUN-QA standards were used for evaluation.

Table 6

Components for Evaluation

Components
1. Competent university teaching staffs are able to: • Design and deliver a coherent teaching and learning programme • Apply a range of teaching and learning methods and select methods most appropriate to desired learning outcomes • Develop and use a variety of instructional media • Employ a range of techniques to assess students' work and match these to intended learning outcomes • Monitor and evaluate their own teaching performance and evaluate programmes they deliver • Reflect upon their own teaching practices •Identify needs and develop plans for continual development
2. The teaching staff establishment or staffing is sufficient to deliver the curriculum and suitable in terms of the mix of qualifications, experience, aptitudes, age, etc.
3. Recruitment and promotion of academic staff are based on merit system, which includes teaching, research and service.
4. Roles and relationship of staff members are well defined and understood.
5. Allocations are appropriate to qualifications, experience, and aptitude.
6. Time management and incentive system are directed to support quality of teaching and learning.
7. All staff is accountable to the Owner of University (e.g. the Government, Board of Trustees, or the Foundation) through the Rector, President or Vice Chancellor and to the stakeholders, taking onto account their academic freedom and professional ethics.
8. There are provisions for review, consultation, and redeployment.
9. Termination, retirement and social benefits are planned and well implemented.
10. There is a well-planned staff appraisal based on fair and objective measures in the spirit of enhancement which are carried out regularly.

Chapter 7
Malaysia Country Report

Quality Assurance for Malaysian Teachers' and Teaching Quality

by Ng Soo Boon, PhD
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1.0 Education system in Malaysia

School education in Malaysia is divided into five stages, namely; the preschool, primary Year 1-6, lower secondary Form 1-3, upper secondary Form 4-5 and pre-university Upper and Lower Six or Matriculation. Preschool is not compulsory; however, primary education is compulsory for all children in Malaysia. Malaysia provides free public school education for its citizen from preschool to pre-university. Children enter primary school at the age of 6+ and secondary school at the age of 12+. There are two types of primary schools, the National School with National Language as the medium of instruction and the National Type Schools where the medium of instruction is Chinese and Tamil. At the secondary education level, the medium of instruction is the National Language which is the Malay language. There are a few types of secondary schools including the Residential School and Religious School. At the end of primary school, students sit for a public examination to gauge their performance. At the end of the upper secondary education, students sit for a public examination to qualify them for further studies. For those students who continue to the Upper Six, they sit for another public examination to qualify them for further studies at the universities.

All teachers in Malaysian public schools are trained by Ministry of Education (MOE) through its Teacher Training Institutes and universities. In 2010, 31% of the primary school teachers have already attained a qualification of at least a bachelor degree, the rest are with at least a diploma in education. Majority of the secondary school science teachers are with a bachelor degree in the respective science discipline which are Biology, Physics or Chemistry. The Teacher Training Institutes under MOE are responsible for training primary school teachers whereas the public universities train the secondary teachers. A number of Teacher Training Institutes have been identified to train specialised primary science teachers and generally most of the premier universities offer bachelor degree in pure sciences as well as diploma in education or master in education. For close to 30 years since end of 1970's, due to the shortage of secondary school science teachers at that time, a number of premier universities offered Bachelor of Science with Education with a major in a chosen specific pure science discipline, this program has been closed more than 5 years ago. In the 1980's many students under scholarship from MOE were also sent to other more developed countries to obtain their bachelor degree in pure sciences; with a current status of almost 100% of graduate science teachers in secondary school, this program has also ceased.

2.0 Quality Assurance Framework for Science Teachers and Science Teaching

Enactment and implementation of policies to safeguard quality of teachers and teaching are of utmost importance to ensure the sustainability of a high standard of education in Malaysia. Realising this, within the last twenty years, the Malaysian government has formulated and implemented a number of policies such as the Education Act 1996 (Act 550), Quality Standard for Education (SKPM), and Standard of Malaysian Teacher (SGM). Science teachers and science teaching are very much part of the Malaysian education system and Science is one of the core subjects compulsory in schools. Science teachers and science teachers are subjected to these same quality assurance policies.

2.1 Education Act 1996 (Act 550)

Under Part IV, Chapter 1 of the Act: National Education System, it is stipulated that:

> The National Education System is made up of the following:
> (a) Preschool education (4-6 years old)
> (b) Primary education
> (c) Secondary education
> (d) Post-secondary education and
> (e) Higher education

The Education Act also specifies that a national curriculum will be developed and shall be used by all schools in the National Education System. All schools regardless of public or private primary and secondary schools need to implement the National Curriculum. Science is listed as a core subject compulsory to be taught in all primary and secondary schools. At the upper secondary level, students can also opt to take pure science as elective subjects.

The Education Act 1996 (Act 550) was amended in 2002 to provide compulsory primary education. It stipulates that every parent is obliged to enrol their child upon attaining the age of six years in primary school and the child shall remain as a pupil in a primary school for the duration of the compulsory education for six years. One of the compulsory subjects in the primary school is science.

Under Part IV, Chapter 9 of the Education Act, it is stated that 'no person shall establish or maintain an institute of teacher education except with the approval of the Minister of Education'. It is further determined that the institute of teacher education established under MOE shall conduct courses of study and training programmes as may be approved by the Minister of Education. Thus, accessibility and quality of teacher education is the sole responsibility of MOE.

Under Part X: The Inspectorate of Schools, it is stipulated that 'the chief inspector or an Inspector of Schools may give advice to the governors or any other person responsible for the management of an educational institution and to teachers on matters relating to teaching and teaching method'. There are 16 states in Malaysia, in each of these states, an office of School Inspectorate has been established and the inspectors in these offices are made up of specific subject experts who conduct inspection on its specific subject area. Thus in each state there is at least one science inspector who is responsible to the inspection of science teaching.

The Education Act 1995 (Act 550) forms the basis for the development of other policies regarding quality of teachers and teaching in classroom for all subjects. With the Education Act 1995 as the backbone, the Quality Standard for Education and Quality Standard for Teachers were formulated.

2.2 Quality Standard for Education (Standard Kualiti Pendidikan Malaysia, SKPM)

The School Inspectorate and Quality Assurance Division (Jemaah Nazir dan Jaminan Kualiti, JNJK) MOE is responsible for schools inspection and quality assurance of teaching and learning. In 2001, in line with its responsibility to ensure an adequate standard of teaching to be developed and maintained in educational institutions, JNJK launched the Quality Education Standard (STKP) mechanism. STKP mechanism consisted of two main components: self-assessment by educational institution itself and external inspection by School Inspectorate. STKP was developed anchoring on the various education related national Acts, regulations, legislatures, circulars that has been formulated by the government. In 2003, STKP had been renamed as Quality Standard for Education in Malaysia – School (Standard Kualiti Pendidikan Malaysia - Sekolah, SKPM). The targets for SKPM are specifically the government or government aided schools which provide education program from preschool to pre-university. SKPM has three main components which are: Standard Statements (SKPM1), Instruments to ensure Compliance to Standard (SKPM2) and School Improvement Program (SKPM3). SKPM2 is developed to measure achievement of school based on standards stated in SKPM1. School Inspectorate uses these documents for school inspection, the other divisions in MOE and State Education Department. The District Education Departments are encouraged to use these documents in carrying out supervision or monitoring in schools. Schools are required to do self-assessment using SKPM2. There are 12 elements in SKPM and these are organised into 4 dimensions as shown in Table 7.

Table 7
Dimension and Elements in SKPM

Dimension	Elements
(I) Direction of school leadership	(1) Vision and Mission
	(2) Leadership
(II) Management of organisation	(3) Organisational structure
	(4) Planning
	(5) Ambiance
	(6) Management and development of resources
	(7) Management of information
(III) Management of Educational Program	(8) Management of curriculum program, co-curriculum and students' affair
	(9) Teaching and Learning
	(10) Development of the personality/ character of students
	(11) Evaluation of students' achievement
(IV) Development of Students	(12) Development of students in academic, co-curriculum and character building

Each of the dimension and element is further elaborated in the standard document to help school leadership and management to ensure quality educational management, planning, leadership, human and resource development, creating the right ambiance, guidance for quality teaching and learning in the classroom as well as the students achieving the educational objectives set by MOE. A detailed instrument to ensure the above quality is provided in the Instruments to ensure Compliance to Standard (SKPM2 - IPS). Using SKPM, schools are rated according to seven levels as shown in Table 8.

Table 8
Levels in SKPM

% of achievement	Level	Status of School
90-100	7	Excellent school (Gemilang)
80-89	6	Good School (Cemerlang)
70-79	5	School with Hope (Harapan)
50-69	4	Average school (Sederhana)
35-49	3	Poor school (Lemah)
25-34	2	
0-24	1	

Although SKPM is designed to serve the schools under MOE, increasingly other stakeholders in the private or early childhood sector are also beginning to refer to this quality assurance scheme. SKPM provides a comprehensive quality assurance framework to maintain a high standard of management as well as teaching and learning in schools.

2.3 Standard of Malaysian Teacher (Standard Guru Malaysia, SGM)

Standard of Malaysian Teacher (SGM) was developed by MOE in 2005 to provide indicators of the professional competencies among teachers as well as for quality assurance in teacher training. This document serves as a guide and reference for teacher's self-reflection, and planning of training courses by teacher trainers in the public or private educational institutions.

There are two components in SGM: Standards and Needs. 'Standard' refers to the statements of professional competencies needed to be achieved by the teacher. 'Need' refer to statements of aspects of teacher training needed to be prepared and implemented by agencies and training institutions related to education and teaching. Elements within Standard and Needs are given in Table 9.

Table 9
Aspects and Elements in SGM

Aspects	Elements
Standard	(S1) Teachers' professionalism in the following domains: - Self (e.g. sincere, believe in God, endurance, love) - Professional (e.g. integrity, teamwork, innovative) - Social (e.g. social skills, love for environment)
	(S2) Knowledge and understanding - Philosophy and aims of education - Subject matter - Information, Communication and Technology, ICT - Setting up conducive learning environment - Assessment
	(S3) Skills in teaching and learning - Planning of lesson - Approaches and strategies of teaching and learning - Monitoring and evaluation of effectiveness of teaching - Classroom management
Needs	(K1) Entry qualification and procedure of intake to teaching training program
	(K2) Training, assessment and evaluation
	(K3) Collaboration

Aspects	Elements
	(K4) Infrastructure and info structure
	(K5) Quality assurance

Assessment and evaluation of performance of teacher training need to adhere to the quality standards stated in the document of SGM. Program auditing and institutional auditing need to be conducted and report prepared to be used for continuous improvement based on the requirement of SGM. Although approval and accreditation of teacher training courses are under the jurisdiction of Malaysian Qualification Agency (MQA), MOE is a member of the panel in MQA. SGM spells out the quality of teachers and teacher training required of all Malaysian teachers.

3.0 The Way Forward: The Malaysia Education Blueprint 2013-2025

The government of Malaysia launched the Malaysia Education Blueprint 2013-2025 (PPPM) in Sept 2013. PPPM recognises teachers and school leaders as the most important school-based drivers of student outcomes. The quality of teachers is believed to impact and determine students' performance either academically or non-academically. Researches have been conducted by MOE and commissioned to be conducted by other national and international agencies to identify the gap and the specific needs of the country to produce an excellent pool of teachers. Among the gap discovered is the comparatively passive teaching methods where students are not motivated and encouraged to participate actively in activities which will ultimately cultivate higher order thinking skills.

Eleven shifts have been identified in PPPM to transform Malaysian education system in order to achieve the aspirations of greater access, higher quality, maintain equity, enhanced unity and higher efficiency of the education system. Among the eleven shifts is Shift 4 which is 'Transforming Teaching into the Profession of Choice'. Within Shift 4, the objectives set are to raise entry bar for pre-service teachers to the top 30% of graduates, upgrade quality of school based capacity development program where more onsite training will be held, reducing administration burdens of teachers, implement competency and performance based career progression, enhancing career pathways for teachers into leadership and subject specialist, and last but not least culture of professional excellence. PPPM will be implemented in three phases, Wave 1 (2013-2015) focuses on improving standards and support systems, Wave 2(2016 to 2020) focuses on enhancing career pathways and progression of the teaching profession and Wave 3 (2020-2025) creating a peer led culture of professional excellence and certification process. All these initiatives are geared towards increasing the quality of teachers and teaching. If MOE Malaysia can ensure each Wave is implemented efficiently and seamlessly, the teachers' quality and teaching quality will definitely be brought to the highest level bringing success to the country in terms of quality of education.

4.0 Conclusion

The government of Malaysia holds great respect for teachers' quality and has identified quality of teaching as the most important key to propel Malaysia to achieve the top 1/3 in terms of quality of education globally. With the formulation of relevant and pertinent quality assurance frameworks for teachers' and teaching quality such as the Education Act, SKPM, SGM and Malaysia Education Blueprint 2013-2025, MOE needs to ensure the proper implementation of these policies and closely monitor its progress. With this emphasis, we believe that Malaysia is on its way to provide quality education and a bright future for the children of Malaysia.

Chapter 8
Myanmar Country Report

The Importance of Science Curriculum Development in Myanmar

by

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Introduction

Education is a systematic process through which a child or an adult acquires knowledge, experience, skill and sound attitude. It makes an individual civilized, refined, cultured and educated. Education is the only means for a civilised and socialised society. Education is an endeavor aiming to fully develop the personality of each and every young person, and it is essential for young pupils to lead happy lives in the future. Education has the mission of cultivating the young pupils who will be the future leaders of Myanmar and its society and its importance remains unchanged across the eras. To further enhance the education offered to these young pupils, Ministry of Education (MOE) of Myanmar has developed the Myanmar National Curriculum. Myanmar currently has an Educational Vision: "To create an education system that can generate a learning society capable of facing the challenges of the knowledge age". The Myanmar National Curriculum was developed based on this Education Vision of Myanmar. The mission indicates what education is expected for young pupils.

Missions

The missions of the Myanmar National Curriculum are as follows:

(1) Young pupils should:

- develop the values, abilities and knowledge that will enable them to live full and satisfying lives .
- seize the opportunities offered by new knowledge and technologies to secure a sustainable social, cultural, economic, and environmental future for the country.
- be confident, connected, actively involved and lifelong learners.

(2) Students should have confidence:

- positive in their own identity.
- motivated and reliable.
- resilient.

They must be able to communicate with community members. Th**ey** should be actively involved as:

- Participants in a range of life contexts.
- Contributors to the well-being of Myanmar (social, cultural, economic and environmental).

They should be lifelong learners who are:

- Literate and numerate.
- Critical and creative thinkers.
- Active seekers, users and creators of knowledge
- Informed decision makers.

However, the principle is the foundation for curriculum decision making.

Principles

The principles of the Myanmar National Curriculum are as follows:

(1) Balanced development
The curriculum provides all pupils with balanced development in terms of intellectual, physical, social, moral, emotional and aesthetic dimensions.
(2) Cultural diversity
The curriculum reflects Myanmar's cultural diversity and values histories and traditions of its entire people.
(3) Inclusion
The curriculum is non-sexist, non-racist, and non-discriminatory. It ensures that pupils' identities, languages, abilities and talents are recognised and affirmed and that their learning needs are addressed.
(4) Learning to learn
The curriculum encourages all pupils to reflect on their own learning processes and to learn how to learn.
(5) Community engagement
The curriculum has meaning for pupils, connects with their wider lives and engages the support of their families and communities.
(6) Coherence
The curriculum offers all pupils a broad education that makes links within and across learning areas, provides for coherent transitions, and opens up pathways to further learning.

Moreover, learning areas are specified science, mathematics, social studies, Myanmar languages and English languages etc. Among them, Science Curriculum Development is focused in this paper.

Science Curriculum Development

It indicates four main parts. They are Primary Science Objectives, Learning area, Learning Outcomes and Learning Activities.

The Aim of Primary Science

The aim of the Myanmar Primary Science curriculum is to provide pupils with practical experience based on exploration of the environment so that they become familiar with the environment and develop affection for it and also to develop their scientific inquiry skills to gain scientific knowledge and positive attitudes towards science.

The outlines of science learning areas are as follows:

Natural Science. Natural Science is the basic study of natural environment around us, especially for pupils at lower primary grades (grade 1 and 2). Through concrete objects (i.e. animals, plants, etc.) and observation of them, pupils understand the natural environment and foster the love and affection for them. Natural Science will provide the pupils with the base for Basic Science. Natural Science has two strands: Living things and the Earth and Space. In each strand, the following learning area is provided.

- ***Living Things***: (a) Various animals and plants, (b) Relationship with our lives and (c) Life cycle
- ***The Earth and Space***: (a) The Earth (b) The Moon and (c) The Sun

Basic Science. Science is a way of investigating, understanding and exploring natural, physical world and the wider universe. It involves generating and testing ideas, gathering evidence, carrying out investigations, modelling, communicating and debating with others, in order to develop scientific knowledge, understanding and explanations. Science has four strands: Living world, Matters, Energy and the Earth and Space. In each strand, the following learning area is provided:

- ***Living World*****:** (a) Relations between living things and environment, (b) Body structures and functions, and (c) Life process
- ***Matters*****:** (a) Preservation of particles, (b) Energy in particles, and (c) Existence of particles
- ***Energy*****:** (a) Characteristics of energy, (b) Transformation and preservation of energy and (c) Use of energy

  The best way to design instruction is to work backwards from its expected outcomes.

Learning Outcomes

The learning outcome is a statement of the concepts, attitudes or skills that students are expected to accomplish by the end of some period of instruction. Learning outcomes are expressed in a way that describes learning that can be evaluated. These could be built from a stem such as: “It is expected students will----” . The action words are now focused on what students will be able to do once they have learned what is wanted, based on the extended objectives. These action words could include: demonstrate, show, identity, describe, report, compare, classify, outline, explain, solve, implement, construct, distinguish, justify, assess, judge, debate, discuss, design and produce, etc. Many of these functions require various learning activities.

Learning Activities

Learning activities are experiences designed to involve students in thinking about and using subject matter. The learning activities are designed to offer the students an effective way to support and enhance their learning. Each learning activity should serve a specific objective. Learning activities should proceed from the simple, concrete and specific to the

more complex and abstract. They should enable students to apply what they have learned in one situation to other new and different situations.

Among the 21st century issues and trends in science education, one must acknowledge the fundamental importance of the science curriculum. It is the one component that brings together content standard, teachers' competency and appropriate assessments. Firstly, National Education Strategic Plan was set up.

National Education Strategic Plan

The Ministry of Education (MOE) commits to achieving the following National Education Strategic Plan (NESP) goal statement by the end of the 2020-2021 fiscal years: improved teaching and learning, vocational education and training, research and innovation leading to measurable improvements in student achievement in all schools and educational institutions.

Nine Transformational Shifts

The MOE has identified nine Transformational Shifts that will collectively contribute to the achievement of the NESP goal.

1. Preschool and Kindergarten education: All children get a head start on their learning pathway through accessing quality preschool and kindergarten education.

2. Basic education – access, quality and inclusion: All children can access progress through and successfully complete quality basic education.

3. Basic education curriculum: All school children develop knowledge, skills, attitudes and competencies that are relevant to their lives and to the socio-economic development needs of 21st century Myanmar.

4. Student assessment and examinations: Teachers and education managers implement a quality assessment system to improve student learning achievement.

5. Teacher education and management: Teachers support, develop and apply interactive classroom teaching and learning benefiting all students.

6. Alternative education: Learners can access and graduate from quality assured, certified and nationally credentialed alternative education programmes to achieve their learning and career aspirations.

7. Technical and vocational education and training (TVET): More learners can access TVET and graduate from quality assured and labour market-responsive TVET programmes under a more effective TVET management system.

8. Higher education: Students have equitable access to a world-class higher education system, leading to better opportunities for employment and significant contributions to a knowledge-based economy.

9. Management, capacity development and quality assurance: Education managers at all levels apply evidence-based decision making and demand accountability for improved teaching and learning in school and educational institutions.

Main Sub-sectors of the National Education Strategic Plan

In order to achieve the nine Transformational Shifts, responsible departments of the MOE and relevant ministries will need to implement ten sub-sectors.

1. Preschool and kindergarten education: Four complementary and linked strategies and programmes will be implemented to achieve the Transformational Shift for preschool and kindergarten education.

2. Basic education reforms for the 21st century: The MOE has developed a conceptual framework for Basic Education Reforms to show the key linkages between the main basic education sub-sector reform areas.

3. Basic education – access, quality and inclusion: Three complementary and linked strategies and programmes will be implemented to achieve the Transformational Shift for basic education.

4. Basic education curriculum: Three complementary and linked strategies and programmes will be implemented to achieve the Transformational Shift for basic education curriculum.

5. Student assessment and examinations: Student assessment and examination will be implemented to improve assessment and examinations and to strengthen co-ordination, management and monitoring.

6. Teacher education and management: Teacher education and management will be implemented to strengthen teacher quality assurance and teacher management, to improve the quality of pre-service teacher education, and to improve the quality of in-service teacher professional development.

7. Alternative education (AE): Alternative education will be implemented to strengthen co-ordination and management, to expand access through multiple AE pathways, and to strengthen the quality of AE programmes.

8. Technical and vocational education and training (TVET): Three complementary and linked strategies for technical and vocational education and training will be implemented to expand access to TVET for various target groups including

disadvantaged populations and people with disabilities, to strengthen the quality and relevance of TVET, and to strengthen TVET management.

9. Higher education: Three complementary and linked strategies for higher education will be implemented to strengthen higher education governance and management capacity, to improve the quality and relevance of higher education and to expand equitable access to higher education.

10. Management, capacity development and quality assurance: Management, capacity development and quality assurance will be implemented to strengthen and sustain sector-wide, sub-sector and sub-national co-ordination mechanisms, to strengthen education sector management structures, systems and tools, and to strengthen the capacity of education managers to successfully undertake education reforms.

Myanmar's Teacher Competency Standards Framework

Teachers have a central role to play in improving educational outcomes. It is recognised th at
the quality of the teaching workforce determines the quality of education and that it is a significant factor in keeping students in school and in improving student educational outcomes. Myanmar's Teacher Competency Standards Framework describes and explains what are considered to be the key characteristics and attributes of good teaching (See Appendix A).

The Framework:

- is grounded in the culture of the country;
- is based upon consensus about the purpose of teaching and about what constitutes successful teaching and learning;
- is based on clear statements of underlying educational philosophy, educational psychology and educational sociology;
- accommodates all the dimensions of teachers' professional work;
- emphasises self-evaluation and improvement;
- is consistent with (but not limited by) the desired basic education learning outcomes, as articulated in the National Curriculum Framework; and contains the key attributes of stability, durability and flexibility.

Teacher competency standards refer to the expectations of teachers' knowledge, skills, attributes and required levels of performance at various stages of their teaching career and is organised in the following four domains:

- Professional knowledge and understanding
- Professional skills and practices
- Professional values and dispositions
- Professional growth and development

The complete set of competency standards includes:

- Teaching competence – the role of the teacher in the classroom, directly linked to the act of teaching (pedagogical content knowledge).
- Teacher competence – the wider systemic view of teacher professionalism; this includes the role and responsibility of the teacher as an individual, within the school, the local community, and as a participant in professional networks.

The Framework provides a core set of competency standards to be used as the point of reference or benchmark for science teacher and science teaching quality in Myanmar. Moreover, not only science teaching quality but also the degree to assess the students' achievement is essential.

Student Assessment and Examinations

The three major challenges facing student assessment and examination are:

(1) Development and implementation of a comprehensive assessment policy for basic education schools. The current emphasis on rote memorisation of factual information in teaching, learning and assessment highlights the urgent need for a more balanced system of formative and summative assessments that assesses student learning against national learning standards. Improved co-ordination, management and monitoring are essential for the Ministry of Education (MOE) to implement integrated student assessment reforms.

(2) A well-designed capacity development program needs to be put on place focusing on assessment strategies, test development and analysis, and interpretation and utilisation of test results to inform teaching and improve student learning. In addition, there is a need to upgrade the assessment-related functions and responsibilities of Ministry of Education departments.

(3) Practical mechanisms need to be established to support the effective co-ordination, management and monitoring of new assessment reforms. In addition, awareness of new assessment systems among parents and the public is vital so that they understand and support the new approaches.

A key focus of assessment reforms under the National Education strategies Plan (NESP) is a move away from a system focused on the accurate repetition of required content knowledge to a more balanced system that assesses student learning progress against national learning standards.

This shift is in line with international research that demonstrates the importance of monitoring a student's ability to engage in and complete complex thinking and problem-solving tasks and to develop self-learning skills. These are skills that students need for personal and professional development. There are also essential skills for a globally competitive workforce. An effective assessment system can help a country to improve the equity of their education system, through identifying area where students need greater support.

Conclusion

The current basic education system comprises of five years of primary education (KG to Grade 4), four years of lower secondary and two years of upper secondary education. At present, there are 47,363 basic education schools in Myanmar reaching approximately 926 million students. The majority of these schools are managed by the Department of Basic Education under the control of the MOE. In addition, a significant percentage of students access basic education through monastic, private, community and other types of schools.

The one major challenge facing the basic education curriculum is upgrading the professional capacity of curriculum development teams, as well as the capacity of head teachers and teachers to successfully implement the new curriculum.

Learning by doing can help students solve their problems. It can also relate contents with real life experience. So, learning is meaningful for learners and it can fulfill the society's need. Therefore, the teaching of science as a subject can contribute to the all-round development of the child so that he/she comes out as a socially useful and efficient citizen of the modern scientific world.

A quality basic education curriculum is a critical building block for Myanmar's socio-economic development and it is an essential pre-requisite for the provision of quality education and the improvement of student learning achievement.

A key curriculum reform challenge is to develop and successfully implement a new basic education curriculum at primary that is more relevant to all students, thereby motivating them to stay in school and complete basic education.

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Teacher Competency Standards Framework (TCSF), Myanmar

Beginning Teachers

Draft Version 2.0
18 July 2017
This version of the TCSF draft 2.0 provides a complete set of competency standards, minimum requirements and indicators for beginning teachers. A further three levels of proficiency related to teachers' continuing professional development – experienced, expert, and leader teachers – are in the process of being developed.

1. Teacher Competency Standards

Domain A: Professional Knowledge and Understanding

This domain centres on the information that teachers should know and be able to demonstrate. It encompasses the knowledge required for teaching different ages and stages and level appropriate subject content competency. Inherent in any focus on subject competency is the necessity to understand how students learn and how they can be effectively taught in the key learning areas. Underpinning all competency standards in this domain is knowledge of educational policy and school curricula for Myanmar, its aims and objectives and developments.

Area of Competence: Professional knowledge and understanding – Educational science

Competency standard A1: Know how students learn
Minimum requirements
A1.1 Demonstrate understanding of different theories of how students learn relevant to their age
A1.2 Demonstrate understanding of how different teaching methods can meet students' individual learning needs

Area of Competence: Professional knowledge and understanding – Instructional technology

Competency standard A2: Know available instructional technology
Minimum requirements
A2.1 Demonstrate understanding of a variety of teaching and learning strategies and resources
A2.2 Demonstrate appropriate use of Information and Communication Technology (ICT) in teaching and learning

Area of Competence: Professional knowledge and understanding – Students, families, schools and communities

Competency standard A3: Know how to communicate well with students and their families
Minimum requirements
A3.1 Demonstrate understanding of the role and expected duties of teachers in Myanmar
A3.2 Demonstrate understanding of the social, linguistic, and cultural diversity of the students and their communities

Area of Competence: Professional knowledge and understanding – Curriculum

Competency standard A4: Know the curriculum
Minimum requirements
A4.1 Demonstrate understanding of the structure, content and expected learning outcomes of the basic education curriculum

Area of Competence: Professional knowledge and understanding – Subject matter

Competency standard A5: Know the subject content
Minimum requirements
A5.1 Demonstrate understanding of the subject matter to teach the appointed subject/s for the specified grade level/s
A5.2 Demonstrate understanding of how to vary delivery of subject content to meet students' learning needs and the learning context

Domain B: Professional Skills and Practices

This domain deals with what teachers are able to do. The teachers' professional knowledge and understanding is complemented by possession of a repertoire of teaching strategies for different educational contexts to meet the needs of individual students as appropriate to different subject areas and stages of schooling.

Area of Competence: Professional skills and practices - Pedagogy

Competency standard B1: Teach curriculum content using various teaching strategies
Minimum requirements
B1.1 Demonstrate capacity to teach the curriculumrelated subject concepts and content
B1.2 Demonstrate capacity to apply different strategies for teaching and learning
B1.3. Demonstrate good lesson planning and preparation in line with students' learning ability and experience

Area of Competence: Professional skills and practices - Assessment

Competency standard B2: Assess, monitor, and report on students' learning
Minimum requirements
B2.1 Demonstrate capacity to monitor and assess student learning
B2.2 Demonstrate capacity to keep detailed assessment records and use the assessment information to guide students' learning progress

Area of Competence: Professional skills and practices - Classroom management

Competency standard B3: Create a supportive and safe learning environment for students
Minimum requirements
B3.1 Demonstrate capacity to create a safe and effective learning environment for all students
B3.2 Demonstrate strategies for managing student behaviour

Area of Competence: Professional skills and practices - Communication

Competency standard B4: Work together with other teachers, parents, and community
Minimum requirements
B4.1 Demonstrate strategies for working together with other teachers, parents, and the local community to improve the learning environment for students

Domain C: Professional Values and Dispositions

This domain refers to the ideas, values and beliefs that teachers hold about education, teaching and learning. It is underpinned by the values expressed in the Myanmar National Education Law and reflects the mutual understanding by teachers and the community about the Myanmar teacher – Teach students to be disciplined, Teach and explain to your best, Teach everything known, Appreciate students and Stand up for students whenever needed, Teach to value the professional work of being a teacher. According to Myanmar tradition, in return, the community will respect teachers. [1]

Area of Competence: Professional values and dispositions – Service to profession

Competency standard C1: Service to profession
Minimum requirements
C1.1 Demonstrate values and attitudes consistent with Myanmar's tradition of perceiving teachers as role models
C1.2 Demonstrate understanding of own educational philosophy and how it influences one's practice as a professional teacher
C1.3 Demonstrate understanding of the possible effect of local culture and context on student participation in school
C1.4 Demonstrate responsibility and accountability for the use of education resources

Area of Competence: Professional values and dispositions - Service to community leadership

Competency standard C2: Service to community leadership
Minimum requirements
C2.1 Demonstrate commitment to serving the school and community as a professional member of the teaching profession

Area of Competence: Professional values and dispositions - Student-centred values

Competency standard C3: Promote quality and equity in education for all students
Minimum requirements
C3.1 Demonstrate a high regard for each student's right to education and treat all students fairly
C3.2 Demonstrate respect for diversity of students and the belief that all students can learn
C3.3 Demonstrate capacity to build students' understanding of different cultures and global citizenship

[1] These are recognised and often cited edicts that are commonly expressed in the knowledge systems and practices of the people of Myanmar.

Domain D: Professional Growth and Development

This domain deals with teachers' continuing professional growth and development. It incorporates teachers' habits, motivation and actions related to their on-going learning and professional improvement. It advocates the importance of all teachers being aware of their role as leaders within the community and highlights the need for active research to support teachers' classroom performance and continuing professional development.

Area of Competence: Professional Growth and Development - Reflective practices

Competency standard D1: Reflect on own teaching practice
Minimum requirements
D1.1 Use evidence of students' learning to reflect on own teaching practice

Area of Competence: Professional Growth and Development - Collaborative learning

Competency standard D2: Engage with colleagues in improving teaching practice
Minimum requirements
D2.1 Improve own teaching practice through learning from other teachers and professional development opportunities

Area of Competence: Professional Growth and Development - Initiative for research culture

Competency standard D3: Participate in professional learning to improve teaching practice
Minimum requirements
D3.1 Demonstrate understanding of the importance of inquiry and research-based learning to improve teaching practice

Chapter 9
Philippines Country Report

The Professional Standards for Teachers and the Quest for Quality Science Teacher in the Philippines

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The Philippine Professional Standards for Teachers (PPST)

The Philippine Professional Standards for Teachers (PPST)), previously referred to as Developmental National Competency - Based Teacher Standards (D-NCBTS), has been developed, nationally validated, and adopted by the Department of Education (DepEd) to further improve teacher quality in the country. The PPST outlines the required skills and competencies the Filipino teachers must have to enable them to cope with the emerging global frameworks. It also serves as the basis for all learning and developmental programs for teachers to ensure that they are properly equipped to effectively implement the K-12 program.

The standards, which were developed by the Teacher Education Council of the Philippines, aim to set the clear expectations of teachers along well-defined career stages of professional development from beginning to distinguished practice. The PPST targets to produce better teachers in the country by improving their qualifications, skills and by increasing their levels of knowledge, practice and professional engagement. The standards also engage teachers to actively embrace a continuing effort in attaining proficiency and apply a uniform measure to assess teacher performance, identify needs and provide support for professional development. The PPST identifies four career stages for teachers – beginning, proficient, highly proficient and distinguished – to guide them in their developmental progression.

The PPST articulates a view of ideal teaching that is closely linked to current understanding about effective teaching and learning. It further defines what effective teaching is in terms of what a teacher is capable of doing to make the students learn better. Thus, the qualities of a good teacher are not defined in an abstract technical sense, as teaching is not viewed merely as a technical process that is executed with prerequisite inputs and expected outputs. Rather, the new paradigm embodied in the PPST is a reflective acquisition and application of complex technical knowledge to facilitating student learning in actual contexts.

The competency-based PPST is categorised into seven domains, namely; content knowledge and pedagogy, learning environment, diversity of learners, curriculum and pedagogy, assessment and reporting, community linkages and professional engagement, and personal growth and professional

development. The following are the essential features of the seven domains that are required by all teachers including science teachers to becoming effective teachers in the 21st Century in the Philippines.

Domain 1: Content Knowledge and Pedagogy

The teachers should recognise the importance of mastery of content knowledge and its interconnectedness within and across curricular areas, coupled with a sound and critical understanding of the application of theories and principles of teaching and learning. They need to apply developmentally appropriate and meaningful pedagogy grounded on content and research. They are expected to display proficiency in Mother tongue, Filipino and English language to facilitate the teaching and learning process, as well as exhibit the needed skills in the use of communication strategies, teaching strategies and technologies to promote high quality learning outcomes.

Domain 2: The Learning Environment

Teachers should provide learning environments that are safe, secure, fair and supportive in order to promote learner responsibility and achievement. They should create an environment that is learning-focused and can efficiently manage learner behavior given the physical and virtual spaces. They should also utilise a range of resources and provide an intellectually- challenging and stimulating activities to encourage constructive classroom interactions geared towards the attainment of high standards of learning.

Domain 3: Diversity of Learners

Teachers are expected to establish learning environments that are responsive to the learners' diversity. They should respect learners' diverse characteristics and experiences, and consider them inputs to the planning and design of learning opportunities. Likewise, they should also encourage the celebration of diversity in the classroom and need to employ differentiated teaching practices to encourage all learners to become successful citizens in a changing local and global environment.

Domain 4: Curriculum and Planning

Teachers should realise how the national curriculum would relate with the local curriculum requirements. They should be able to determine how to translate curriculum content into learning activities that are relevant to learners'lives and based on the principles of effective teaching and learning. They need to apply their professional knowledge to plan and design, individually or in collaboration with colleagues, well-structured and sequenced lessons that are contextually relevant, responsive to learners' needs and incorporate a range of teaching and learning resources. They should also communicate learning goals to support learner participation, understanding and achievement.

Domain 5: Assessment and Reporting

Teachers are expected to apply a variety of assessment tools and strategies in monitoring, evaluating, documenting and reporting learners' needs, progress and achievement. They should

use assessment data in multiple ways to inform and enhance the teaching and learning process and programs. They should also provide learners with the necessary feedback about their learning outcomes that informs the reporting cycle and enables teachers to select, organize and use sound assessment processes.

Domain 6: Community Linkages and Professional Engagement

Teachers are expected to establish strong school-community partnerships aimed at enriching the learning environment, as well as the community's engagement in the educative process. They should identify and respond to opportunities that link teaching and learning in the classroom to the experiences, interests and aspirations of the wider school community and other key stakeholders. Likewise, they need to understand and fulfill their obligations in upholding professional ethics, accountability and transparency and promote professional and harmonious relationships with learners, parents, schools and the wider public.

Domain 7: Personal Growth and Professional Development

Teachers should realise the importance of personal growth and professional development. They should exhibit high regard for the profession by maintaining qualities that uphold the dignity of teaching such as caring attitude, respect and integrity. They should understand the value of personal and professional reflection and learning to improve practice and assume responsibility for personal growth and professional development for lifelong learning.

The PPST has clearly stated the strategic and indispensable role of the teacher in the learning process of the students. Because of this, it is necessary that teacher development be continuously supported and nurtured based on PPST. Hence, it is imperative to determine each individual teacher's strengths and weaknesses along the said competencies.

It is in this context that the Results –Based Performance Management System (RPMS) , previously referred to as National Competency Based Teacher Standards- Teacher Strengths Needs Analysis (NCBTS-TSNA) tool, was designed. The RPMS is anchored on the overarching concept of teacher professional development. It is formative as a tool that encourages teachers in taking personal responsibility for their own growth and professional advancement. Through the RPMS, the Department of Education ensures that work efforts focus towards achieving its vision, mission, values and strategic priorities toward the delivery of quality educational services to Filipino learners.

There are three RPMS tools being used for three categories of teachers such as (a) for Teachers 1 with 0-3 years of service, (b) for Teachers I-III with more than 3 years of service and, (c) for Master Teachers I-II. Each tool describes the duties and responsibilities of the teacher across career stages as reflected in the Key Result Areas (KRAs). Each tool also presents in detail the various Means of Verification (MOV) that serve as proof of the attainment of specific objectives alongside performance indicators, from outstanding to poor performance, to help both rater and ratee in the assessment process. The performance indicators provide descriptions of quality and quantity given five performance levels: 5- Outstanding, 4 – Very Satisfactory, 3- Satisfactory, 2-Unsatisfactory, and 1- Poor. Embedded in the performance indicators are elements of quality, efficiency and timeliness.

An important outcome of the RPMS process is the impact from the individual teacher that it feeds in the preparation of the Individual Plan for Professional Development Program (IPPD). It is used in designing professional development programs and activities for teachers at the school, division and regional levels. The consolidated IPPDs would in turn inform the School Improvement Plan (SIP), Division Development Plan (DEDP) and the Regional Development Plan (REDP).

For purposes of formative appraisal for supervision, the Classroom Observation Tools-RPMS (COT-RPMS), previously referred to as NCBTS-TSNA, tool is used. The tools generate objective information needed for the technical support of instructional supervisors for the teachers.The COT-RPMS tools are composed of five forms, namely; (a) Rubric, (b) Pre-observation checklist, (c) Observation notes form, (d) Rating sheet , and (e) Inter-rater reliability exercise forms. Each form is used at a specific stage in the observation process.

The rubric captures the teaching performance of teachers. It shows a continuum of level of performance for each career stage such as for Teacher 1-III with 0-3 years in service (with levels 1-5), the expected attained level is at least level 4, **Developing,** for Teacher I-III with more than 3 years in service (with levels 3-7), the expected attained level is at least level 5, **Applying** and for Master Teacher I-II (with levels 4-8), the expected attained level is at least level 7, **Integrating.**

The Qualities of Science Teacher in the Philippines

The quality of science teacher matters. It is the most important school-related factor in influencing student achievement in science . The effectiveness of science teachers rooted mainly from their confidence of the subject matter, how to teach it (pedagogy) and their attitude. Indeed, inspirational science teaching occurs when a teacher is not only enthusiastic about the science topic being taught, but also fully understands the topic in order to present it in a comprehensive and meaningful way to each learner. To be able to achieve effective science teaching, teachers should see themselves as capable of achieving the dimensions of good teaching.

In 2011, the Science Education Institute – Department of Science and Technology (SEI-DOST) and the University of the Philippines National Institute for Science and Mathematics Education Development (UP NISMED) came up with the publication entitled "Framework for Philippine Science Teacher Education" and included a chapter on the "Qualities of Science Teacher in the Philippines". The behaviors used to indicate effective science teachers have been grouped under three categories adopted from ASTA: professional knowledge, professional practice, and professional attributes. The behaviors under each category are considered standards of performance of teachers, something they can work for. Standards are broadly stated expectations of what teachers should know and be able to do (UP NISMED, DepED-JICA, 2007). These standards provide the criteria for making judgments about the quality of professional development opportunities that elementary and high school teachers need.

The list of standards and behaviors are by no means complete. But they are useful for professional development programs to focus on so that teachers can be helped to achieve most, if not all, of them. The following are the standards and its descriptions.

A. Professional Knowledge

Professional knowledge includes knowledge of science content, knowledge of pedagogical content, knowledge of general pedagogy, and knowledge of the science curriculum.

- Knowledge of science content

Content knowledge refers to the disciplinary conceptual knowledge of the teacher. Good subject knowledge involves understanding the substance, content, structure and organisation of the science subject itself. It is essential for the teacher to explain not only the facts of science but more importantly the arguments for the scientific model. When it is weak, many teachers find it difficult to deal with learners' questions and resort to teaching from a textbook to avoid having their lack of knowledge exposed.

The science teacher may have a particular area of expertise (represented by an academic degree or the equivalent), but it is essential that he or she has breadth of knowledge across several other science disciplines to become scientifically, technologically, and environmentally literate.

- Knowledge of general pedagogy

Knowledge of general pedagogy refers to teachers' knowledge about characteristics and cognitive levels of varied learners, variety of learner-centered teaching and learning approaches including assessment and classroom management. More specifically, it includes knowledge about how learners learn, alternative conceptions that many learners hold, issues of safety, availability of appropriate resources, and the values held by various stakeholders in the education process.

- Pedagogical content knowledge

Pedagogical content knowledge refers to knowledge that the teacher must have to be able to teach the subject matter. This type of knowledge is complex with many interacting aspects included under general pedagogy.

- Knowledge of the curriculum structure and materials

Curricular knowledge refers to knowledge of the place of science in the basic education level, the interrelatedness of the content of science across the science discipline and with other curricular areas, and the quality materials needed to support the curriculum.

B. Professional Practice

This category outlines what teachers are expected to do to achieve quality learning outcomes - the objective of science education. It also expects teachers to work with the learners, colleagues, parents and other community members to achieve this objective.

Practice 1: Designs sound science teaching and learning experiences suitable for the needs and interests of varied learners

Practice 2: Creates and maintains a learner-centered, emotionally supportive, and physically safe learning environment
Practice 3: Engages students in scientific investigations to be able to generate, construct, and test knowledge and evaluate evidence
Practice 4: Finds and implements ways to extend students' understanding of the ideas and concepts being learned
Practice 5: Builds students' confidence and capacity to use scientific knowledge and processes to make informed decisions
Practice 6: Uses a wide variety of strategies consistent with learning goals to monitor and assess students' learning and to provide effective feedback

C. Professional Attributes

Professional attributes are those characteristics that enable teachers to embrace change to develop and improve teaching practice as well as sustain professional growth. Professional attributes include modeling scientific inquiry skills and scientific attitudes. These attributes include being reflective, committed to improvement, and becoming active members of their professional community.

Attribute 1: Analyses, evaluates, and refines teaching practices to improve student learning of science
Attribute 2: Works with other teachers within the school and joins professional teachers and/or community organiations to improve the quality and effectiveness of science education

Conclusion

The NCBTS-TSNA is a self assessment tool used currently by all the public school teachers in all the schools since June 2009 in the country. The School Principals/ Heads utilise the results of the TSNA and begin to work on the needs of teachers. This tool was already revised and now called as Classroom Observation Tools-RPMS **(COT-RPMS**) and will be used and implemented next year and the years to come.

The CB- PAST Forms 3A, B and C are tools for formative evaluation of competency- based performance of teachers which is now revised as the **COT-RPMS tools**. Results of which could provide the supervisors with the knowledge of the technical support to be accorded to all Filipino teachers.

The following aspects in science teaching under professional development of science teachers require further exploration and support :

1. Carrying out personal professional reflection through classroom research, peer observation and review;
2. Developing action plans that involve the processes of needs analysis, goal setting, implementation, review and revision;
3. Keeping abreast of contemporary developments in science, pedagogy and policy through continuing professional development;
4. Engaging actively with professional learning communities within the school and beyond; and

5. Upgrading with respect to the three categories – professional knowledge, professional practice, and professional attribute – is an individual decision but this is sustained and enhanced when the efforts are collaborative and synergistic among communities of teachers.

Reference

Results-Based Performance Management System Manual for Teachers and School Heads *prepared by the Department of Education-Bureau of Human Resource and Organization Development(BHROD), the National Educators Academy of the Philippines (NEAP), in coordination with Philippine National Research Center for Teachers Quality (RCTQ).*

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NCBTS-TSNA Orientation Manual Guide for Trainers and Implementers (2007)

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The following is the google drive link for the files: (1) NCBTS; (2) NCBTS-TSNA Self-assessment tool; (3) Instructional Supervisory Tools. URL: https://drive.google.com/ drive/folders/1IupGECh1nHgHo3J0DuAyTJkJmmwuy_Nk?usp=sharing

Chapter 10
Thailand Country Report

Quality of Science Teachers and Science Teaching Evaluated in Thailand

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The system on evaluating quality of teachers and science teaching in Thailand is still inactive yet. Although, KHURUSAPHA announce a Teacher Standards, there is no formal evaluation for the quality of teachers and also their teaching profession practice.

Regarding the assurance in terms of quality of teachers, KHURUSAPHA has launched criteria and standards for pre-service teachers to apply for teaching license, and also for in-service teachers to retain their teaching license. Teacher is not simply identified as a career, but profession in education, which gives services to the public based on knowledge and expertise. It is specific, not overlapping with other professions, and with established standards. Professional educators, including teachers, must have sufficient training both in theory and practice before entering it. Therefore, there must be control over the profession by having standards suitable for its status. It differs from simply being a career, which specifically involves the expectation of remuneration in order to make a living.

The profession in education is highly esteemed as belonging to honorable profession. Educational educators involved must naturally have greater responsibility because of the impact they have on the service end-users and the public. Therefore, it is necessary to have specific controls over the profession to create confidence in it. Therefore, Professional educators must utilise intellectual methods; with a long period of training; having professional autonomy according to professional standards; a professional code of ethics; and professional institutes or organisations as the center of creativity and promotion of the profession.

The profession in education which the Teachers and Educational Personnel Council Act B.E. 2546 prescribes it to be a practice of licensed profession, mandates standards for the profession stipulating its primary duty relating to the teaching and learning process and promotion of learning among learners through various methods; including responsibility for administration of public and private Educational Institutes at early child, basic and higher education levels below a degree level; and educational administration outside Education Institutes at the Educational district level; as well as education support; provision of services or undertaking of activities in relation to the teaching and learning process, supervision and education administration in various Educational Agencies consisting of:

1. The Profession of Teachers
2. The Profession of Educational Institution Administrators
3. The Profession of Education Administrators
4. The Profession of other Education Personnel (Supervisors)

Those who are going to enter the said professions must receive a professional license to practice from KHURUSAPHA before beginning practicing the profession, with the exception of those who have been permitted by law not to have a professional license. In addition, when in the profession, they must follow professional practices under the established restrictions and conditions. They also must perform and conduct themselves according to the professional standards of ethics of the profession. This has to be followed in order for the profession to be conducted in accordance with the prescribed standards.

Entering the Profession

Through the enforcement of the Teachers and Educational Personnel Council Act B.E. 2546, enacted on 12 June B.E. 2546, Professional Educators, namely; Teachers, Educational Institution Administrators, and Education Administrators and Other Educational Personnel designated in the ministerial regulation took effect, are given the right to apply for a license to practice. The Act also creates professional standards, suitable for the professional practice, to allow those who want to practice the profession after the valid enforcement of the Act, to develop knowledge and experience in accordance with the established standards in order to apply for the license and to use it to show that they have qualification in accordance with the established standards and that they are well-equipped to practice. KHURUSAPHA, then, issued its regulations on Professional Standards and Ethics B.E. 2547 effective from 9 December B.E. 2547 and its regulations on Professional Standards and Ethics B.E. 2548 effective from 5 September B.E. 2548

Those who want to have a profession in education shall have to go through the following process in obtaining a professional license:

1. Those who want to work in the teaching profession must meet any one of the following:
   (1) Those with a degree in education or other degree designed by the Teachers' Committee, Gor Por, to fit in the employment and appointment of a teaching post before the effective date of the Teachers and Educational Personnel Council Act B.E. 2546, are able to use such qualifications in applying for a professional license.
   (2) Those with a degree in education which includes teaching practices in an institution not exceeding one year according to the curriculum for the degree in education or equivalent degree or other certification certified by KHURUSAPHA, showing their knowledge and ability in
      - Language and Technology for Teacher
      - Curriculum Development
      - Pedagogy
      - Psychology for Teacher
      - Learning Assessment and Evaluation
      - Classroom Management
      - Educational Research
      - Educational Innovation and Information Technology
      - Teaching Profession.
   (3) Those with the qualifications other than the ones in (1) and (2), if they want to enter the profession must be certified on professional knowledge and experience by KHURUSAPHA stating that they have knowledge, testing and training in accordance with the criteria prescribed by KHURUSAPHA, before applying for the license for professional practice.

2. Those who want to work in the professions of Educational Institution Administrators, Education Administrators, and other Educational Personnel must have the following qualifications:
   (1) A license for the teaching profession
   (2) Professional knowledge and experience according to professional standards in the Regulations of KHURUSAPHA on Professional Standards and Ethics B.E. 2548.

Retaining Oneself in the Profession

Those who have received a license for professional practice must practice the teaching profession under restrictions and conditions. They also have to practice and conduct themselves in accordance with professional standards and ethics for the profession as well as to develop professional teaching practice to correspond with the conditions set forth in the renewal of the license for professional practice in order to retain oneself in the professional field according to the stipulated professional standards as follows:

1. Retaining Oneself in the Professional Field

Professional educators with a license to practice, dated five years from the date of the issuance of the license, have to develop their skills and professional practices in order to attain the criteria set up by the Teachers' Council of Thailand Board for the renewal of the license.

2. Developing Professional Practice

Professional educators shall receive professional training in knowledge and experience, performance and practice under professional standards and ethics for the profession. KHURUSAPHA has established a development strategy and system to increase professional educator potential, to promote and create social confidence, faith and trust, relevant to those for honorable professional practice.

3. Acquiring Expertise in Professional Practice

Professional educators with performance to the quality level of an expert according to the professional standards under the rule and regulations of KHURUSAPHA shall be certified as experts in professional practice.

4. Promoting, Supporting, Commending and Upholding Professional Educators

Professional educators who practice and conduct themselves in accordance with the professional standards and ethics for the professional and also with clear evidence of work, shall be officially recognized and held in high esteem as a various forms.

Chapter 11
Vietnam Country Report

THE QUALITY AND ASESSMENT OF NATURAL SCIENCE TEACHERS IN VIETNAM

By Dr. Duong Quang Ngoc, The Vietnam Institute of Educational Sciences, Hanoi, Vietnam

1. The Placement of Science Subject in Vietnamese General Education System

There is no Science subject particularly in Vietnam but it is organised into specific subjects.

At primary level: Nature and Society- Grade 1, 2, 3 and Science- Grade 4, 5.

At secondary level (from Grade 6 to Grade 9) and high school level (from Grade 10 to Grade 12): Physics, Chemistry, and Biology.

The duration of subjects which belong to natural science field in each level and grade is shown in the following Table 10 and Table 11.

Table 10
The Duration of Subjects at Primary Level

Subject	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Nature and Society	35 hours[2]	35 hours	70 hours		
Science				70 hours	70 hours

Table 11
The Duration of Subjects at Secondary Level and High School Level

Subject	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Physics	35 hours	35 hours	35 hours	70 hours	70 hours	70 hours	70 hours
Chemistry			70 hours	70 hours	70 hours	70 hours	70 hours
Biology	70 hours	70 hours	70 hours	70 hours	35 hours	52 hours	52 hours

[2] One hour equals 40 minutes at primary level

According to a scheme of innovating curriculum and textbook at general education after 2015, there are some new subjects which are Life around us (Grade 1, 2, 3) and Discover nature (Grade 4, 5) at primary level; Natural science at secondary and high school levels.

2. Natural Science Curriculum and Textbooks in Vietnamese General Schools

Curriculum and textbooks of Natural Science subject in Vietnam have undergone numerous changes to meet the needs of each period. Since 1945, natural science curriculum has changed five times. The current curriculum has been implemented since 2002.

The structure of current curriculum of Natural Science subject in Vietnam is suitable with general structure of curriculum in many countries around the world which includes various elements: Subject objectives (knowledge, skills and attitude); scope and structure of content; knowledge and skill standards and achieved requirement of attitude after each stage of learning; methods and organisational forms of teaching; and way of evaluating learning outcomes.

Curriculum ensures a balance between theory and practice, focus on teaching mounted with the reality and can be designed based on the spirit of ensuring knowledge system of Natural science; at the same time ensure the suitability with cognitive level of Vietnamese students. The curriculum also expresses the spirit of innovating teaching method towards improving activeness, aggressiveness and creation of student; innovating learning assessment. However, due to the characteristic of Natural Science in Vietnam that is divided into 3 specific subjects: Physics, Chemistry and Biology presented in theoretical system, the relationship between Natural Science and the real life of learner has not been shown. Therefore, students often obtain scientific knowledge passively and often confuse with scientific events, and phenomenon which are close to daily life.

The issue of textbooks: There is only one type of textbook in the whole country. Most of the textbook authors are experienced scientists, teachers in researching and teaching. Textbook of Natural Science keeps abreast with the framework of national curriculum, concretise contents needed to learn adequately, ensure suitability and logical development of knowledge. Natural Science textbook in general education in Vietnam has compiled towards facilitating teacher organising learning activities to obtain scientific knowledge, practical elements chosen and put in textbook more than before. The presentation of textbook facilitates student self- learning and teachers can also use it as a way of innovating teaching method.

3. Teaching Staff of Natural Science Subject in Vietnamese General Schools

The number of teachers teaching Natural Sciences in Vietnam accounts for a high percentage in total of general teachers (according to collected data of MOET[3], there was 847,752 general teachers in Vietnam in school year 2012 – 2013). According to statistics of MOET in school year 2012 – 2013, the percentage of teachers who have training level over standards in every level are: Primary: 99.69%; Secondary:

[3] MOET: Ministry of Education and Training

99.33%; and high school: 99.61%. In general, teaching competency of teachers can meet the basic needs of curriculum. Most of them understand the spirit, requirements, and logic of teaching contents but these understanding mostly stand at textbook while the whole body of curriculum is not gained firmly, knowledge about application of subject profession is still limited. In recent years, a number of quality students attend to pedagogical universities that lead to the quality of teacher. In addition, pedagogical universities sometimes do not meet the need of innovation that is suitable with new curriculum, textbook and teaching method.

4. Training and Retraining of Natural Science teachers

The vast majority of Natural Science teachers in Vietnam have been trained in pedagogical institutions which include: pedagogical colleges (train primary teachers); pedagogical colleges (train secondary teachers); pedagogical universities (train high school teachers). In recent years, there are many primary teachers who have been trained in pedagogical colleges or universities, similar to secondary teachers. In addition to pedagogical universities, there are some other universities which have pedagogical faculty who also take part in training teachers.

However, these pedagogical institutions do not really serve general curriculum effectively and tend to focus on equipping knowledge of Natural Science while do not emphasise on pedagogical profession. Therefore, students who graduated from pedagogical colleges mostly meet the need of professional knowledge but some young teachers are still unfamiliar with innovation of teaching method as well as other educational activities at school.

The issue of retraining teacher has been implemented in various ways: organising summer retraining course for teachers by MOET and MOET in provinces, organising seminars for researching theoretical materials of pedagogical profession in professional groups in schools. Besides, many schools improve researching activities as well as exchange, discussion by groups, professional groups and apply to deal with every obstacles towards innovation teaching method; organise retraining phases which is alternated or mixed into professional activities; fostering workmanship every week, every month in professional groups or in teaching festivals; excellent teacher festivals of all levels. However, retraining teacher issue is not close to the requirement of improving knowledge as well as pedagogical profession and does not follow the orientation of innovating teaching method. The relationship between training at pedagogical institutions and using workforce in general schools along with the direction from management levels is still inadequate.

5. Grading and Evaluation of Natural Science Teachers

General schools in Vietnam often conduct teacher evaluation based on legal documents issued by MOET every year. Natural science teachers as well as other subject teachers are graded following general regulations. The evaluation of primary teacher is based on professional standards for primary teachers while the evaluation of secondary teachers is based on professional standards for secondary teacherswhich include 6 standards and 25 criteria.

Standard 1: Qualities of politics, ethics, lifestyle

Standard 2: Competency of finding out object and educational environment

Standard 3: Teaching competency

Standard 4: Educational competency

Standard 5: Competency of politics and social activities

Standard 6: Competency of developing occupation

The processes of evaluation, grading, and classification of secondary teachers based on standards are conducted as follows:

Step 1: Self- evaluation and grading by teacher

Step 2: Evaluation and grading by professional group

Step 3: Evaluation and grading by principal

Evaluation of teacher based on standards essentially is evaluation about occupational competency of the teacher. These competencies are expressed in terms of qualities of politics, ethics and lifestyle as well as pedagogical competency of teacher. Evaluating the teacher based on standards is the process of collecting appropriate and adequate evidences to identify the level of occupational competencies of the teacher. These professional standards will:

- Help the teacher in self-assessment of qualities of politics, ethics, lifestyle and occupational competency. Hence, teachers can develop plans of practicing qualities of ethics and improving their professional level;

- Create a basis to evaluate and grade teacher annually in order to design training plans as well as retraining and using teaching staff;

- Create a basis to design and develop training and retraining plans for teachers; and

-Create a basis to research, propose, and implement policies for teachers and provide materials for other management activities.

Evaluation of the teachers based on standards is not only for commenting formulation annually but also for reviewing what teachers have implemented as well as what teachers can and need to conduct. Based on this, teachers are encouraged to design curriculum, self- practice plan as well as self- retraining to improve their professional standard.

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Chapter 12

The Analysis of Output: Dimensions of the Southeast Asia Regional Standards for Science Teachers (SEARS-ST)

The development of SEARS-ST document resulted in the following four dimensions within which are a number of components. Each component has one or more elements.

Dimension 1: Professional Knowledge

This dimension encompasses knowledge and understanding of the fundamental ideas, principles and interdisciplinary/interconnected nature of science (Table 12). In this dimension, the word 'knowledge' is used generically to include 'understanding and application'. This knowledge is intertwined with effective pedagogy in the teaching and learning of science such as inquiry-based approaches. The latter includes an in-depth knowledge of the characteristics of the students and implications for the use of appropriate strategies for students of varying abilities, socio-cultural and religious backgrounds. This dimension also emphasizes the use of prevailing technologies as a means to promote deep engagement with the concepts and the procedures of science.

Key Aspects:

- Developing knowledge and understanding of the fundamental ideas, principles and interdisciplinary/interconnected nature of science
- Developing knowledge and understanding of scientific processes, inquiry methods and procedures
- Developing knowledge and understanding of science curriculum, assessment, teaching and learning
- Developing knowledge and understanding of students and their science learning within the learning environment
- Developing knowledge and understanding of the use of technology in science teaching and learning

Table 12
Components and Elements for Dimension 1 Professional Knowledge

Components	Elements
Knowledge of science	Knowledge of science content (e.g. facts, concepts, principles, theories, philosophies, explanation, ideas, etc.)
	Knowledge of nature of science (NOS) (e.g. tentativeness, etc.)
	Knowledge of scientific skills (include science process skills and science manipulative skills
	Knowledge of science in the cultural context (e.g. religion, indigenous knowledge, etc.)
	Knowledge of scientific attitude and noble values
	Knowledge of the big ideas in science [e.g. energy, climate, interconnectedness of science with other disciplines, etc.]
	Knowledge of application and implication of science [e.g. Sustainable Development (including conservation, waste management, etc.)]
Knowledge of science teaching and learning	Knowledge of a range of relevant theories, models and practices in science teaching and learning
	Knowledge of current research in science teaching and learning (e.g. new approaches, in creating positive teaching and learning environments)
	Knowledge of the repertoire of effective science teaching strategies
	Knowledge of strategies to address needs of diverse learners (e.g. ability, cultures), in diverse teaching and learning environments
	Knowledge of curriculum
	Knowledge of assessment
Knowledge of students	Knowledge of students' motivation and engagement in learning science (e.g., attitudes toward science, students' educational expectations, readiness to learn)
	Knowledge of students' background (e.g. socioeconomic, home environment support, cultural, ethnic and religious)
	Knowledge of developmental characteristics of the students(e.g. physical, social, emotional, spiritual and intellectual)
	Knowledge of students' learning needs (e.g. literacy, special needs, etc.)

(continued)

Components	Elements
Knowledge of students' learning of science	Knowledge of the impact of students' prior knowledge and skills on their science learning
	Knowledge of factors that promote science learning (e.g., school resources, teaching and learning approaches of science, contexts, school climate, etc.)
	Knowledge of potential difficulties in learning particular science concepts
	Knowledge of the application of learning and pedagogical theories in the teaching of science
	Knowledge of students' learning progression
Knowledge of enhancing students' thinking	Knowledge of strategies for supporting creativity and innovation in science
	Knowledge of strategies for developing students' higher order thinking (including metacognitive) skills in science
	Knowledge of strategies for developing students' ability in making interconnections between key concepts in science
Knowledge of ICT	Knowledge of integration of ICT in the teaching and learning of science (e.g. supporting learning of concepts, modelling, solving science problems, etc.)
	Knowledge of application of ICT in the assessment of science learning
	Knowledge of application of ICT in administration (e.g. monitoring and recording)
	Knowledge of developing students' ability in using of ICT in learning science
Knowledge of health and safety	Knowledge of safety related to science activities (e.g. handling laboratory equipment and chemicals, disposing waste, doing field work, etc.)
	Knowledge of risk assessment related to science activities (e.g. slippery floor, current health threat, etc.)
	Knowledge of emergency procedures
	Knowledge of health and safety regulation, procedure, policy and law

Dimension 2: Professional Practice

This dimension encompasses the teacher's competencies in effective planning, implementing lessons and assessing learning in science (Table 13). Professional practice must focus on the development of students holistically in terms of the cognitive, psychomotor, affective, social and spiritual domains. The learners in the 21st century will need to acquire knowledge and skills across all the aforementioned five domains. Acquiring knowledge and skills will enable students to think critically and creatively, solve problems, make informed decisions, collaborate and communicate effectively.

Key Aspects:

- Provide students with appropriate learning experiences that are meaningful and relevant
- Create a positive and safe learning environment where students are encouraged to participate actively (mind, body and emotion)
- Use a variety of assessment methods to inform, monitor and evaluate teaching and student learning
- Reflect critically on teaching and learning to evaluate and improve teaching practice and student learning

Table 13
Components and Elements for Dimension 2 Professional Practice

Components	Elements
Plan and design effective learning experiences	Plan and design a range of meaningful and relevant learning activities that are aligned to the curriculum (e.g. learning objectives, methods and assessment)
	Plan and design assessments to inform teaching and learning
	Plan to use appropriate teaching and learning technologies and tools that aid teaching and advance learning
Implement teaching and learning plans	Promote student scientific inquiry to develop deep understanding and foster values and attitudes related to science
	Engage students in reflecting on the nature of science
	Use appropriate strategies to foster key skills and to address the needs of diverse learners as well as diverse teaching and learning environments
	Use appropriate questioning and discussion techniques to challenge students' thinking and engage them effectively
	Use appropriate scientific language and correct concepts
	Manage student behaviour effectively (e.g. expectations for, monitoring of and response to student behaviour)
	Establish a positive culture for learning (e.g. create an environment of value, respect and rapport)
	Manage safe classroom and laboratory routines, procedures, transitions, materials and supplies effectively
	Use technologies and tools effectively to aid teaching and advance learning
	Provide effective enrichment and enhancement experiences for science learning beyond the classroom

(continued)

Components	Elements
Implement assessment plans	Use a range of types and strategies of assessments continuously (in terms of the cognitive, skills and affective domains)
	Set and share assessment criteria with students
	Give timely, specific, relevant and accurate feedback to advance student learning
	Describe, analyse, evaluate and document student performance data
	Use performance data to inform and improve teaching practice and student learning
	Communicate learning results to students, parents and other stakeholders
Reflect critically on teaching and learning	Use data about learning to reflect on and assess student learning
	Use data about learning to reflect on and evaluate teaching practice
	Use evidence to reflect on and identify areas for professional growth

Dimension 3: Professional Attributes and Ethics

This dimension encompasses elements of personal attributes and responsibilities towards self and others that are relevant to the science teaching profession (Table 14). The focus is on attitudes for effective teaching whereby science teachers must have the desire to listen, to learn, and to apply knowledge. A commitment to continuing professional development is paramount to uphold the teaching profession. Science teachers should be committed to be involved with the community in and outside the school for the promotion of science learning.

Key Aspects:

- Science teachers should exhibit personal attributes that assist students to engage, appreciate, value, challenge their science learning and develop their full potential
- Science teachers should engage with the school communities to promote science learning
- Science teachers should act ethically, behave in ways that uphold the teaching profession, comply to regulations and should be accountable to their students

Table 14
Components and Elements for Dimension 3 Professional Attributes and Ethics

Components	Elements
Personal attributes	Passionate about science and teaching science
	Be able to apply a range of ways of teaching and managing the classroom appropriate to the needs of their students
	Reflect regularly on own practices for continuous improvement
	Be open and prepared to implement new ideas with regards to teaching and learning
	Be a positive role model who is inquisitive as well as open to new ideas and evidence in science
	Act with integrity and with a strong conscience of their personal and professional responsibility

(continued)

Components	Elements
Personal responsibilities towards others	Demonstrate caring and approachable attributes
	Show positive expectations and support for the total development of the students
	Impart values, knowledge and skills enthusiastically
	Empower students to take charge of their own science learning (and advancement)
	Engage in school and community science activities to promote science learning
	Demonstrate and encourage scientific ethics
	Implement health and safety measures
Professional ethics	Comply with the Professional Code of Ethics for teachers
	Model personal and social responsibility for citizenship (e.g. sustainability of living environment, co-existence of humans, well-being, safety of children, etc.) to contribute to the harmony and betterment of the nation and the world at large

Dimension 4: Professional Development

This dimension encompasses the importance of science teachers reflecting professionally on their practice, where they are responsible for their personal and professional development, including their contribution to professional groups and organizations to improve students' outcomes (Table 15). Professional reflection involves the collection of evidence, reflection that is supported by peers, analysis and review of practice, as well as the identification of strengths and weaknesses. The action planning process may be facilitated through mentoring or coaching. The dimension also encompasses the importance of being an active member of professional learning communities.

Key Aspects:

- Carrying out personal professional reflection through classroom research, peer observation and review
- Developing action plans that involve the processes of needs analysis, goal setting, implementing, reviewing and revising
- Keeping abreast of contemporary developments in science, pedagogy and policy through continuing professional development
- Engaging actively with professional learning communities within and beyond the school

Table 15
Components and Elements for Dimension 4 Professional Development

Components	Elements
Reflecting on evidence	Collecting classroom evidence (e.g. students' work, portfolio, observation, etc.)
	Analyzing the evidence collected in relation to students' outcomes (e.g. student' work, portfolio, observation, etc.)
	Identifying own professional strengths and weaknesses to inform professional development needs
	Reflecting with peers (e.g. coach or mentor) to improve professional practice
Developing and implementing action plans	Identifying professional development needs
	Formulating professional development goals
	Developing strategies for achieving professional goals
	Implementing action plans
	Reviewing achievement of action plans
	Revising action plans for further improvement

(continued)

Components	Elements
Enriching professional knowledge	Keeping abreast of contemporary scientific developments (e.g. reading publications,attending meetings, workshops, colloquia,etc.)
	Keeping abreast of contemporary pedagogies
	Keeping abreast of educational policies
	Engaging with scientists and science educators
Collaborating with professional learning communities	Participating in professional groups (e.g. professional associations, department team, lesson study groups, etc.) at school, state, national and/or international levels
	Sharing exemplary practices within and beyond the school(e.g. participating in professional learning communities, delivering professional development courses and workshops either orally or in written form)
	Becoming a mentor or a coach

Chapter 13
Conclusion and the Way Forward

This chapter summarises the efforts of SEAMEO RECSAM to initiate the development of Southeast Asian Regional Standard for Science Teachers (SEARS-ST) document through a regional collaborative effort participated by curriculum specialists, experts and officers from the SEAMEO Member Countries. Similar efforts for Southeast Asian Regional Standard for Mathematics Teachers (SEARS-MT) were also reported by Thien and Ng (2016) in Thien and Mohd. Johan (2016).

Summary and Implications

The SEARS-ST is developed for the benefits of the science teachers and educators from the 11 SEAMEO Member Countries. Prior to the development of SEARS-ST in 2014, Southeast Asian country representatives, except Myanmar, Singapore and Timor-Leste, have presented their respective country reports (refer Part II for the updated version) outlining the existing policy or standards related to science teachers' quality in their own context. Some of the country representatives also updated their respective country reports between 2015 and 2017. All information is summarised in Table 16.

Table 16
Summary of Existing Policy or Standards Related to Science Teachers' Quality

Country	Existing Policy or Standards Related to Science Teachers' Quality
Brunei Darussalam	▪ Assuring qualities of science teachers by Higher Education Institution ▪ Assuring qualities of science teachers by the Ministry of Education (MOE) ▪ The National Education System for the 21st Century Science Curriculum– *Sistem Pendidikan Negara Abad ke-21* (SPN 21) (as reported in 2014)
Cambodia	▪ Pre-service teacher training curriculum system ▪ In-service teacher training programme
Indonesia	▪ Teachers' academic qualification and competency standard - Pedagogical competency - Personal competency - Professional competency - Social competency ▪ Teacher certification to assure science teacher quality based on portfolio assessment ▪ The learning process standard to assure quality in science teaching

Country	Existing Policy or Standards Related to Science Teachers' Quality
Lao PDR	▪ Pre-service teacher training programme to ensure teacher quality
Malaysia	▪ Curriculum standard by Curriculum Development Division, Ministry of Education (MOE) ▪ Higher Standard Quality of Education for Malaysian Schools (in Malay language *Standard Kualiti Pendidikan Malaysia* or SKPM) by The School Inspectorate and Quality Assurance (in Malay language *Jemaah Nazir dan Jaminan Kualiti* or JNJK) ▪ The Malaysian Teacher Standard (or in Malay language *Standard Guru Malaysia*) by MOE, Malaysia ▪ The Quality Standard of Management and Teaching Science for Primary as well as Secondary School by The School Inspectorate and Quality Assurance (JNJK)
Philippines	Philippine Professional Standards (PPST), which is built on National Competency Based Teacher Standards (NCBTS) , compliments the reform initiatives on teacher quality from pre-service training to in-service training. 1. Recognize the importance of mastery of content knowledge and its interconnectedness within and across curricular areas, coupled with a sound and critical understanding of the application of theories and principles of teaching and learning. 2. Provide learning environment that are safe, secure, fair and supportive in order to promote learner responsibility and achievement. 3. Establish learning environment that are responsive to the learner diversity. 4. Interact with the National and local curriculum requirements. 5. Apply a variety of assessment tools and strategies in monitoring, evaluating, documenting and reporting learner's needs, progress and achievement. 6. Establish school-community partnerships aimed at enriching the learning environment, as well as the community's engagement in the educative process. 7. Value personal growth and professional development and exhibit high personal regard for the profession by maintaining qualities that uphold the dignity of teaching such as caring attitude, respect and integrity. Source: Philippine Professional Standards for Teachers (PPST), Nationally-validated version: Finalised as of August 4-5, 2016.
Thailand	▪ General Professional Standard - Standards of Conduct - Standards of Teachers' Experience - Standards of Teachers' Knowledge - Standards of Teachers' Performance ▪ National Basic Core Curriculum ▪ Ordinary National Educational Test (O-NET) to assure teacher quality ▪ Standards for academic standing ▪ Ten (10) of Science Teachers Standard pertaining to assessment, communication skills, content knowledge, professional learning community as well as teaching and learning.

Country	Existing Policy or Standards Related to Science Teachers' Quality
Vietnam	▪ Attending pedagogical colleges and pedagogical universities ▪ Retraining of natural sciences teachers organised by MOET ▪ Grading and evaluating of natural sciences teachers (6 standards and 25 criteria)

It is notable that not every Southeast Asian country has a specific nationally-recognised standard pertaining to science teachers although policy and standards or efforts had been documented as well as initiated to assure teacher quality in terms of qualification and professional teaching. Therefore, in line with the aspiration of ASEAN integration, it comes to the right time to propose a Southeast Asian Regional Standard for Science Teacher (SEAR-ST) that could be used across the 11 Southeast Asian countries. Based on the constructive discussions among experts and country representatives in the two workshops, the SEARS-ST has been developed consisted of four dimensions: (1) professional knowledge, (2) professional practice, (3) professional attributes and ethics as well as (4) professional development. The conceptual meaning for each dimension is as follows.

- **Professional knowledge** refers to understanding of science, scientific skills, as well as scientific and noble values, to be competent in teaching scientific knowledge or deliver science content effectively so that students can possess scientific endeavour to understand natural phenomena and technological advancement for better life.
- **Professional practice** refers to teachers' ability to develop teaching strategies and employ appropriate tools as well as resources to engage students in science, promote student-centred inquiry-based learning to gauge students' learning outcome and conduct authentic assessment for learning.
- **Professional attributes and ethics** refers to teachers' personal and professional characteristics including passion to infuse students with enthusiasm to pursue science, intellectual, and scientific curiosity to inspire students to love science as well as being the role model in practising scientific attitudes and noble values.
- **Professional development** refers to the continuous involvement of teachers to improve or keep abreast with latest knowledge, skills towards maintaining professional standards in science teaching on an individual basis, and work collaboratively in their community to fulfill each other's professional needs.

Recommendations and Future Direction

The SEARS-ST is not a binding document and should be used as reference for the country experts to develop their respective tools for the enhancement of science teachers' proficiency and evaluation of the standard level of the teachers. Additional local descriptors could be added under the four dimensions of SEARS-ST. The revised document could serve as a model for the development of science teachers' quality standards and as the benchmarking in the formulation of any development initiatives or Research and Development (R&D) activities to enhance the quality of science teachers.

The SEARS-ST has been incorporated into the preparation of framework of Centre's projects/programmes with presentation and dissemination of findings in the following list of both international and national platforms:

- 3rd Regional Conference on Campus Sustainability (3RCCS), Adamson University, Manila, Philippines, 7–9 April, 2016 (Ng, et al., 2016).

  Title: *Preparing Sustainable Platforms for Professional Development and Networking: A Reflective Study towards Stronger SEAMEO Community*.

- 1st Regional Conference on Campus Sustainability (1RCCS) 2014, Universiti Malaysia Sabah, 8-9 April 2014 (Ng, Aligaen, Thien, & Hazura, 2014).

  Title: *Tracking Milestones and the Way Forward: The Roles of a Regional Centre in Building Sustainable Campus Integrating Blended Approaches*

Feedback from the presentations above has engendered several recommendations and follow-up activities. The authors felt the need for the Centre in collaboration with MOE in the region and collaborative partners to pursue on the following activities.

- Development of a set of local descriptors [as has been prepared for Malaysian Science Teachers' Quality Standards (MSTQS)(2015)] based on the alignment between teachers' perception and the four dimensions that underlying SEARS-ST especially for the countries that are still in the process to develop their own science teacher quality standards (MTQS).
- Developing science teachers' profile with the main focus on the extent to which science teachers have attained based on the four dimensions of SEARS-ST: (1) professional knowledge, (2) professional practice, (3) professional attributes and ethics, and (4) professional development to inform policy making for each individual country.
- Development of a reliable and valid instrument to measure science teacher quality based on the four dimensions of SEARS-ST: (1) professional knowledge, (2) professional practice, (3) professional attributes and ethics, and (4) professional development.
- Dissemination of documents related to SEARS-ST and MSTQS using blended-mode platforms, e.g., uploading the documents online onto the official website of the Centre (SEAMEO RECSAM, 2014) and social learning platforms, conducting seminar/colloquium supported by digital tools to reach out to wider audience (Ng, Ng, Devadason, & Lay, 2015), and so forth.
- Various studies were conducted and reported. For example, 'Reinvigorating Technology-enhanced Science Learning with MSTQS as a Guide' as reported by Devadason, Ng, Ng, and Lay (2016); 'The Examination of the Construct Validity of the Malaysian Teacher Disposition Index (MTDI)' as reported by Lay, Ong, Ng, and Norazah (2016); 'The Development of MSTQS from SEARS-ST' as reported by Ng, Devadason, Lay, and Ng (2015); as well as 'The Development of SEARS-ST for Teacher Professionalism in Science and Technology Education (STE)' as reported by Ng, Devadason, Lay, and Ng (2016, 2017). Further studies should also be conducted to examine how the development of SEARS-ST and MSTQS could affect science teachers' performance to raise students' achievement in the international assessment such as TIMSS and PISA.

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Appendix A

List of Participants During the 1st SEARS-ST (20-22 January 2014) Workshop

Invited Consultants or Experts:

Dr. Mark Windale	Sheffield Hallam University, United Kingdom
Prof. Dr. Lindsey Conner	New Zealand
Prof. Ismundar Ismu	SEAMEO QITEP Science, Indonesia
Assoc. Prof. Dr. Nabilah Abdullah	Universiti Teknologi MARA (UiTM), Malaysia
Assoc. Prof. Dr. Lay Yoon Fah	Universiti Malaysia Sabah, Malaysia
Dr. Devadason Robert Peter	Institut Pendidikan Guru Malaysia (IPGM) Kampus Ipoh, Malaysia
Datin Dr. Ng Soo Boon	Curriculum Development Division (CDD), Ministry of Education (MOE), Malaysia
Assoc. Prof. Dr. Mageswary Karpudewan	Universiti Sains Malaysia, Penang, Malaysia
Assoc. Prof. Dr. Nurulhuda Ab. Rahman	Universiti Pendidikan Sultan Idris (UPSI), Tanjong Malim, Malaysia
Ms. Nor Ruzaini Jailani	Institut Pendidikan Guru Malaysia (IPGM) Ilmu Khas, Kuala Lumpur, Malaysia
Mr. Azmi b. Harun	Curriculum Development Division, MOE Malaysia
Mr. Chin Chee Keong	IPGM Kampus Tuanku Bainun, Malaysia
Ms. Linda Toh	Penang Free School, Penang

SEAMEO RECSAM Staff:

Dr. Hj. Mohd. Johan bin Zakaria	Centre Director, SEAMEO RECSAM, Penang, Malaysia
Mr. Shamsul Azha b. Md. Yusuf	Deputy Director (Administration Division), SEAMEO RECSAM, Penang, Malaysia
Dr. Suhaidah Tahir	Deputy Director [Research and Development (R&D) Division], SEAMEO RECSAM, Penang, Malaysia
Dr. Ng Khar Thoe	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Hazura Ab. Bakar	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Corrienna Abdul Talib	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Nur Jahan Ahmad	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Thien Lei Mee	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Kanageswary Karpudewan	Specialist (R&D Division), RECSAM, Penang, Malaysia

Dr. Leong Chee Kin	Deputy Director [Training Programme Division (TPD)], SEAMEO RECSAM, Penang, Malaysia
Dr. Koay Suan See	Specialist (TPD), SEAMEO RECSAM, Penang, Malaysia
Mr. Julito C. Aligaen	Specialist (TPD), SEAMEO RECSAM, Penang, Malaysia
Mr. Dominador Dizon Mangao	Specialist (TPD), SEAMEO RECSAM, Penang, Malaysia
Mr. Lee Shok Mee	Specialist (TPD), SEAMEO RECSAM, Penang, Malaysia

Group Photo and Snapshots of Activities During the 1st SEARS-ST Workshop

Figure 2. Photo taken during 1st 'Southeast Asia Regional Standards for Science Teachers' (SEARS-ST) workshop (20-22/1/2014)

Third and fourth row(from left): Dr. Kanages Shanmugam (ex-RECSAM); Mr. Dominador Dizon Mangao (RECSAM); Assoc. Prof. Dr. Lay Yoon Fah (UMS); Mr. Chin Chee Keong (IPGTB); Datin Dr. Ng Soo Boon (CDD, Malaysia); Mr. Lee Shok Mee(RECSAM); Assoc. Prof. Dr. Mageswary Karpudewan (USM); Ms. Nor Ruzaini (IPGM Ilmu Khas); Assoc. Prof. Dr. Nabilah Abdullah (UiTM); Dr. Devadason Robert Peter (IPGM Kampus Ipoh); Ms. Linda Toh (Penang Free School);
Second row(from left): Dr. Koay Suan See (ex-RECSAM); Dr. Thien Lei Mee (ex-RECSAM); Dr. Nur Jahan Ahmad (RECSAM); Dr. Corrienna Abd. Talib (ex-RECSAM); Assoc. Prof. Dr. Nurulhuda Ab. Rahman (UPSI); Dr. Hazura Ab Bakar (ex-RECSAM);
First row(from left): Dr. Ng Khar Thoe (RECSAM); Prof. Dr. Lindsey Conner (New Zealand); Dr. Suhaidah Tahir (ex-RECSAM); Dr. Hj. Mohd. Johan b. Zakaria (RECSAM); Dr. Mark Windale (United Kingdom); Prof. Ismunander Ismu (ex-SEAQIS Indonesia

Figure 3. The 1st SEARS-ST Workshop activities in progress.

Appendix B

List of Participants During the 2nd SEARS-ST (16-18 June 2014) Workshop

Invited Consultants or Experts:

Dr. Mark Windale	Sheffield Hallam University, United Kingdom
Prof. Dr. Lindsey Conner	New Zealand
Prof. Datuk T. Subahan Mohd. Meerah	Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia
Assoc. Prof. Dr. Nabilah Abdullah	Universiti Teknologi MARA (UiTM), Malaysia
Assoc. Prof. Dr. Lay Yoon Fah	Universiti Malaysia Sabah, Malaysia
Dr. Devadason Robert Peter	Institut Pendidikan Guru Malaysia (IPGM) Kampus Ipoh, Malaysia
Assoc. Prof. Dr. Mageswary Karpudewan	Universiti Sains Malaysia, Penang, Malaysia
Ms. Nor Ruzaini Jailani	Institut Pendidikan Guru Malaysia (IPGM) Ilmu Khas, Kuala Lumpur, Malaysia
Mr. Shamsulbahri Muhammad	Ministry of Education, Brunei Darussalam
Dr. Thongloon Vilaythong	Lao PDR
Dr. Duong Quang Ngoc	Vietnam
Dr. Luz E. Osmena	Philippines
Dr. Kusalin Misukul	Thailand
Mr. See Sin Tion	Ministry of Education, Brunei Darussalam
Mr. Kandi Do	SEAMEO QITEP Science (SEAQIS), Indonesia
Mr. Mam Chansean	Cambodia
Mr. Retzy Noer Azizah	CDETEP and ex-SEAQIS, Indonesia
Mr. Chin Chee Keong	IPGM Kampus Tuanku Bainun, Malaysia
Ms. Komala Devi	SMK Convent Butterworth, Butterworth, Penang
Ms. LindaToh	Penang Free School, Penang

SEAMEO RECSAM Staff:

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Dr. Suhaidah Tahir	Deputy Director [Research and Development (R&D) Division], SEAMEO RECSAM, Penang, Malaysia
Dr. Ng Khar Thoe	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Nur Jahan Ahmad	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Hazura Ab. Bakar	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Corrienna Abdul Talib	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Thien Lei Mee	Specialist (R&D Division), RECSAM, Penang, Malaysia
Mr. Dominador Dizon Mangao	Specialist [Training Programme Division (TPD)], SEAMEO RECSAM, Penang, Malaysia
Mr. Marmon Pargunsan	Specialist (TPD), SEAMEO RECSAM, Penang, Malaysia

Group Photo and Snapshots of Activities During the 2nd SEARS-ST Workshop

Figure 4. Photo taken during 2nd 'Southeast Asia Regional Standards for Science Teachers' (SEARS-ST) workshop (16-18/6/2014).

Second row(from left): Mr. Shamsulbahri Muhammad (Brunei Darussalam); Dr. Thongloon Vilaythong (Lao PDR), Dr. Duong Quang Ngoc (Vietnam); Dr. Thien Lei Mee (RECSAM); Mr. Marmon Pargunsan (RECSAM); Dr. Luz E. Osmena (Philippines); Dr. Kusalin Misukul (Thailand); Mr. See Sin Tion(Brunei Darussalam); Dr. Nur Jahan Ahmad (RECSAM); Mr. Dominador Dizon Mangao (ex-RECSAM); Dr. Hazura Ab Bakar (ex-RECSAM); Mr. Kandi Do [ex-SEAMEO QITEP Science (SEAQIS), Indonesia)

First row(from left):Mr. Mam Chansean (Cambodia); Prof. Datuk T. Subahan Mohd. Meerah (Malaysia); Dr. Mark Windale (United Kingdom); Prof. Dr. Lindsey Conner (New Zealand); Dr. Hj. Mohd. Johan b. Zakaria (RECSAM); Dr. Suhaidah Tahir (ex-RECSAM); Dr. Ng Khar Thoe (RECSAM); Mr. Retzy Noer Azizah (CDETEP and ex-SEAQIS, Indonesia)

Figure 5. The 2nd SEARS-ST workshop activities in progress.

Appendix C

List of Participants During the MSTQS (26-27 May 2015) Workshop

Invited Consultants or Experts:

Dr. Mark Windale	Sheffield Hallam University, United Kingdom
Dr. Devadason Robert Peter	Institut Pendidikan Guru Malaysia (IPGM) Kampus Ipoh, Malaysia
Prof. Datuk T. Subahan Mohd. Meerah	Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia
Assoc. Prof. Dr. Lay Yoon Fah	Universiti Malaysia Sabah, Malaysia
Assoc. Prof. Dr. Nabilah Abdullah	Universiti Teknologi MARA (UiTM), Malaysia
Datin Dr. Ng Soo Boon	Curriculum Development Division (CDD), Ministry of Education (MOE), Malaysia
Assoc. Prof. Dr. Mageswary Karpudewan	Universiti Sains Malaysia, Penang, Malaysia
Dr. Suma Parahakaran	Sathya Sai Academy, Kuala Lumpur, Malaysia
Dr. Chin Phoi Ching	IPGM Kampus Pulau Pinang, Malaysia
Mr. Azmi b. Harun	Curriculum Development Division, MOE Malaysia
Mr. Timbul Pardede	SEAMOLEC, Indonesia
Mr. Renaldo Rhesky Nosyafril	SEAMOLEC, Indonesia
Mr. Dona Octanary	SEAMOLEC, Indonesia
Mr. Chin Chee Keong	IPGM Kampus Tuanku Bainun, Malaysia
Ms. LindaToh	Penang Free School, Penang
Ms. Komala Devi	SMK Convent Butterworth, Butterworth, Penang

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Dr. Suhaidah Tahir	Deputy Director [Research and Development (R&D) Division], SEAMEO RECSAM, Penang, Malaysia
Dr. Ng Khar Thoe	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Hj. Mohd. Sazali b. Khalid	Specialist (R&D Division), RECSAM, Penang, Malaysia
Dr. Thien Lei Mee	Specialist (R&D Division), RECSAM, Penang, Malaysia
Mr. Dominador Dizon Mangao	Specialist (R&D Division), RECSAM, Penang, Malaysia
Mr. Pedro Lucis Montecillo	Specialist [Training Programme Division (TPD)], SEAMEO RECSAM, Penang, Malaysia

Group Photo and Snapshots of Activities During MSTQS Workshop

Figure 6. Photo taken during 'Malaysian Science Teachers' Quality Standards' (MSTQS) workshop (26-27/5/2015)

Second row(from left): Dr. Hj. Mohd. Sazali b. Khalid; Mr. Dominador Dizon Mangao (Philippines); Assoc. Prof. Dr. Lay Yoon Fah (Malaysia); Mr. Timbul Pardede (SEAMOLEC, Indonesia); Dr.Suma Parahakaran (Malaysia); Dr. Mageswary Karpudewan (Malaysia); Dr. Thien Lei Mee (RECSAM); Mr. Renaldo Rhesky Nosyafril (SEAMOLEC, Indonesia); Mr. Azmi b. Harun (Malaysia); Mr. Chin Chee Keong (Malaysia) and Assoc. Prof. Dr. Nabilah Abdullah (not in photo)

First row(from left): Prof. Datuk T. Subahan Mohd. Meerah (Malaysia); Datin Dr. Ng Soo Boon (Malaysia); Ms. Komala Devi (Malaysia); Dr. Devadason Robert Peter (ex-RECSAM, Malaysia); Mr. Shamsul Azha b. Md. Yusuf (RECSAM); Dr. Suhaidah Tahir (ex-RECSAM); Dr. Mark Windale (UK); Dr .Ng Khar Thoe (RECSAM); Mr Dona Octanary (SEAMOLEC, Indonesia)

Figure 7. MSTQS workshop briefing and introductory activities in progress in Malaysia Room.

Figure 8. Colloquium to introduce SEARS-ST four dimensions at RECSAM's Auditorium [with testing of VC via WebEx (SEAMOLEC) and Webinar/Skype (RECSAM)]

Figure 9. Presentation on the first dimension of SEARS-ST during MSTQS workshop in RECSAM's Auditorium.

Figure 10. Presentation on the second dimension that was also presented through blended-mode [with testing of VC via WebEx (SEAMOLEC) and Webinar/Skype (RECSAM)]

Figure 11. Presentation on the first dimension of SEARS-ST during MSTQS workshop in RECSAM's Auditorium.

Figure 12. Presentation on the fourth dimension of SEARS-ST during MSTQS workshop in RECSAM's Auditorium.