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Diverse Approaches to

Developing and Implementing Competency-based ICT Training for Teachers:

A Case Study

vol. 1

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Foreword

In this highly connected and rapidly changing world, there is no doubt that teachers play a key role in successfully integrating ICT into education. Realizing the importance of teachers' capacity to do this, governments, teacher education institutions, the private sector, and NGOs alike provide training opportunities – ranging from the skills needed to use a particular software, to integrating educational technologies, to innovating teaching to promote 21st century skills. However, more often than not, teachers' actual use of ICT in the classroom is reported as incremental, merely reinforcing traditional teacher-centred approaches by using slides and drill-and-practice exercises. Teachers' use of ICT to actually innovate teaching is an exception rather than the norm.

From the policy perspective, facilitating ICT-pedagogy integration in school education takes more than sporadic professional development, requiring more systematic policy-level changes to create an enabling environment. Research also shows that an essential condition to foster innovative teaching and learning is a close alignment between what the policy envisions and what actually happens in the classrooms. Inadequate monitoring of teachers' development and their integration practices of ICT have also been raised as reoccurring concerns.

With the formal adoption of the 2030 Agenda for Sustainable Development at the United Nations General Assembly in September 2015, Member States are asked to abide by the *Education 2030 Framework for Action* that underscores the central role of teachers in achieving the new set of education goals. In line with this Framework, all governments are enjoined to ensure that by 2030, all learners are taught by qualified, professionally trained, motivated, committed, and well-supported teachers who use relevant pedagogical approaches. Accordingly, one of the major focus areas for the governments is equipping teachers with the competencies through quality teacher training and continuous professional development, alongside favourable working conditions and appropriate support.

In response to this, UNESCO Bangkok has implemented the 'Supporting Competency-Based Teacher Training Reforms to Facilitate ICT-Pedagogy Integration' project. Supported by Korean Funds-in-Trust, this project encourages governments to enact systematic policy-level changes. They include reforming teacher training and professional development programmes into competency-based ones, whereby teacher development is systematically guided, assessed, monitored and tracked at policy and institutional levels.

As part of the project, UNESCO Bangkok gathered four exemplary cases which took diverse approaches to developing and implementing competency-based ICT training and development for teachers. This publication is to take stock of different frameworks, models, processes, and reference materials that are used in developing and implementing national ICT competency standards for teachers and to provide step-by-step references for countries or organisations that wish to develop and implement competency-based teacher training and development.

We hope that this collection of case studies, with varying approaches, will provide policy-makers with sufficient background and models to develop and implement ICT competency standards for teachers within their respective contexts.

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UNESCO Bangkok

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The publication was coordinated by Jonghwi Park, Programme Specialist in ICT in Education, UNESCO Bangkok, with tireless efforts and support from her team, Maria Melizza Tan, Auken Tungatarova, and Sutin Dechaboon.

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Analysis and Synthesis: Case studies on the development of ICT Competency Standards for Teachers

By Jonghwi Park (UNESCO Bangkok) and Petra Wiyakti Bodrogini (ICT in Education Consultant)

Abstract

UNESCO Asia and Pacific Regional Bureau for Education (UNESCO Bangkok) has conducted a case study to document and disseminate diverse approaches and national experiences in the development and implementation of ICT competency-based teacher training and development. The case study consists of four exemplary cases that took different journeys to a common goal, ranging from integrating ICT into the overall national Teacher Standards and comprehensive career path (Australia), to closely involving teachers and practitioners in the process of competency modelling (Korea), to encompassing different groups of experts to review and determine a national framework (China), and to a partnership-driven pilot project to contextualize the *UNESCO ICT-CFT* (GeSCI). This chapter provides an analysis and synthesis of the differences and similarities in their development and implementation of the ICT competency-based teacher training and development, support provisions for teachers, and key factors in the successful implementation of the entire process. Ultimately, it is suggested that there is no 'one-size-fits-all' solution to developing national-level ICT competency standards for teachers. Countries and organisations that plan to employ approaches featured in this publication are strongly recommended to closely consider their own policy development processes, the technical/infrastructure landscape, and teachers' current ICT readiness in order to design a contextually relevant approach.

1. Background

With the rapid expansion of opportunities and changes in the 21st century, technology in education has become no longer an option or a choice, but an inevitable reality. Teacher capacity is a core enabler in successfully integrating technologies into teaching and learning, and helping develop the necessary skills in the minds of students.

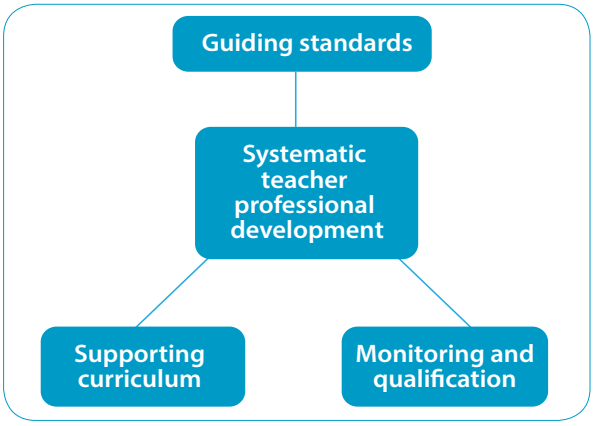
According to a recent research by Shear, Gallagher and Patel (2011) that looked at teaching practices of more than 20 schools from seven countries, one of the key factors that fosters innovative teaching and learning is the close alignment and connection between what the policy envisions and what actually happens in the classrooms. A great deal of research also shows that facilitating ICT-pedagogy integration in school education takes more than sporadic professional development, requiring more systematic policy-level changes to create an enabling environment.

These findings align with those in the previous UNESCO Bangkok projects. A close examination of the lessons learned reveals that the needs of the Asia-Pacific region are associated with a lack of alignment and coordination between national ICT in Education policies and actual teacher development to effectively use ICT to enhance pedagogy and student learning. Inadequate monitoring of teachers' development and their integration practices of ICT have also been a

reoccurring concern raised throughout various UNESCO Bangkok forums in the region. In practice, this ultimately leads to gaps between ICT in Education policies and practices that are less effective in supporting teachers' professional development pathways.

UNESCO Bangkok, through the 'Supporting Competency-Based Teacher Training Reforms to Facilitate the ICT-Pedagogy Integration' project, aims to assist Member States in determining and developing the required ICT competency standards for teachers that are clearly aligned with the Member States' policy vision, goals, and ICT in Education Master Plans. These national standards will guide the development of a comprehensive roadmap that promotes competency-based teacher ICT training programmes where teachers' development is systematically guided, monitored, assessed, and tracked at policy and institutional levels (Figure 1).

Figure 1: Project framework for systematic teacher training and professional development



The specific objectives and activities of the project are:

- To develop a set of generic tools and training modules to help build national capacity in defining national ICT competency standards, and developing an assessment/monitoring system;
- To build the capacity of national teacher education institutions (TEIs) in developing appropriate curricula to be aligned with the developed national ICT competency standards; and,
- To share and disseminate evidence-based information across the Asia-Pacific region, and support the localization of the developed tools/training modules into different languages and contexts.

As part of the project, a case study has been carried out to document and understand diverse approaches and national experiences in the development and implementation of ICT competency-based teacher training and development from different contexts. Four cases were collected: three representing national programmes from Australia, China and Korea, as well as one from a non-profit organisation, GeSCI, that supported pilot projects in Kenya and Tanzania. Each case study illustrates: (a) how national ICT competency standards for teachers were developed; (b) how the developed competencies systematically guided the development of teacher training curriculum for in-service and/or pre-service teachers; and (c) how these competency standards have been assessed/evaluated and recognized.

This chapter aims to provide a synthesis of the case studies. It intends to scrutinize the following:

- Introduction to competency standards;
- An overview of different approaches that each case took;
- Processes through which ICT competency standards for teachers (ICST, hereafter) were developed;

- Implementation of the competency-based teacher training and professional development, including continuous support and assessment of the acquired competencies;
- Key success factors.

2. Introduction to Competency Standards

Competency refers to an element or combination of knowledge, skills and attitudes that an individual should be able to use to perform at work, school or other environments. The competency-based human resource management movement started in 1970's as an alternative way to assessing performance through academic testing, which was then seen as failing to accurately assess executive and skill-based occupations (McClelland, 1973). For example, how can one assess and certify the performance of medical doctors only through academic testing, without examining how they actually perform medical treatments?

Teaching is one of the most complex professions that requires a combination of content knowledge, pedagogical skills and professional attitudes. Indeed, teaching has long been identified as one of the professions that could benefit from competency-based training and certification since 1970's, when the competency movement started (McClelland, 1998). In Australia, where the Competency Standards have been well established and guiding the teacher professional development, a Senate inquiry in 1998 underscored the importance of identifying, assessing and recognizing teachers' skills and knowledge:

> A system of professional recognition for teachers must be established which is based on the achievement of enhanced knowledge and skills and which retains teachers at the front line of student learning. Such knowledge and skills should be identified, classified and assessed according to criteria developed by expert panels drawn from the profession. Education authorities should structure remuneration accordingly (Parliament of Australia, n.d., p. 7).

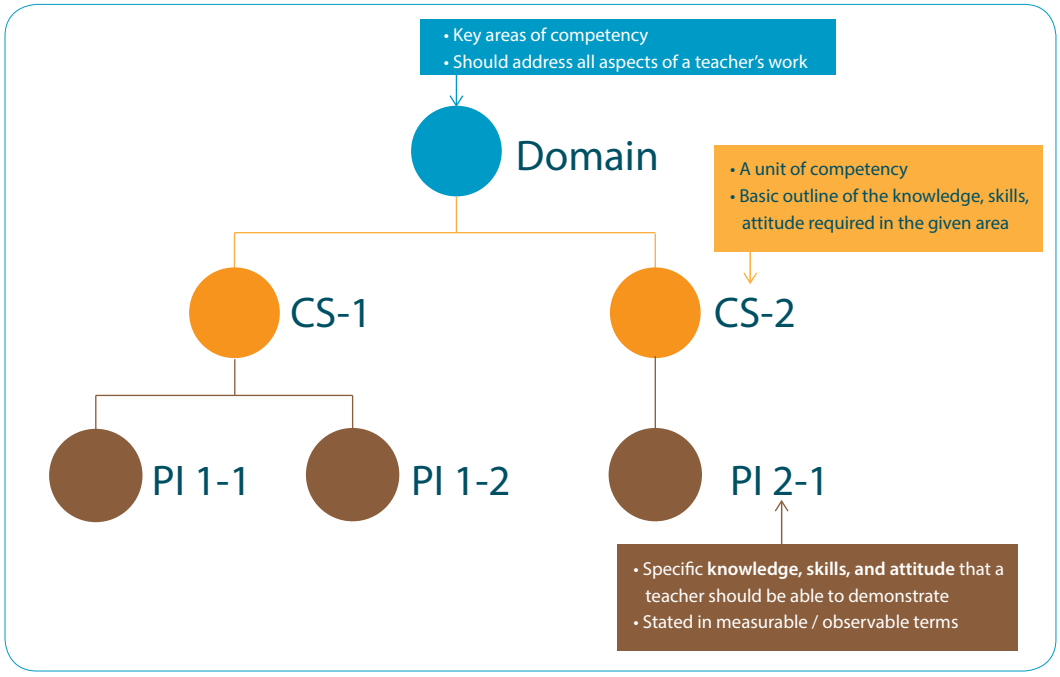
Competency standards consist of domains, standards and performance indicators, as shown in Figure 2. Domains are defined to identify key areas of competency. When it comes to teacher competency, the domains should address all aspects of a teacher's work. Standards refer to the basic outline of knowledge, skills and attitudes in the given domain/area. One domain can have a number of standards. Finally, performance indicators are specific knowledge, skills, and attitudes (KSA) that teachers should be able to demonstrate. One of the essential principles of developing professional competency standards, not just for ICT competency standards for teachers, but for any other competency profiles, is to clearly classify the competency elements into knowledge, skills, and attitudes, accompanied by measurable performance indicators. This process is also imperative in designing effective assessment tools to measure whether an individual has acquired the competency element (USOPM, n.d.).

For example, a competency, such as "teachers should be able to use a search engine"[1] is a skill, and should be tested through demonstration, not through a pencil-paper test, a common modality to test knowledge components. More importantly, the competency standards should be closely aligned with the national policy and vision. For example, if the country's vision stated in the national education sector plan is "creating a knowledge society", teachers' professional development should go beyond basic computer literacy, such as how to use a word processing software.

1 One of the competency element examples in *UNESCO ICT-CFT*: TL.4.f. in Appendix 1.

With this introductory knowledge of competency standards in mind, the analysis of the four case studies will be presented on their respective development and implementation of ICST in the following chapters.

Figure 2: Constitution of Competency Standards



3. Overview of the Cases: Diverse Approaches

Each case employed unique approaches in its own ICST development and implementation, tailored to their policy environment and education contexts.

The case study consists of four exemplary cases that took different journeys to the common goal of developing and implementing ICST. They range from integrating ICT into the overall national Teacher Standards and comprehensive career path (Australia), to closely involving teachers and practitioners in the process of competency modelling (Republic of Korea), to encompassing different groups of experts to review and determine a national framework (China), and to a partnership-driven pilot project to contextualize the *UNESCO ICT-CFT* in Kenya and Tanzania. Table 1 summarizes the approaches that each case took, along with a brief background of the corresponding policy environment.

Table 1: Summary of ICST from the cases

	Title	Nature of Approach	Background/Policy Environment
Australia	Australian Professional Standards for Teachers (APST)	• ICT competency as an integral part of the overall APST • Positioning ICT in teachers' four-staged career path, namely, Graduate, Proficient, Highly Accomplished, and Lead Teachers.	• The *Melbourne Declaration of Educational Goals for Young Australians* (MCEETYA, 2008) as the foundation for the development of the Australian Curriculum (p.27) • 'Teaching Teachers for the Future' project (2011-2012) (p.30)

	Title	Nature of Approach	Background/Policy Environment
Korea	Teacher Competencies for SMART Education	• Profiling competencies through a Delphi methodology with exemplary teachers, together with experts and policy makers	• As part of the new SMART Education Policy launched in 2012 • To train teachers to effectively use digital textbooks, a national initiative by the government
China	ICT Competency Standards for National Primary and Secondary School Teachers	• Through a two-year research by the National Teachers Expert Committee for ICT in Education • Drawn on extensive reviews of internationally renowned frameworks for ICT competency standards for teachers	• As part of the 10th 5-Year National Plan (2001-2005) • The Competency Standards for Teachers currently undergoing significant upgrades based on the ICT 10-year Development Plan (2011-2020)
GeSCI	*ICT Competency Framework for Teachers* for SIPSE Curriculum Pathways	• Partnership for a demand-driven assistance (two-year pilot) between development agency, private sector and government • Adapted the *UNESCO ICT-CFT* as a framework	• As part of SIPSE (Strengthening Innovation and Practice in Secondary Education) project, a partnership programme of GeSCI, MasterCard and Ministries of Education • To enhance ICT competencies and skills to teach STEM (Science, Technology, English and Mathematics) in Kenya and Tanzania

An analysis of the nature of the different approaches reveals three distinctive patterns: 1) Embedded vs. stand-alone standards; 2) Brand-new vs. adapted frameworks; and 3) Government-led vs. partnership-driven. For example, the Australian case represents an embedded ICST in the overall Teacher Professional Standards, whereas the other three cases developed ICST as stand-alone standards. When it comes to frameworks for developing ICST, GeSCI employed *UNESCO ICT-CFT*, whereas the other three cases came up with a brand-new national framework. Finally, the cases from Australia, China and Korea were led by national education reform initiatives, while GeSCI's case was a successful example of a demand-driven partnership assistance programme, involving Ministries of Education.

These unique features in turn led to contextualized procedures to develop and implement their ICSTs. What follows provides a detailed analysis of the development procedures.

4. Development of Competency Standards

Developing ICST is not a simple task. It takes a wide range of key stakeholders and considerable amount of time and effort. A critical factor to consider in planning the ICST development would be the availability of resources and expected timeline. This section provides different development procedures of ICST from each case, drawn on the aforementioned analysis of the diverse approaches.

4.1 Embedded vs. Stand-alone

One of the notable characteristics that emerged from the four cases is the relation of the ICST with the overall teacher standards. For example, Australia's ICT Competency Standards are seamlessly embedded into the Australia Professional Standards for Teachers (APST), while the other three cases reported their ICT Competency Standards being stand-alone. The cases from China and Korea exhibited how a national policy and vision informs and triggers education reforms, and

can be translated into Teacher Competency Standards. Both countries developed ICST as a set of stand-alone competencies in order to stress the prominence of teachers' capacities in using ICT to help students develop 21st century skills.

Developing ICST as an integral part of the overall teacher professional standards is a comprehensive approach, for it allows ICT competencies to be trained, assessed and monitored as part of the overall performance of teachers. However, the development process can be more extensive as it requires well-established and endorsed professional standards for teachers as an imperative prerequisite. Table 2 summarises the procedure and timeline of APST development in six stages.

Table 2: Development of the Australian Professional Standards for Teachers

Focus Area	Stage	Element and timeline	Process
APST development	1	Advice and drafting from the expert group and appointed writers *(18 months: June 2009 to Dec 2010)*	• Analysis and review of the Standards in use by Australian teacher registration authorities, employers and professional associations • Development of draft Standards for consultation • Continuing revision based on consultation
	2	Extensive public consultation *(3 months: March to May 2010)*	• National consultation workshops • Online submissions • Analysis of submissions
	3	Validation Study of Standards *(6 months: July to December 2010)*	• Online surveys: (i) administered to teachers in selected schools, and (ii) open to any teacher • Focus group workshops with teachers, teacher educators and teacher associations
ICT Competency Standards integration	4	'Teaching Teachers for the Future' project: ICT Statements and Illustrations of Practice *(18 months: April 2011 to December 2012)*	• Development of Statements of Practice using consultants and focus groups of expert teachers • Development of three Illustrations of Practice through a partnership between the Australian Council for Computers in Education (ACCE) and Education Services Australia (ESA)[15] • Development of a further seven Illustrations of Practice by AITSL and ESA
Operationa-lisation	5	Certification of Teachers *(Commenced June 2011: Ongoing)*	• Development of the national framework • Development of the certification process
Evaluation	6	Evaluation *(Commenced June 2013: Ongoing)*	• National forum – wide range of stakeholders • National online survey of teachers, school leaders, teacher educators, pre-service teachers.

Source: Adapted from the Australia case study (pp. 28-33).

Stand-alone standards do have their own advantages. For example, if a government aims to timely reinforce the implementation of a new ICT provision and policy, say, digital textbooks, competency standards for teachers to effectively use the digital textbook will systematically inform what teachers need to know and do to implement the digital textbook in schools, as exemplified in the Korean case in the following section.

4.2 Brand-new Standards vs. Adapted from Existing Frameworks

As analysed earlier, the cases from Australia, Korea and China created their own frameworks and ICST accordingly, highly contextualized to their respective policy environments, education issues

and teachers' needs.

These cases report their own conceptual frameworks based on extensive research conducted by a group of experts. For example, Korea and China took a close consideration of their unique education contexts and needs, and created their own conceptual framework. This approach may be more time consuming than adapting an existing framework, but can maximize the local voices and provide ownership of the competency standards.

One of the notable methodologies that generated brand-new frameworks and ICST is from the Korea case, as shown in Table 3. The SMART Competency Standards were developed to support the digital textbook initiatives launched by the government in 2012. Using a Delphi survey methodology, its framework for the Competency Standards were derived from a number of interviews with selected exemplary teachers and an assessment of their described performance in the classrooms. The initial set of the identified competencies were reviewed and tested by the experts and teachers to confirm if they accurately reflect the current contexts and needs.

Table 3: Development of ICT Competency Standards in Korea

Stage	Step	Activities and Timeline	Tools
Stage 1: Competency modelling of 21st century teachers in Korea	Step 1	Forming a research team *(2 months)*	Focus group and Behavioural Event Interviews (BEI)
	Step 2: Delphi round 1	Analyzing current status on teacher competency modelling and future direction of education. Identifying the framework of teacher competency *(2 months)*	Structured survey questionnaires
	Step 3: Delphi round 2	Rating importance of competency *(1 month)*	Structured survey questionnaires
	Step 4: Delphi round 3	Making consensus *(1 month)*	Delphi questionnaires
	Step 5: Confirmation by KERIS	Confirming the set of teacher competencies	Delphi questionnaires
Stage 2: Investigation of exemplary performance of SMART Education	Step 1: Critical incident analysis	Identifying teachers' critical experiences *(1 month)*	BEI
	Step 2: Survey study	Confirming the findings *(2 weeks)*	Questionnaires
Stage 3: Development of Teacher Competencies for SMART Education	Step 1: Integration	Identifying teacher competencies for SMART Education *(1 month)*	Expert panel reviews and interviews
	Step 2: Validation	Confirming the findings *(2 months)*	Questionnaires

Source: Adapted from the Korea case study (pp. 49-53).

On the other hand, GeSCI adopted and contextualized *UNESCO ICT-CFT* for the development of ICST in Kenya and Tanzania in a pilot project. One of the advantages in basing the development of ICST on an existing framework is being able to devise a comprehensive view on what teachers should know and do without having to spend too much time and resources on building a framework. It is especially true when the framework is internationally recognized and proven effective. The *UNESCO ICT-CFT*, for example, can be an excellent starting point and reference for countries with emerging economies who attempt to develop their national ICST for the first time, as the Framework addresses all aspects of a teacher's work and what a teacher needs to do and know to effectively perform using ICT. According to the *UNESCO ICT-CFT* (2011),

> UNESCO's Framework emphasizes that it is not enough for teachers to have ICT competencies and be able to teach them to their students. Teachers need to be able to help the students become collaborative, problem solving, creative learners through using ICT so they will be effective citizens and members of the workforce. The Framework therefore addresses all aspects of a teacher's work (p.3).

Table 4 summarizes GeSCI's approach to the development of ICST, adapting *UNESCO ICT- CFT*, in their pilot project in Kenya and Tanzania.

Table 4: Development process of ICT Standards development in Kenya and Tanzania

Stage	Activities and Timeline	Tools
Stage 1: Needs assessment and situational analysis	1. Review of ICT teacher development landscape 2. A stakeholder analysis and determination of key national counterparts for the ICT in Teacher Education initiatives in consultation with the Ministries of Education 3. Determining at what level to pilot the *ICT Teacher Competency Framework* in alignment with country needs and objectives 4. Identifying teacher training institutions to target for piloting the ICT – CFT frameworks *(2 months)*	• Interviews • FGD • Surveys • Questionnaires
Stage 2: Contextualisation and prioritisation of *ICT-CFT*	1. Formulation of a Roadmap tool for ICT Competency Standards for Teachers, which included reviewing competencies from other countries; restructuring ICT Teacher Competency Roadmap 2. Contextualizing competencies through a consensus building process *(2 days)*	• ICT Teacher Competency Roadmap tool • Competency review tool • 'Standards for Standards' tool
Stage 3: **Curriculum mapping using *ICT-CFT* priorities**	1. Curriculum review and improvement with shorter review cycles 2. *UNESCO ICT-CFT* review tool 3. STEM curriculum review - Kenya and Tanzania *(4 months)*	• *UNESCO ICT-CFT* review tool
Stage 4: **Module development using *ICT-CFT* and *TPACK***	1. Curriculum mapping for module development 2. Mapping curriculum objectives, content and pedagogy strategies 3. Open education resources identification 4. Course guided writing 5. Module piloting in Kenya and Tanzania 6. Platform development *(2 weeks)*	• *TPACK* instructional design/ module structure • Online platform/communication tools
Stage 5: **Assessment and evaluation**	This stage is ongoing. The plan is to establish a support system. SIPSE is facilitating courses to deliver and pilot the assessment and evaluation frameworks. *(Ongoing)*	*Assessment Framework:* • *TPACK* observation framework tool • Lesson review framework • Whole school review tool *M&E framework:* • Online survey • Online self-assessment • School visit protocol • *TPACK* classroom observation protocol • Student survey tool

Source: Adapted from the GeSCI case study (pp. 101-115).

This is not to say that an internationally recognized framework can be simply introduced as it is, and be expected to fit in the country context without additional examination and modification. As clearly shown in all four cases in this case study, one of the first steps should be delving into a wide range of conceptual and theoretical frameworks for teaching with ICT, and deriving the best possible framework or approach that is suitable for the national/organisational contexts and goals by modifying and adapting necessary components.

In this regard, it is noteworthy that in the reported case by GeSCI, the Framework of the organisation used for the pilot countries has four stages of teacher development (i.e. Emerging, Technology Literacy, Knowledge Deepening and Knowledge Creation), instead of the original three in the *UNESCO ICT-CFT*. Adding "Emerging" to the stages was mainly to reflect and accommodate the target countries' needs and context, an important localization process of the Framework. Interested readers can find detailed information in the chapter on "Cultivating synergies in enhancing ICT competencies: A partnership approach".

4.3 Government-led vs. Partnership for Assistance Programmes

The case analysis reveals that the ICST development were most likely to be triggered by the government initiative and/or national education reform. When a government declares an education reform or new education policy, it usually implies considerable changes in the national curriculum, hence updating what teachers are required to do to teach the new curriculum and to achieve the new national education goal. In this approach, the governments' commitment and political will drive the entire process of the ICST development and implementation in a timely manner.

According to the case from China, for example, the National Teacher Education Informatisation Expert Committee was formed in early 2000's to support the implementation of the 10th 5-year National Plan. After conducting a series of literature reviews, the Committee was divided into three groups, namely the theory group, skills group, and application group, corresponding to the conceptual framework drawn from the literature review (Table 5).

Table 5: Development process of ICT Competency Standards in China

Stage	Activities and Timeline	Tools
Design of Framework and contents	• Set up the main research group of the project and design the Framework and contents through literature review. • Sub-research groups, such as theory group, skill group and application group, are assigned to work on the development of Standards. • The main research group has integrated all of the research results and formed the first draft of the Standards. *(April 2002 – October 2003)*	Literature review
Broad consultation	• On-the-spot investigation report and experiments. *(October 2003 – November 2003)*	Interviews, surveys
Discussion and amendment of first draft	• Based on the extensive consultation, testing results and the investigation report, the guidelines are developed to amend the first draft of the Standards. • Modification scheme is determined; the draft for approval is formed. *(December 2003 – July 2004)*	N/A

Stage	Activities and Timeline	Tools
Testing and improvement of the Standards	• Expert committee meeting to discuss the implementation of the Standards (draft for approval), further processing and improvement of the preface, general programme, terms and definitions, Sub-Standards are performed. Standards (released version) has been developed and is ready for implementation.	Committee meetings, teacher surveys

Source: Adapted from the China case study (pp. 71-74).

Upon completion of stage 4, China's Ministry of Education aligned ICT competencies with the teacher training curriculum by launching the 'National ICT Capacity Building Project for Primary and Secondary School Teachers' (usually termed as the ICT Capacity Building Project) in the following year. The project included reforming teacher training, as well as their examination and certification in a systematic manner, which is another significant advantage of government-led ICST development and implementation.

The case reported by GeSCI showed that a demand-driven partnership assistance programme can yield an equally effective output and positive impacts. Since 2010, GeSCI has assisted Ministries of Education in partner countries of Rwanda, Kenya, Tanzania, Nigeria and Ghana. Particularly, the 'Strengthening Innovation and Practice in Secondary Education' (SIPSE) project[2] was launched in Kenya and Tanzania in July 2013 as a two-year pilot initiative. The SIPSE project is a partnership programme with GeSCI, MasterCard and Ministries of Education to enhance teacher capacity in ICT competencies and skills to teach science, technology, English and mathematics (STEM) at secondary schools for the 21st century context. The project-based scheme serves as an effective outset for ICST development, which allows for greater flexibility and innovation. The project also created a pool of open educational resources based on the identified ICST, in order to increase access to quality of teaching and learning materials. The project benefited 12 teacher educators (Master trainers) and 120 secondary STEM teachers from 20 schools (6 STEM teachers in each school) across the two project countries during its two-year pilot implementation.

The domains and competency standards from the four cases are presented in Table 6.

Table 6: Summary of Competency Standards from the case study

	Domain	Standards	Remarks
Australia	Professional Knowledge Professional Practice Professional Engagement	1. Know students and how they learn 2. Know the content and how to teach it 3. Plan for and implement effective teaching and learning 4. Create and maintain supportive and safe learning environments 5. Assess, provide feedback and report on student learning 6. Engage in professional learning 7. Engage professionally with colleagues, parents/ carers and the community	Each Standard is further defined by Focus Areas. The following three Focus Areas make explicit reference to ICT • Focus Area 2.6: ICT • Focus Area 3.4: Select and use resources • Focus Area 4.5: Use ICT safely, responsibly and ethically Descriptors are also available across the four career stages, as shown on p.26.

2 Read more on the GeSCI, Master Card Foundation and Ministry of Education SIPSE Partnership Programme at: http://gesci.org/media-info/news/single/news/detail/News/mastercard-foundation-and-gesci-introduce-stem-teachers-to-new-mobile-learning-platform/ and http://www.mastercardfdn.org/groups-announce-nearly-18-million-in-funding-for-secondary-education-in-developing-countries/

	Domain	Standards	Remarks
Korea	Fundamental	1. Creative problem-solving 2. Social skills 3. Flexibility 4. Technology literacy 5. Ethics 6. Passion	The 13 Competency Standards are divided into 68 indicators (as shown on pp. 64-65). The indicators in turn become a critical basis for developing 28 training modules.
	Field Practice	7. Understanding future 8. Expertise in content 9. Rapport building with learners 10. Instructional design 11. Learning affordance building 12. Evaluation and reflection 13. Network building	
China	Awareness & Attitude	1. Awareness of importance (of ICT) 2. Application awareness 3. Evaluation and reflection 4. Lifelong learning	Descriptors of each Standard are available on pp. 76-77.
	Knowledge & Skills	5. Basic knowledge 6. Basic skills	
	Application & Innovation	7. Instructional design and implementation 8. Teaching support and management 9. Research and development 10. Cooperation and communication	
	Social Responsibility	11. Fair application 12. Effective application 13. Healthy use 14. Regulation	
GeSCI	Policy	Teachers exhibit knowledge and understanding of the intentions of local, national and global policies regarding the goals, objectives, standards and strategies for ICT use in education and classroom practice.	Each Standard is further divided into four different levels of teacher development, namely, Emerging, Technology Literacy, Knowledge Deepening and Knowledge Creation (as shown on pp. 131-136).
	Curriculum	Teachers use their knowledge of curriculum content, assessment and technology to facilitate experiences for enabling student understanding of subject-specific concepts, research, collaboration and communication.	
	Pedagogy	Teachers use their knowledge of methods and processes of teaching and learning and the use of technologies to engage students in authentic problem solving, inquiry and project based learning experiences that support social interaction, collaborative knowledge production, innovation and communication.	
	ICT	Teachers use their knowledge about various technologies, from low-tech technologies such as pencil and paper to high-tech technologies such as the Internet, digital video, radio and software programmes to support teaching and learning strategies, student knowledge construction and continuous reflective learning.	
	Organisation & Management	Teachers exhibit leadership in the school and professional communities by promoting effective use of technology for student centred learning in individual group and whole class teaching and learning.	
	Professional Development	Teachers continuously evaluate use of technology to improve their own professional learning, participate in local and global learning communities, and become lifelong learners contributing to the effectiveness and regeneration of the teaching profession.	

5. Implementation and Continuous Support

Developing competency standards on paper is one thing, but implementing them in practice is another. According to the case analysis, the full implementation of competency-based teacher training for ICT takes several steps, such as:

1. incorporating the ICST into teacher training and professional development curriculum;
2. providing training, resources and materials to support teachers in acquiring the desired competencies;
3. assessing teachers' performance through collecting diverse evidences; and
4. setting up a mechanism or system to recognise and incentivise teachers' acquired competencies.

5.1 Incorporating ICST into the Teacher Curriculum

Albeit the similarity in the development steps, the case analysis revealed that approaches to implementing ICST-based teacher training and professional development vary from country to country due to diverse political environments.

For example, in the Chinese case, the implementation process shows a highly centralized approach. Following the finalization of the national ICST in 2004, the Ministry of Education launched the 'National ICT Capacity-Building Project for Primary and Secondary School Teachers' in April 2005, encompassing three essential components, namely: training, examination, and certification. With the support of educational administration departments at all levels and the National Teachers Education Network Alliance, it aimed at training 10,000 national key teachers, 100,000 provincial key teachers, and more than 10 million primary and secondary school teachers in three years.

On the contrary, the case from Australia is aligned with its state-based decentralized governance system. Although the National Standards (APST) were developed by the government, how the Standards should be implemented is a decision to be made by each teacher education institution, for example:

- University A has opted to develop dedicated semester-long ICT subjects;
- University B has elected to cover the ICT elements of the Standards as a cross-curriculum or embedded activity;
- University C has adopted a hybrid approach providing a core Digital Learning subject and ensuring other subject-specific aspects (such as ICT in teaching of English, Mathematics, Physical Education, etc.) to be covered as cross-curriculum activity.

Despite the great autonomy given to TEIs, they must go through and be approved by a rather rigorous accreditation and re-accreditation process. This 5-year cycle accreditation process ensures the consistent quality of teacher training across the country.

In the case of GeSCI, their extensive ICST, which were drawn on *UNESCO ICT-CFT*, were translated into a set of five modules for in-service teachers: Modules 1,2 and 3 for the Technology Literacy level, and Modules 4 and 5 for the Knowledge Deepening level:

- **Module 1** – ICT and Didactic Teaching – focus on practice and drill of ICT tools; and introducing presentation, spreadsheet and word productivity tools
- **Module 2** – ICT and STEM Curriculum Standards – focus on the presentation of ICT tools
- **Module 3** – ICT in the Classroom and the Computer Lab – focus on simulation tools; special

unit on national policies and their impact on education

- **Module 4** – Problem-Based learning – focus on concept and mind mapping of ICT tools
- **Module 5** – Project-Based Learning – focus on STEM Subject Specific ICT Tools and Webquest

The five-month module implementation was carried out through a blended learning approach of face-to-face workshops and online learning, e-learning and m-learning platforms, and CDs. Communication tools were also provided to encourage peer-to-peer interaction among the SIPSE teachers.

5.2 Providing Continuous Support and Resources

Teachers are an extremely demanding profession. For any new education policy to be successfully implemented, continuous support for teachers is vital to enable them to act as the forefront change agents.

In this regard, Australia's Illustrations of Practice exemplify a brilliant approach to supporting teachers in changing practices with ICT. As part of the 'Teaching Teachers for the Future' project, ten Graduate-level Illustrations of Practice were developed by Education Services Australia (ESA) in collaboration with the Australian Council for Computers in Education (ACCE). As the name suggests, it illustrates how an exemplary Standard-based practice would look like in actual classrooms, helping teachers understand and visualize what has to be done. It consists of video footage of sample teaching practices and original/re-purposed materials that were used in the classroom.

In Korea, teachers are provided with the government-run website[3] where their current competencies can be diagnosed through a series of questionnaires. In addition to the diagnostic function, the mobile-friendly website also provides information on where the teachers' current competency level is at, compared to peers by school level, gender, career and subjects. Most importantly, it provides customized feedback for necessary training contents and direction for self-development.

5.3 Assessing Teachers' Performance through Diverse Evidences

Whether a teacher successfully acquired the required competency or not can be assessed through diverse evidences, other than traditional pencil-paper tests. As a matter of fact, many countries have employed portfolio approaches, allowing teachers to collect a wide range of evidences to prove their competency level.

Table 7 presents different approaches to assessing teachers' acquired competencies.

Table 7: Summary of teacher competency assessments

	Assessment/evidences	Remarks
Australia	• Portfolio (demonstration of evidence) • Recommendation from school / workplace • Site visits, observations (for Highly Accomplished and Lead Teachers) • Professional discussion	For in-service professional development after the Graduate level (Graduate competencies are assessed under the autonomy of teacher education institutions provided that the institution is accredited)

3 For more information, visit http://www.edunet.net/redu/smrtsvc/listSmrtEduTeaForm.do?menu_id=0025

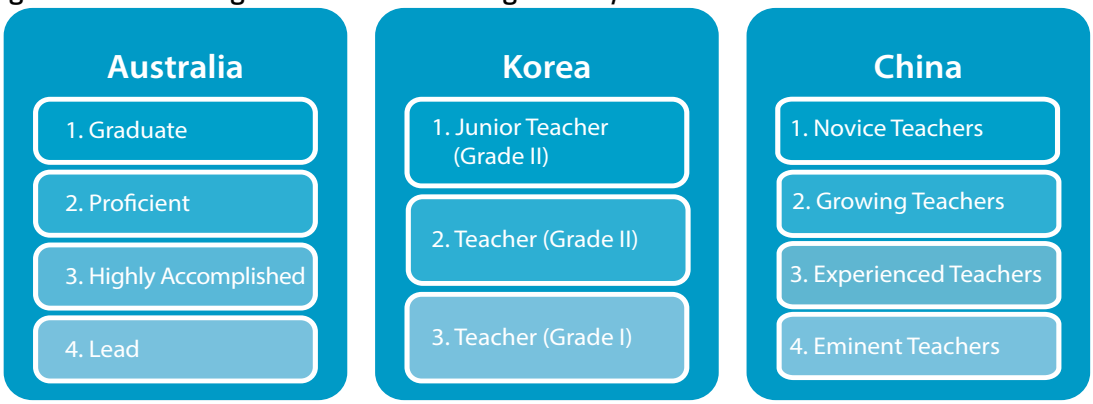
	Assessment/evidences	Remarks
Korea	• Certification upon course completion • Online diagnosis (formative)	For in-service professional development
China	• National Test (written)	As a prerequisite for teacher qualification
GeSCI	• Classroom observation (50%) • Teacher portfolio (40%) • Group project (10%)	Participation in training is the minimum criteria Observation against a *TPACK* observation framework tool

5.4 Recognizing and Incentivising Teachers' Acquired Competencies

Motivating teachers is always an issue when a new line of competencies is introduced and required. With all the effort in developing ICST, designing ICST-based teacher training, and assessing teachers against them, the project can quickly become useless or irrelevant if teachers are not motivated to follow the ICST. Two major aspects may be considered when developing a system to recognize and incentivise teachers' acquired ICST.

First, teachers are known to be more motivated when they are provided with a clear career path and how ICT competencies are positioned in the career path (as shown in the Australian Professional Standards for Teachers with reference to ICT by career stage on p. 26). Figure 3 shows the clearly laid out career stages from the three case countries.

Figure 3: Career stages of teachers among country cases



- ***Australia***. Clear career stages for teachers were developed based on the Australian Professional Standards for Teachers. A teacher can move to a higher career ladder after having completed the required training hours (20 hours per annum over a span of three or five years).
- ***Korea***. In-service training programmes are offered for teachers to obtain certificates and professional training. The programmes are available for both Grade I and Grade II teachers as well as librarians (Grade I), nursing teachers (Grade I), professional counsellors (Grade I), vice principals and principals. Each programme is held for a minimum of 30 days (180 hours). Training programmes are categorized according to the purpose of training: information digitalization, curriculum formulation, general training, and teaching training.
- ***China***. Teachers are able to continue to develop their skills through internships, in-service training, school-based educational research, and accumulation of sound pedagogical skills and rich teaching experience.

Second, particularly for in-service teachers, diverse channels and flexible learning paths should be allowed and recognized. There are a number of training providers when it comes to ICT for teaching, ranging from private sectors, to NGOs, and to teacher training institutions. Teachers nowadays have additional opportunities through video clips, web-based resources, or school-based peer learning. Teachers' improved competencies through such informal learning paths should also be recognized, possibly through a prior learning acquisition and recognition scheme. What teachers are able to do should be measured and recognised, not who provides the training or for how many hours. This will not only motivate teachers to improve their competencies but also encourage them to develop a culture of lifelong learning.

6. Key Factors

Despite the diverse approaches utilized, the featured cases equally achieved the implementation of the national ICT competency standards for teachers that fit best to their own educational contexts. Common factors that contribute to their success are the following:

- **Identification and involvement of multiple stakeholders** along the process

  More often than not, teachers are left out of the policy making process and are simply informed to implement new policies (e.g. new curriculum, new training, etc.) without being consulted. Such policy is to be criticized for its distance from the school reality. Considering that the teachers are those who will be at the forefront to implement the integration of ICT in teaching and learning, the exemplary cases wisely identified and closely involved key stakeholders at every stage of development and implementation of the competency standards. Table 8 summarizes the stakeholder involvement of each case country.

Table 8: Multi-stakeholder involvement in each case country

Countries	Who were involved?	How were they involved?
Australia	Teachers, representatives of teacher professional associations, unions, and teacher education academics.	In the consultation process of draft Standards development.
	Thirty-nine stakeholder groups (among others included key education organisations, teacher professional associations, national bodies, policy makers, employers and school leaders).	In the evaluation of the Standards. A National Forum was held to explore perceptions of the success factors for Standards implementation.
Korea	Education experts, policy makers, and school teachers.	In the Delphi rounds for Standards development.
	Parents and community	Identification of parent support and voluntary services for local communities.
China	Teaching, administrative, and technical staff.	In the investigation and consultations for Standards development.
	Schools	In the feedback process from implementation.
Kenya and Tanzania	Policy makers, TEIs and universities representatives, teachers, principals, national task force members, and partner experts.	During all stages of activities, from situational and needs assessment, contextualisation, curriculum mapping, module development, and evaluation.

- **Interdepartmental coordination** for in-service and pre-service training, and other divisions for teacher performance and evaluation

  It is of paramount importance to ensure that competency standards of pre-service teachers are coherently aligned with those of in-service teachers. In many countries, pre-service teacher training and in-service teacher development are governed by different agencies whose lack

of communication and coordination with each other often cause discrepancies between the pre- and in-service training programmes. What a graduate teacher is expected to perform with regard to using ICT for teaching and learning should correspond to an entry point competency for in-service teachers. This simple equation is unfortunately an exception rather than the norm in many countries, and the four cases in this case study illustrate that it can be achievable only through close coordination among different departments and agencies. It is therefore recommended that when national competency standards for teachers are developed, the task force team involves agencies and stakeholders for both pre- and in-service teacher training.

- A strong system of **teacher preparation and professional development**, drawn upon the standards

  National competency standards for teachers are merely a policy document unless they are operationalised through teacher preparation training, professional development and teacher qualification. As evidenced from a number of countries that have spent painstaking amounts of time and resources on developing competency standards, projects often end shortly after their development, and the standards remain as simply a document. The cases in this case study exemplify the importance of the governments' commitment in implementing the competency-based teacher training reforms to ensure and reinforce their full employment in teacher training and qualification.

- Providing key stakeholders with **support and guidance for implementation**

  Upon the completion of formulation of ICT competency standards for teachers, different stakeholders often require support and guidance for implementation. This will help ensure the fluency of the process from initiation of standards usage (e.g. dissemination and training), to their implementation and evaluation. The types of support could vary in different country contexts, from written guidelines for teachers and teacher supervisors, and online/offline or school based trainings, to face-to-face meetings of teacher working groups, or online help desks. The four case studies demonstrate the implementation support through dissemination of quality documentation and provision of guidance to the stakeholders. In particular, the Australia case study puts forward the Illustrations of Practice to support teachers in translating the Standards into everyday practices.

- A **performance evaluation** system against the standards

  When the standards inform teacher professional development programmes, the performance evaluation and appraisal of teachers should also be informed by the standards. Given that competencies consist of knowledge, skills and attitudes, it is critical to design the evaluation process to measure what it should measure. For example, the evaluation methods should/can be diversified to measure different competencies, including interviews, class observations, skills demonstration and portfolio, in addition to the traditional knowledge tests.

- A clear **recognition/qualification system** that motivates teachers to continuously develop their competencies

  In most of the country cases, there are clear career paths for teachers to follow and refer to. For example, Australia and China have four stages of the teacher career, whereas Korea has three. The ICT Competency Standards are clearly aligned with each stage, show what teachers should be capable of at each stage, and what is required to move on to the next. Not only does it enhance transparency for teacher qualification/promotion mechanisms, but it also motivates teachers to continuously develop their competencies.

7. Conclusion

In conclusion, it is suggested that there is no 'one-size-fits-all' solution for developing national-level ICT competency standards for teachers. Countries that plan to employ approaches from this book are strongly recommended to closely consider their respective contexts, including the roles of education stakeholders, school infrastructure, and teachers' current ICT skills readiness, and adapt different approaches that work best in their own contexts.

The sequential chapters feature the detailed descriptions of how each case developed ICST and implemented ICST-informed training and professional development for teachers. It is hoped that countries and organisations find the cases as useful references, customize them as needed, and choose/create their own approaches with the key success factors in mind.

The results of this review will contribute to the development of the *Guidelines for Competency-based Teacher Training Reform to Facilitate ICT-pedagogy Integration*. From the four case studies in Australia, Korea, China, and GeSCI, the Guidelines offer rich information, resources and tools to consider and learn from. The Guidelines will extract practical information that will provide respective governments with a walk-through to begin their work on developing ICT competency framework and standards for teacher professional development.

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Positioning ICT in teachers' career path:

ICT Competency as an integral part of Teacher Standards

Positioning ICT in teachers' career path: ICT Competency as an integral part of Teacher Standards

By Margaret Lloyd (Queensland University of Technology), Toni Downes (Charles Sturt University), and Geoff Romeo (Australian Catholic University)

Abstract

Twenty-first century teachers need the technical, pedagogical and content skills to use information and communication technologies (ICT) to create meaningful learning experiences for their students. In Australia, Standards have been developed and operationalised at the national level and steps have been taken to ensure that both beginning and practising teachers demonstrate appropriate ICT competencies. Firstly, the Australian Professional Standards for Teachers (AITSL, 2011a, 2011b) describes what a teacher should know and do at four career stages: Graduate, Proficient, Highly Accomplished, and Lead. One such Standard is simply entitled 'Information and Communication Technology', and requires individual teachers to demonstrate increasing capacity and leadership in ICT pedagogy. Second, teacher education institutions must show national accreditation panels, through the Initial Teacher Accreditation Programme Standards (AITSL, 2012a), how pre-service teachers have opportunities to gain and demonstrate the relevant Australian Professional Standards for Teachers at Graduate Level; and, also, how institutions themselves are using ICT in their own teaching and in the resources they make available to their students. This case study will detail the Australian Professional Standards for Teachers and Initial Teacher Education Programme Accreditation Standards relating to ICT pedagogy. This study will build on the ambitious large-scale 2011-2012 'Teaching Teachers to the Future' (TTF) project (ACDE, 2012) that involved all major teacher education providers in Australia and provided an important step in building the capacity necessary for effective ICT pedagogy. Both national Standards and the TTF project have helped to ensure that Standards are enacted in the daily practice of classrooms across the nation.

1. Country Context/Background

1.1 Background Information

Australia is a democratic nation comprised of six states and two territories occupying a combined landmass of 7,741,220 sq. km. According to the Australian Bureau of Statistics (ABS, 2013a), the population of Australia at 30 June 2013 was 23,130,900. Australians enjoy a prosperous lifestyle with relatively low levels of unemployment, high rates of participation in education, and a 99 per cent literacy rate (CIA, 2013). Data drawn from the *2010 Measure of Australia's Progress* indicated that 'the people of Australia are becoming more highly educated. Over the past 10 years, there has been an increase in the proportion of people who have a vocational or higher education qualification, from 49 per cent to 63 per cent' (ABS, 2010, para. 1).

Schooling in Australia is largely controlled by the states and territories. This is a consequence of the British colonial settlement of Australia from the late 18th century, which saw separate colonies

opened either as penal settlements, such as New South Wales and Tasmania, or open to free settlers, such as South Australia and Western Australia. Each, in turn, gained statehood when the Commonwealth of Australia came into being in 1901. Despite previous failed attempts, it is only in the 21st century that national initiatives in education have been truly implemented.

Australia's expenditure on education in terms of its GDP has, as with many other countries, varied in response to the global financial crisis which began in 2008 (OECD, 2014). The OECD has reported that Australia's expenditure has risen but has remained consistently under the OECD average: in 2000, it was 5.23 per cent (compared to OECD average of 5.37 per cent); in 2008, it was 5.34 per cent (compared to OECD average of 5.78 per cent); and, in 2011, it was 5.85 per cent (compared to OECD average of 6.07 per cent) (OECD, 2014).

1.2 Australia: a National Vision for School Education

Despite its organisation at the state and territory levels, school education in Australia takes its strategic goals and directions through national declarations approved by a top-level council made up of Commonwealth, State and Territory Education Ministers.[4] The first of these was the *Hobart Declaration* (1989) superseded by the *Adelaide Declaration* (1999). The most recent is the *Melbourne Declaration* (MCEETYA, 2008), which has led directly to the development of a nationally agreed Australian Curriculum managed by the Australian Curriculum, Assessment Reporting Authority (ACARA, n.d.). The Australian Curriculum outlines (ABS, 2012a, para. 4):

- key learning areas (such as English, mathematics, science and history) and other subjects (such as geography, languages, the arts, economics, business, civics and citizenship, health and physical education, information and communication technology, and design and technology);
- national general capabilities (literacy, numeracy, information and communication technology competence, critical and creative thinking, ethical behaviour, personal and social competence, and intercultural understanding); and,
- national cross-curriculum priorities (Aboriginal and Torres Strait Islander histories and cultures, Asia and Australia's engagement with Asia, and sustainability).

Critically, the Australian Curriculum has included information and communication technology as a general capability. This means, quite simply, that ICT is to be explicitly addressed and demonstrated at all years of schooling and in each learning area.

1.3 Schooling in Australia

Australian schooling has two distinct formal structures: primary schooling (pre-year 1 to year 6 or 7, depending on jurisdiction) and secondary schooling (year 7 or 8 to year 12) (see AEI, n.d.). The difference, explained by the previously-cited state and territorial control of education from the colonial era, also extends to differences in the age that children begin formal schooling with most children in Australia beginning around 5 years of age (ranging from 4.5 to 6 years). While students are entitled to leave formal schooling at age 16, considerable effort has been made to universally extend school attendance to age 17 or, rather, to the end of year 12. The proportion of students staying at school to year 12 has remained at around 75 per cent since the early 1990s (ABS, 2012b).

Overall, there are 9,427 registered schools in Australia (see Table A.1). A simple categorisation of these is as government (n=6,661, 70.91%) or non-government (n=2,732, 29.09%) schools. Of the

4 See also Section 3 for a discussion of the role of this council in approving the Australian Professional Standards for Teachers

non-government schools, the majority are Catholic schools (n=1,717, 62.85%) with the remainder labelled as independent (n=1,015, 37.15%), but typically run by religious institutions such as the Anglican Church. Table A.1 also includes a category for special schools which cater for children with severe physical or intellectual disabilities: the majority of children with hearing, sight or mobility impairments are now 'main-streamed' into standard classrooms.

Table A. 1: Summary of schools by jurisdiction and schooling type

	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Total
Primary (P-Yr 6 /7)	2,113	1,561	1,153	496	662	156	71	78	6,290
Secondary (Yr 7/8-12)	515	342	253	87	105	43	24	23	1,392
Combined (P-12)	303	235	246	146	222	57	90	22	1,321
Special	151	95	63	21	77	6	6	5	424
TOTAL	3,082	2,233	1,715	750	1,066	262	191	128	9,427

Source: Adapted from ABS (2013d)

Table legend: NSW - New South Wales, Vic. - Victoria, Qld - Queensland, SA - South Australia, WA - West Australia, Tas. - Tasmania, NT - Northern Territory, ACT - Australian Capital Territory

There are an estimated 3,589,986 students enrolled in Australian schools, while the ABS (2013b) reported an estimated 258,985.6 full-time equivalent (FTE) teaching staff, with 167,151.9 (FTE) at government schools and 91,833.7 (FTE) at non-government schools (ABS, 2013c).

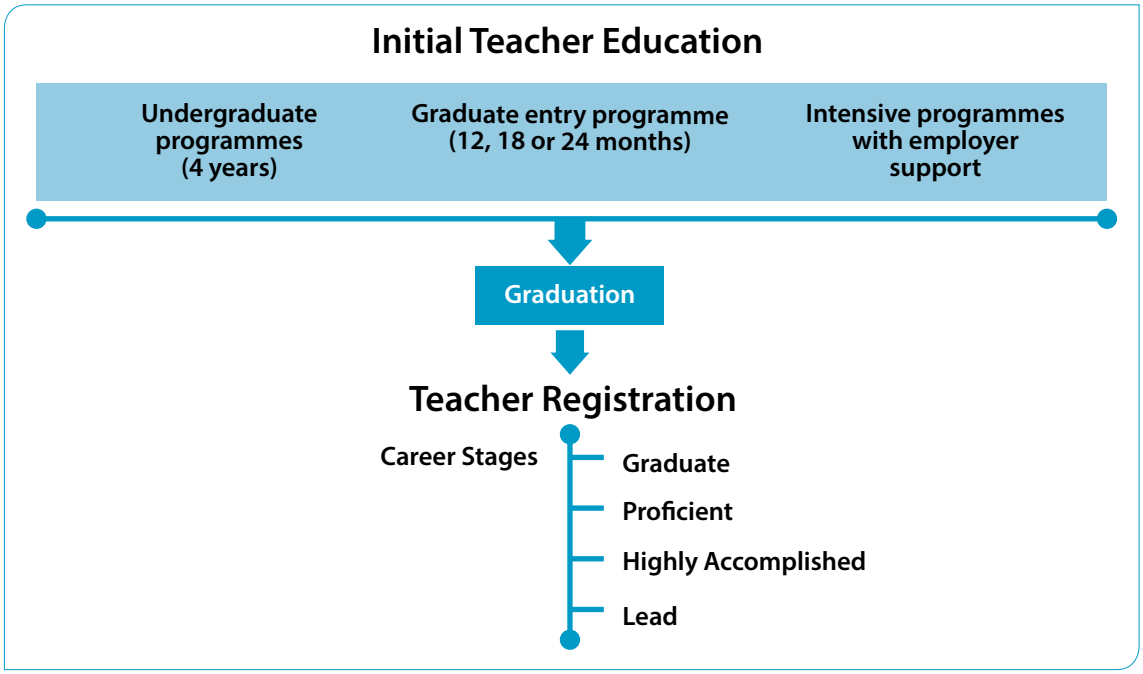
1.4 Teacher Qualification in Australia

There are a number of pathways to becoming a qualified teacher in Australia. All are governed by Accreditation Standards put in place by the Australian Institute for Teaching and School Leadership[5] (AITSL, 2011a, 2012a), teacher regulatory authorities in each state and territory, as well as higher education authorities (Lloyd, 2013). There are around 400 formally accredited initial teacher education programmes[6] covering early childhood, primary, middle years and secondary schooling offered through 50 higher education institutions in Australia, with the majority based in public universities. How these programmes are accredited is covered in detail in Section 5 of this report. The initial teacher education programmes offered in Australian institutions, based on the Programme Standards for the accreditation of initial teacher education programmes (AITSL, 2012a) and as noted in Figure A.1, are:

- undergraduate programmes (4 years), typically a Bachelor of Education; or,
- graduate entry programmes (12, 18 or 24 months), typically a Graduate Diploma in/of Education or a Master of Teaching; or,
- intensive programmes with employer support such as 'Teach4Australia' (TFA)[7] or 'TeachNext'[8].

5 AITSL, http://www.aitsl.edu.au
6 For a list of accredited programmes, see http://www.aitsl.edu.au/initial-teacher-education/accredited-programs-list.html
7 See http://teachforaustralia.org for details of this programme
8 See http://deewr.gov.au/teach-next for details of this programme

Figure A. 1: Progression of career from Graduate (initial teacher education) to Lead teacher



Following graduation but prior to employment, teachers apply for registration with the regulatory authority[9] in the jurisdiction where they intend to teach (see Section 5 for further information). Once they begin their employment, they may proceed through the career stages (shown in Figure A.1 and described in detail in the following section).

1.5 Career Ladder for Practising Teachers

In recent years, a clear career ladder for teachers has appeared based on the career stages used to structure the Australian Professional Standards for Teachers[10] (AITSL, 2011b). These career stages are: Graduate, Proficient, Highly Accomplished and Lead (see Figure A.1). The Standards at the Graduate stage serve a double role for both beginning teachers and programme accreditation.

The responsibility for in-service professional development generally falls to the individual teacher (see Section 5) and, in all jurisdictions; renewal of teacher registration[11] is dependent on having met requisite training hours (20 hours per annum over 3 or 5 years, depending on jurisdiction). This may be through attendance at relevant seminars, conferences and workshops (see, for example, the continuing professional development [CPD] requirements in the state of Queensland). [12] AITSL has developed an overarching Australian Charter for the Professional Learning of Teachers (AITSL, 2012b) which:

- affirms the importance of learning in improving the professional knowledge, practice and engagement of all teachers and school leaders to achieve improvement in student outcomes;
- articulates the expectation that all teachers and school leaders actively engage in professional learning throughout their careers; and,

9 See http://www.atra.edu.au for a list of all teacher regulatory authorities in Australia and also New Zealand
10 For a complete list of the Australian Professional Standards for Teachers, see http://www.teacherstandards.aitsl.edu.au
11 Teachers in Australia need to be 'registered' in order to work as a teacher in both government and non-government schools. Before 2013, registration was governed by state and territory regulation.
12 The Queensland requirements may be found at http://www.qct.edu.au/Renewal/CPDFrameworkExplained.html

- describes the characteristics of a high quality professional learning culture and of effective professional learning, to assist teachers, school leaders and those who support them to get the most from their professional learning.

The identified characteristics of effective professional learning for teachers are that it should be: relevant, collaborative and future focused.

The main providers of teacher professional development – aligned to the Australian Professional Standards for Teachers (AITSL, 2011b) – are educational systems and teacher professional associations. AITSL has set in place self-paced professional learning[13] based on the Professional Standards and a number of universities conduct short courses specifically designed to support teachers' continuing professional learning.

2. ICT Professional Development Strategy for Teachers

Much of the reporting in this case study will refer to the Australian Professional Standards for Teachers (AITSL, 2011b) introduced in Section 1. These will be referred to using the acronym APST. As previously noted, the APST provide the framework to guide professional learning, registration and certification for all practising teachers. Later in this report, it will become apparent how these Standards – along with other requirements – are used in the design and accreditation of teacher education programmes in Australia (see Section 4). The APST are based on three domains: (AITSL, 2010a, 2010b, 2011b)

- ***Professional Knowledge,*** with two Standards: (1) Know students and how they learn; and (2) Know the content and how to teach it;
- ***Professional Practice,*** with three Standards: (3) Plan for and implement effective teaching and learning; (4) Create and maintain supportive and safe learning environments; and, (5) Assess, provide feedback and report on student learning; and,
- ***Professional Engagement,*** with two Standards: (6) Engage in professional learning; and (7) Engage professionally with colleagues, parents/carers and the community.

Each Standard is further defined by Focus Areas, each with descriptors across the four designated career stages introduced in Section 1. These are: Graduate, Proficient, Highly Accomplished, and Lead.

While there is no formal nationally-accepted ICT Professional Development Strategy for Teachers in Australia, a de facto strategy may be seen to be embedded within the APST. While many Standards can be demonstrated through the meaningful use of ICT in the classroom[14], there are three Focus Areas which explicitly reference ICT. These, drawn from differing domains, are described in full in Table A.2.

Of critical importance in regard to these Standards are their developmental nature and their grounding in professional learning. Just as in UNESCO's (2008) *ICT Competency Standards for*

13 The self-paced programme may be found at http://www.aitsl.edu.au/professional-learning/professional-learning.html

14 For ICT elaborations at the Graduate stage, please see http://acce.edu.au/sites/acce.edu.au/files/TTF%20-%20Graduate%20Teacher%20Standards%20-%20ICT%20Elaborations%20-%20200411.pdf

Teachers and in the research literature (see, for example, the SAMR [Substitution, Augmentation, Modification and Redefinition] model [Redecker and Johannessen, 2013]), teachers' use of ICT should change over time either in terms of deepening their own knowledge and those of their peers or by changes in their teaching practice to enhance student learning outcomes.

Table A. 2: Australian Professional Standards for Teachers with explicit reference to ICT, by career stage

Career Stage	Focus Area 2.6: Information and Communication Technology (ICT)	Focus Area 3.4: Select and use resources	Focus Area 4.5: Use ICT safely, responsibly and ethically
Graduate	Implement teaching strategies for using ICT to expand curriculum learning opportunities for students.	Demonstrate knowledge of a range of resources, including ICT, that engage students in their learning.	Demonstrate an understanding of the relevant issues and the strategies available to support the safe, responsible and ethical use of ICT in learning and teaching.
Proficient	Use effective teaching strategies to integrate ICT into learning and teaching programmes to make selected content relevant and meaningful.	Select and/or create and use a range of resources, including ICT, to engage students in their learning.	Incorporate strategies to promote the safe, responsible and ethical use of ICT in learning and teaching.
Highly Accomplished	Model high-level teaching knowledge and skills and work with colleagues to use current ICT to improve their teaching practice and make content relevant and meaningful.	Assist colleagues to create, select and use a wide range of resources, including ICT, to engage students in their learning.	Model, and support colleagues to develop, strategies to promote the safe, responsible and ethical use of ICT in learning and teaching.
Lead	Lead and support colleagues within the school to select and use ICT with effective teaching strategies to expand learning opportunities and content knowledge for all students.	Model exemplary skills and lead colleagues in selecting, creating and evaluating resources, including ICT, for application by teachers within or beyond the school	Review or implement new policies and strategies to ensure the safe, responsible and ethical use of ICT in learning and teaching.

Source: Adapted from AITSL (2010a, 2010b, 2011b).

3. Development of ICT Competencies for Teachers

The development of the ICT competencies for teachers in Australia parallels that of the development of the Australian Professional Standards for Teachers (APST) (see previous sections). There were a large number of stakeholders involved ranging from state and federal government officers to representatives from teacher groups and universities. This began officially in 2009 and continues to the present. This section will outline the steps taken to achieve this outcome.

In 2009, as the Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDYA), the Ministers formally commissioned Teaching Australia to begin work on what was tentatively called the *National Framework for Professional Teaching Standards*. Teaching Australia, and its successor Australian Institute for Teaching and School Leadership (AITSL) formed in January 2010, has continued this work to date. In December 2010, MCEECDYA endorsed the National Professional Standards for Teachers (AITSL, 2011b), which later became known as the Australian Professional Standards for Teachers. This work was governed by a subcommittee of MCEECDYA. The membership of the original subcommittee and its working groups formed in 2010 are summarised in Table A.3. Terms of reference for these groups are not publicly available.

Table A. 3: MCEECDYA working groups on the development of national Standards

	Chair	Members	Writer/ Contractor
National Standards	Head, State Education Systems	15 senior officers of Commonwealth, State and Territory education systems, regulatory authorities, and academics.	Delegated work to subcommittees
Subcommittees/Working Groups of the MCEECDYA subcommittee			
Expert Writing	Senior Officer, State Education Systems	8 senior officers of Commonwealth, State and Territory education systems, regulatory authorities, and academics.	Senior Officer, a state regulatory authority.
Validation Steering Committee	Head, National regulatory authority	11 senior officers of principals' and teachers' professional associations and unions, and regulatory authorities.	SiMERR[29], University of New England

Source: SiMERR website[15]

The Board of AITSL has a standing committee called the Teacher Quality Advisory Committee (TQAC) chaired by a member of the AITSL Board and with members representing major stakeholders in the school education sectors. The purpose of TQAC is to review and shape initiatives, resources and support materials associated with the teacher quality agenda and to promote the Australian Professional Standards for Teachers. Work on certification and evaluation is steered by relevant internal and external working groups and committees of AITSL, including TQAC.

The December 2010 endorsement followed more than a decade of activity with the first recommended set of national Standards being published by the Australian Council of Deans of Education (ACDE) in 1998 (ACDE, 1998). Through this period, work was being undertaken at Commonwealth, State and Territory levels to define and promote quality teaching, learning and curriculum with various jurisdictions developing their own Professional Teacher Standards (see, for example, New South Wales Institute of Teachers, 2005) and providing significant resources to support their application and assessment (see, for example, Board of Studies, Teaching and Educational Standards [NSW], 2015).

Further to this were a range of initiatives at the state and territory level in developing and using various ICT capability and standards frameworks with some of these involving formal certification. For example, in Queensland (until late 2012), teachers in government schools were required to demonstrate their ICT competency, making use of a specially-designed three-level framework known as the *Smart Classrooms Professional Development Framework* (DETE, 2011). The highest level attainable was a Digital Pedagogy Licence (Advanced).

At the Commonwealth level, there were significant policy initiatives under way. These included The National Partnership on Improving Teacher Quality (2008); and the *Melbourne Declaration of Educational Goals for Young Australians* (MCEETYA, 2008), which, as noted in Section 1, included the foundations for the development of the Australian Curriculum.

The formal work begun by AITSL towards defining national Teacher Standards drew on a groundswell of previous work in schools, professional teacher associations, educational systems at the state and territory levels, and policy and programme work at the national level. A critical contributor to this development was the 2011-2012 'Teaching Teachers for the Future' project

15 SiMERR, Centre for Science, ICT and Mathematics Education for Rural and Regional Australia based at the University of New England, see http://simerr.une.edu.au

(ACDE, 2012), which added an explicit focus on ICT through ICT Statements and Illustrations of Practice[16] at the Graduate career stage. The development of these Standards involved five elements with the TTF project providing a sixth element for the purposes of this case study. These elements with descriptors and a timeline are summarised in Table A.4 and elaborated in further detail in the text, which follows.

Table A. 4: Development of the Australian Professional Standards for Teachers

#	Element and timeline	Process
1	Advice and drafting from the expert group and appointed writers *18 months* *June 2009 to Dec 2010* *(includes Elements 2 and 3)*	• Analysis and review of the Standards in use by Australian teacher registration authorities, employers and professional associations • Development of draft Standards for consultation • Continuing revision based on consultation
2	Extensive public consultation *3 months* *March to May 2010*	• National consultation workshops • Online submissions • Analysis of submissions
3	Validation study of Standards *6 months* *July to December 2010*	• Online surveys: (i) teachers in selected schools, and (ii) open to any teacher • Focus group workshops: teachers, teacher educators, and teacher associations
4	'Teaching Teachers for the Future' project: ICT Statements and Illustrations of Practice *18 months* *April 2011 to December 2012* *NB: Work on Illustrations of Practice of other dimensions of the Standards is ongoing.*	• Development of Statements of Practice using consultants and focus groups of expert teachers • Development of three Illustrations of Practice through partnership between the Australian Council for Computers in Education (ACCE) and Education Services Australia (ESA) • Development of a further seven Illustrations of Practice by AITSL and ESA
5	Certification of teachers *Commenced June 2011* *Ongoing*	• Development of national framework • Development of certification process
6	Evaluation *Commenced June 2013* *Ongoing*	• National forum – wide range of stakeholders • National online survey of teachers, school leaders, teacher educators, pre-service teachers.

3.1 Governance of the Development of Teacher Standards, including ICT Competencies

The following provides elaborations of selected elements listed in Table A.4.

Element 1, concerned with the initiation of the development of the Standards, has been discussed in the preamble to this section.

Element 2: Consultation of Draft Standards (March-May, 2010)

The consultation phase was undertaken over a three-month period (see Table A.4) and involved a wide range of stakeholders including but not limited to teachers, representatives of teacher professional associations, unions, and teacher education academics. The draft national Standards

16 Refer to http://www.aitsl.edu.au/australian-professional-standards-for-teachers/illustrations-of-practice/find-by-career-stage

were made available on the MCEECDYA website in early March 2010[17] and consultation ended late May. The consultation took two forms:

- ***Consultation workshops***: Local education authorities, employers and regulatory authorities determined the arrangements for consultation within their jurisdictions while the Commonwealth Government conducted consultations with national stakeholders; and,
- ***Submissions invited through advertisement***: A total of 120 submissions were received from Commonwealth, State and Territory governments, regulatory authorities, unions, professional teacher associations, parent associations, universities, schools and individuals including teachers, school leaders, academics and other interested stakeholders. Some submissions represented the views of organisations that had themselves undertaken extensive consultation with their members/constituents.

Questions were developed to focus discussion and feedback:

- Does the preamble to the Standards give a clear picture of the context for the reason, use and purpose of the Standards?
- Do the draft Standards describe a realistic and developmental teacher professional standards continuum?
- Do the draft Standards reflect what you would expect teachers to know and be able to do for each of the four career stages, namely, Graduate, Proficient, Highly Accomplished, and Lead teachers?
- Are there other descriptors the draft Standards should include?
- Remembering that there will be substantial support materials, will it be possible for educators to use the Standards to evaluate teacher practice?

Feedback and submissions were analysed by a team of experts engaged for this work. Each of the submissions was read by multiple analysts to ensure that the views expressed could be represented accurately in the final consultation report (AITSL, 2010b).

Element 3: Validation (July-December, 2010)

This element was an essential inclusion to determine the validity and reliability of the draft Standards in different types of schools in different locations across Australia. The group charged with this responsibility was the Centre for Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR), based at the University of New England (see Table A.3).

Involving nearly 6,000 school leaders and classroom teachers from over 500 schools ensured that the views of professionals played a significant role in determining the applicability and usefulness of the Standards. The *Final Report on the Validation of Draft National Professional Standards for Teachers* (Pegg, et al., 2010) was completed in November 2010. The executive summary of the validation report stated that the aim of the study was:

> To validate the draft standards proposed for the four career stages of teacher development against teacher perceptions of the difficulty, and the appropriateness, preparedness and priority for development of the descriptors, and through analysis of teacher comments about their career development and of the nature of their work (p. i).

17 The 2010 Draft Professional Standards may be found at http://www.aitsl.edu.au/docs/default-source/default-document-library/consultation_report

Below is a summary of the methodology used in the validation process. Where appropriate, the text is an extract from or paraphrase of the text in the validation report's executive summary.

> The first steps involved psychometric analysis of two sets of surveys directed at teachers in each State and Territory. Both surveys examined teachers' perceptions of the Standards (closed questions) and commentary on them (open questions).
>
> - ***Survey 1*** addressed the perceived attainment 'difficulty' of descriptors as a means of validating the descriptors in each of the career stages. The study involved teachers in 177 schools. Rasch scale modelling was used to analyse the reliability estimates and item fit with Item Fit maps generated for descriptors in each Standard and for all descriptors. Descriptors not fitting the model were identified. Difficulty estimates were also calculated using a common scale and descriptors ranked from most to least difficult. The relative difficulty within a Focus Area provided evidence on the need to modify and amend descriptors.
> - ***Survey 2*** addressed the internal validity of the descriptors in terms of three constructs: (i) appropriateness, (ii) preparedness, and (iii) priority for development within each career stage. Survey 2 involved teachers in 377 schools and teachers who responded to an advertising campaign through educational systems and professional teacher associations. Using Rasch scaling techniques, the data were analysed for each career stage, in terms of each of the three constructs and as a single construct. Issues and advice was provided based on the evidence of descriptors not fitting, fitting, or deemed to 'overfit' the model.

The validation process also involved National Focus Group workshops in each State and Territory. The focus of these workshops was on possible issues associated with the implementation of the descriptors and on the evidence basis that might determine their achievement. Participants to these National Focus Group Workshops were nominated high-quality teachers at a range of career stages drawn from government and non-government primary and secondary schools. Members of professional associations and tertiary institutions were also invited to send representatives to the Workshops.

As a consequence of the evidence outlined above, the validation team and members of the expert writing team revised descriptors and Focus Areas prior to the preparation of the Standards for approval and subsequent endorsement. The validation report (Pegg et al., 2010) also provided additional advice on the differing needs of various education systems, the development of Standards for school leaders, and the issue of transition from university to early career teacher.

Element 4: 'Teaching Teachers for the Future' (2011-2012), and the Development of ICT Statements and Illustrations of Practice

The nationally significant AUD$8.8million 'Teaching Teachers for the Future' project[18] was funded through a Commonwealth ICT Innovation Fund (ICTIF) and was managed by the Australian Council of Deans of Education. It was aimed at building the ICT pedagogy capacity of Australian teacher educators with the expectation that this would not only influence and impact the next generation of teachers but would, in turn, influence and impact the current generation of teachers (see ACDE, 2012; Romeo, Lloyd and Downes, 2012b).

The project represented the first time that all Australian higher education institutions offering teacher education had come together to work collaboratively on building the ICT integration pedagogy capacity of pre-service teachers and teacher educators using the Australian Curriculum,

18 For a general introduction to the TTF Project, see http://www.acde.edu.au/pages/page50.asp

the Australian Teacher Professional Standards, and theoretical understandings drawn from the *Technological Pedagogical Content Knowledge (TPACK)* framework (Koehler and Mishra, 2009; Koehler, Mishra and Yahya, 2007; Mishra and Koehler, 2006) as a backdrop. *TPACK* was selected as it 'attempts to capture some of the essential qualities of teacher knowledge required for technology integration in teaching, while addressing the complex, multifaceted, and situated nature of this knowledge' (Mishra and Koehler, 2006, p. 1). It further supported the focus on teaching over technical skills highlighted in the APST relating to ICT pedagogy in schools and in the Programme Accreditation Standards relating to teaching in higher education. Romeo, Lloyd and Downes (2012a, 2012b) further explained that *TPACK* highlighted 'the nuanced and complex relationships between these three forms of knowledge; emphasised the connections, interactions and affordances, and constraints between and among content, pedagogy and technology; and influenced approaches to ICT integration in curricula and in teacher education' (p. 958).

One of the outcomes of TTF was the generation of ICT Statements, which aimed to demonstrate how each of the Standards might be demonstrated through the meaningful use of ICTs. Through a process led by AITSL, the ICT Statements were developed to provide a more detailed description of the types of practices that would meet the Standards when ICTs were being used effectively for teaching and learning.[19] A total of 32 ICT Statements were developed for the 37 descriptors at the Graduate career stage.[20]

The methodology for the development of the ICT Statements involved subcontracting the initial drafting to consultants followed by having an expert focus group of experienced ICT-using teachers review the Statements and provide feedback. Once final versions were generated, they were trialled by a number of initial teacher education providers.

Finally, ten Graduate-level Illustrations of Practice were developed by Education Services Australia (ESA) in collaboration with the Australian Council for Computers in Education (ACCE). The Illustrations of Practice drew on original materials (including video footage) and re-purposed materials. At each stage of development, there was a quality assurance process to ensure that they were robust and fit for the purpose. Those developed specifically for the TTF project were later included in the Illustrations of Practice housed on the AITSL website. AITSL also developed an e-Evidence user guide to support pre-service teachers' use of the ICT Statements and Illustrations of Practice.[21] It is common practice in Australia to develop, and authenticate resources such as the Illustrations of Practice and exemplar materials, with input from expert teachers, academics, and curriculum specialists sourced through subject associations, education departments and other agencies such as ESA, ACCE and AITSL.

Element 5: Certification (from June 2011)

In Australia, initial training, and further formal qualification of teachers is through accredited university qualifications. Continuing professional development (CPD), as noted in Section 1, is undertaken through a wide range of formal professional learning opportunities offered by private providers, universities, education systems, and subject associations. Many informal opportunities such as webinars, workshops, and conferences are also available.

19 This work was undertaken as part of the 'Teaching Teachers for the Future' (TTF) project funded by the Australian Government Department of Education, Employment and Workplace Relations through the ICT Innovation Fund. For further information, see http://www.aitsl.edu.au/docs/default-source/apst-resources/teaching_teachers_for_the_future.pdf

20 The ICT Statements can be found at http://www.aitsl.edu.au/docs/default-source/apst-resources/teaching_teachers_for_the_future_-_graduate_teacher_standards_-_ict_statements.pdf

21 These may be found at: http://www.aitsl.edu.au/certification/certification-evidence

While most teachers participate in formal and informal professional learning relating to ICT in Education, their skill, knowledge and understanding of the use of technology in learning and teaching, is not formally assessed by, for example, a written exam. They are however, required, in order, to gain full registration and further certification, to evidence growth and development in Standards 2.6, 3.4, and 4.5. The process of attaining and renewing professional registration is handled by State and Territory regulatory authorities, usually on the recommendation of the Principal. Since 2013, these assessment and appraisals have been progressively undertaken using:

- The Australian Professional Standards as a taxonomy by which teacher performance is to be judged;
- A nationally consistent approach to teacher registration; and,
- A national certification process for Highly Accomplished and Lead teachers.

AITSL undertook the work to develop the last two of these measures. In both cases, this involved extensive national consultation based on audits and analyses of existing state or territory, national and international practices as well as invited submissions, focus group workshops, targeted meetings and think tanks that brought together national and international experts in the relevant areas.

The nationally consistent approach to teacher registration[22] outlines the requirements for teachers to initially progress from Graduate to Proficient career stages (see Table A.2, Figure A.1). These requirements include: an initial period during which a new teacher has a form of licence that allows them to be employed as a teacher; a fixed period where the new teacher is required to demonstrate proficiency and suitability to teach; and possible sanctions, including withdrawal of registration, if the new teacher fails to meet the required standards of personal and professional behaviour or professional performance. Teachers undertake their registration processes with their State or Territory-based teacher regulatory authority.

The national certification process for Highly Accomplished and Lead teachers (see Table A.2, Figure A.1) is a formal certification process designed to recognise and promote quality teaching, provide an opportunity for teachers to reflect on practice, and provide a reliable indication of quality teaching used to identify and recognise Highly Accomplished and Lead teachers nationally. The certification process is managed by the State or Territory-based teacher regulatory authorities.

Within this national approach to Standards, registration and certification, there is an expectation that as teachers progress through the career stages of Graduate, Proficient, Highly Accomplished, and Lead, they will provide, usually through a professional portfolio, substantiated and credible evidence that they meet each Standard. This evidence must be: Standards-based, focused on student improvement, and based on nationally and internationally recognised appropriate practice. AITSL provides guidelines on what constitutes evidence as well as self-assessment tools, examples of evidence sets, processes and procedures for acquiring internal and external feedback on performance, and accessing networks and communities of practice. AITSL also provides guidelines and frameworks for school leadership teams involved in the assessment of teacher performance.[23]

22 More details about teacher registration in Australia can be obtained from AITSL at http://www.aitsl.edu.au/verve/_resources/Teacher_Registration_in_Australia.pdf

23 More details about Certification of Highly Accomplished and Leader teachers can be obtained from AITSL at http://www.aitsl.edu.au/verve/_resources/Certification_of_Highly_Accomplished_and_Lead_Teachers_-_Principles_and_processes_-_April_2012_file.pdf

Element 6: Evaluation of the Standards (from June 2013)

AITSL, in partnership with the Centre for Programme Evaluation at the University of Melbourne and the Australian College of Educators, is conducting a major three-year evaluation of the implementation of the APST. Cyclical reviews of the Standards are important. A major review after three years, especially in the early stages of implementation is appropriate followed by minor reviews possibly every three years.

The focus of this evaluation is on the usefulness, effectiveness and impact of implementation of the Standards on improving teacher quality. There have been a range of initiatives that have contributed to the implementation of the Standards, which include but are not limited to: the accreditation of initial teacher education programmes; the implementation of nationally consistent teacher registration; the development of a certification process for Highly Accomplished and Lead teachers; and the development of support materials and resources at the national, state, sector and local levels. The Evaluation has three stages:

Stage 1

- Build evaluation foundation; establish groups and teams; and list, review and programme logic;
- Hold a national forum; and
- Collect and review existing documentation.

Stage 2

- Undertake national online survey;
- Analyse and present preliminary report;
- Undertake case studies; and
- Continue collection of existing documentation.

Stage 3

- Undertake stakeholder interviews; finalise collection of existing documents;
- Conduct second national online survey; and
- Triangulate findings; revisit programme logic and outcomes; and draw overall conclusions.

The Centre for Programme Evaluation published its interim report (AITSL, 2014), which included the following information:

National Forum (June – August 2013)

A total of 39 stakeholder groups including key education organisations, teacher professional associations, national bodies, policy-makers, employers and school leaders participated in the National Forum that included a number of workshops and interviews. The forum explored participants' perceptions of the success factors for implementation of the Standards. Group open-ended responses were coded to elicit common success factors.

National online survey (October – November 2013) investigated participants' perceptions of, their knowledge of, attitude towards and use of the Standards. Participants involved teachers, school leaders, teacher educators and pre-service teachers. Just over 6,000 educators participated in the survey with nearly 70 per cent of these being practising teachers.

4. Aligning the Teacher Training Curriculum with the ICT Competencies

There is a clear alignment between the ICT competencies described in the Australian Professional Standards for Teachers (APST) (see Sections 2 and 3 of this report) and initial teacher education in Australia. Further to this are two requirements placed on all teacher education programmes for accreditation: (1) Initial Teacher Education Programme Accreditation Standards (AITSL, 2011a, 2012a); and (2) the Elaborations of Priority Areas, as outlined by Standing Council on School Education and Early Childhood (SCSEEC, 2012).

4.1 Initial Teacher Education Programme Accreditation Standards

All Australian higher education institutions offering initial teacher education are required to have their pre-service programmes accredited irrespective of their format (see Figure A.1). This accreditation is in accordance with the seven AITSL Programme Accreditation Standards[24] (see Table A.5), which are deemed to underpin 'high-quality initial teacher education programmes' (AITSL, 2011a, p. 3). Institutions are required to demonstrate the Standards at the time of both accreditation and re-accreditation (see Section 5).

Table A. 5: Summary of ITE Programme Standards

#	Name	Summary
1	Programme outcomes	Includes meeting the Graduate career stage of the Australian Professional Standards for Teachers
2	Programme development	Includes consultation to ensure consideration of: school and system needs; current expert knowledge; authoritative educational research; and, community expectations
3	Programme entrants	Outlines minimum entry requirements
4	Programme structure and content	Describes time allocation (as percentages) of differing requirements within programmes
5	School partnerships	Describes conditions for practicum (professional experience), namely, length, location, range of experience
6	Programme delivery and resourcing	Includes teaching and assessment strategies, staff qualifications and experience, resourcing (library and ICT)
7	Programme information and evaluation	Outlines self-evaluation and annual reporting

Source: AITSL (2011a).

Of particular interest to this case study are Programme Accreditation Standards 1 and 6.

Programme Accreditation Standard 1

Programme Accreditation Standards 1.1 and 1.2 specify that the graduates of the presented programme must meet the Graduate career stage of the APST. ICT competencies for pre-service teachers are guaranteed through the institution's response to those Standards, which explicitly reference ICT (see Table A.2) namely:

24 As outlined in the *Accreditation of Initial Teacher Education Programs in Australia: Standards and Procedures*, see http://www.aitsl.edu.au/docs/default-source/initial-teacher-education-resources/accreditation-of-ite-programs-in-australia.pdf

- APST 2.6: Information and communication technology (ICT)
- APST 3.4: Select and use resources, including ICT
- APST 4.5: Use ICT safely, responsibly and ethically

Programme Accreditation Standard 6

Programme Standard 6.1 specifies that: Programmes must use effective teaching and assessment strategies (linked to intended learning outcomes) and resources, including embedded information and communication technologies.

Programme Standard 6.4 specifies that: Providers ensure that their facilities conform to the general expectation for a contemporary higher education learning environment appropriate to the mode of delivery, including such matters as access to education-related library resources, and information and communication technologies.

How these Standards are met is a decision to be made by the Higher Education Institution itself (SCSEEC, 2012). The following discussion will briefly present the differing approaches taken by four Australian TEIs with data drawn from accredited programmes. The institutions are de-identified and will be referred to as Institution A to D.

Institution A, in its undergraduate Bachelor of Education programmes, with specialisations in early years, primary and secondary education, has opted to develop dedicated semester-long ICT subjects.[25] These cover technical competency as well as pedagogy. Pre-service teachers are encouraged to develop both digital artefacts as well as written responses such as lesson plans or critiques of research. Institution A has also opted to list APST 2.6, 3.4 and 4.5 in their practical field studies programme, that is, where it is expected that these Standards will be demonstrated in school settings under the supervision of a practising teacher.

Institution B, in its fully online graduate-entry Master of Teaching (Early Years) programme, has elected to cover the ICT elements of Programme Accreditation Standard 1, that is, APST 2.6, 3.4 and 4.5, as a cross-curriculum or embedded activity. For example, APST 2.6 is addressed in five discrete subjects respectively concerned with literacy, language, technology, mathematics and the arts. The students are asked to demonstrate their ICT competency through such activities as developing: an online teaching resource to develop children's literacy, a lesson plan, which makes use of ICT, to support literacy, and elsewhere to support mathematical concepts; a multimedia presentation for a hypothetical audience of parents; and a lesson plan which demonstrates the responsible use of ICT in the teaching of science.

Similarly, APST 3.4 is met in Institution B through six semester-long subjects with some overlaps to those, which address Standard 2.6. The additional subjects are in health and physical education and indigenous perspectives. The cited subject in the arts demonstrates APST 3.4 through a different assessment task to that which demonstrates APST 2.6. This pattern is repeated in the achievement of Standard 4.5. In providing evidence for Programme Standard 6, Institution B describes how it will support the online cohort through a customised learning management system (LMS), which makes effective use of content display, sharing and creation as well as interactive communication tools.

25 The term, 'subject' is adopted here to describe a self-contained unit of study, typically one semester (13-14 weeks in length). Subjects are referred to by differing names in Australian higher education institutions. A 'programme' is here used to describe the degree or course, which is made up of individual 'subjects.'

Another, ***Institution C,*** has adopted a hybrid approach in designing an on-campus Master of Teaching (Secondary Education). It has developed a core 'Digital Learning' subject that asks students, in response to:

- APST 2.6 and 3.4, to critique and adopt appropriate pedagogical approaches using learning technologies to engage teenagers in authentic, active and collaborative learning.
- APST 4.5, to investigate contemporary issues and current trends in ICT in Education through an inquiry project.

In addition to this, other subjects in the programme address differing aspects of the APST, for example, the application of ICT in physical education and health (APST 2.6) and in science (APST 3.4). At Institution C, the ethical component of APST 4.5 is embedded in broader understandings of professional conduct and demonstrated in the practicum. In its response to Programme Accreditation Standard 6, Institution C referred holistically to its adoption by teaching staff of digital resources as well as to specific infrastructure resources, such as its library and online LMS.

Finally, ***Institution D,*** in its Master of Teaching (Primary Education) programme has also adopted a hybrid approach. It differs from Institution C in that it offers a partially dedicated or shared subject, that is, one, which addresses the teaching of both technology and the arts. It also offers a strong emphasis on ICT in curriculum subjects dedicated to the teaching of English, social education, mathematics, and health and physical education. This programme interestingly combines with an engineering faculty for the teaching of robotics.

What is clear in this brief overview is that the APST, which comprises the de facto ICT competency framework, can be achieved in multiple ways. Institutions will need to show, when it comes time to re-accredit their programmes, that they have delivered on the promises made in their initial submissions (see also Section 5).

4.2 Elaborations of Priority Areas

The Standing Council on School Education and Early Childhood (SCSEEC) has endorsed a list of national priority areas (SCSEEC, 2012). These are: Aboriginal and Torres Strait Islander education; Classroom management; ICT; Literacy and numeracy; and, Students with special educational needs. For each of these, in concert with peak bodies such as the Australian Council of Deans of Education (ACDE), the Australasian Teacher Regulatory Authorities (ATRA), and the Australian Teacher Education Association (ATEA), AITSL has developed elaborations, particularly of requisite knowledge, which provide a useful insight into how the priority area might be covered in teacher education programmes. The elaborations for ICT are presented in Table A.6.

Table A. 6: Elaborations for ICT as a national Priority Area

Knowledge	Teaching strategies
• Understanding of the underlying social and pedagogical implications of ICT and their application to education • Knowledge of responsible and ethical use of digital information including in relation to plagiarism, copyright, censorship, bullying and privacy	• Understanding of innovative use of information and communication technologies in enhancing student learning • Understanding of the capacity of ICT to support differentiated student-centred learning and the development of critical and creative thinking • Ability to select and evaluate ICT-based learning materials and software and integrate them into their teaching • Ability to effectively employ ICT applications to support specific syllabus outcomes, content and processes • Ability to design a range of ICT-based assessment tasks linked to curriculum outcomes • Understanding of the collaborative and student-led nature of effective ICT-mediated learning
Using information	**Technical skills**
• Understanding of the issues of appropriate access to, and verification of, information gained from a variety of sources including the Internet and other digital resources • Ability to critically evaluate, retrieve, manipulate and manage the information from a range of digital sources including social media	• Understanding of the range of applications and adaptive technologies available to support students with special needs • Ability to construct and manipulate texts and images, create presentations and store and retrieve digital information for classroom and on-line learning • Ability to use appropriate digital resources for student profiling and reporting, lesson preparation, and class/faculty administration • Ability to safely and effectively use ICT in online collaborative environments

Source: SCSEEC (2012).

The Programme Accreditation Standards and the national priority areas together show how ICT competencies need to be aligned to, included in and demonstrated by the Australian teacher training curriculum. They also allow scope in how the requirements are met.

5. Assessing Acquired ICT Competencies

The previous sections have described the Australian Professional Standards for Teachers, and their development, including the embedding of ICT competencies within the general Standards. Notwithstanding state and jurisdictional differences, there is a general expectation that through initial teacher education (training) and ongoing professional development, teachers will aspire to, and in most cases, meet the Standards and acquire ICT competencies.

The checks and balances within the system to ensure that this is the case are seemingly well developed and effective at the teacher training and graduation level, but less so after gaining registration/employment (see Section 3). As a teacher progresses through the system from Graduate to Accomplished teacher and beyond (see Figure A.1), there is an expectation that individuals will take responsibility for building their own professional capabilities. They are also expected to gather evidence, usually through a professional portfolio, to demonstrate that Standards and competencies have been met. Generally, motivation for doing so includes, but is not limited to, professional pride, employability, pay increases and promotion.

This system has produced a very professional and skilled workforce – Australian teachers are highly regarded, well-qualified and overall produce excellent results. However, the system does have its challenges especially in the capacity of teachers to teach through, with and about technology.

5.1 Training/Graduation/Provisional Registration

As noted, pre-service teacher training, often referred to in Australia as initial teacher education (ITE), is delivered by higher education institutions, typically universities. These institutions are regulated by the Tertiary Education Quality Standards Agency (TEQSA), which assures the quality of the higher education sector in Australia as a whole. TEQSA also registers and assesses the performance of institutions against a *Higher Education Standards Framework*.[26]

As similarly noted, the institutions delivering pre-service teacher programmes must have their courses approved and accredited/re-accredited by AITSL (see Section 2). While TEQSA ensures that the institution overall meets general tertiary education standards relating to provision, qualifications, teaching and learning, information, and research, it is jurisdictional teacher regulatory authorities that accredit and approve pre-service teacher courses using the nationally agreed approach.[27.]

For an ITE course to be approved and accredited, the institution must submit detailed evidence to the relevant jurisdictional regulatory authority showing that successful completion of the course will result in students meeting the Graduate Standards – the first career stage depicted in the Australian Professional Standards taxonomy.[28] Specially convened panels including experienced teacher educators review the submissions and decide whether each of the Programme Accreditation Standards, including the Australian Professional Standards for Teachers, has been met, and globally, if the national priority areas (see Section 4) have been addressed.

As noted in Sections 2, 3 and 4, the institution must, in particular regard to ICT, provide evidence[29] of how graduate teachers will be taught to:

- Implement teaching strategies for using ICT to expand learning opportunities for students (APST 2.6);
- Demonstrate knowledge of a range of resources, including ICT, that engage students in their learning (APST 3.4); and,
- Demonstrate an understanding of the relevant issues and the strategies available to support the safe, responsible and ethical use of ICT in learning and teaching (APST 4.5).

The approval and accreditation process normally takes 6-8 months with courses being approved for 5 years, after which re-accreditation must be sought. Institutions are required to provide samples of student work at the time of re-accreditation. This will be the clearest indication if, or not, the APST relating to ICT have been met. Accredited programmes are listed on the AITSL website.[30] Successful completion of an accredited programme generally leads to provisional registration as a teacher and a provisional licence to teach (it should be noted that jurisdictional differences apply).

26 For more information, see http://www.teqsa.gov.au/about
27 See http://www.aitsl.edu.au/initial-teacher-education/initial-teacher-education.html
28 See http://www.aitsl.edu.au/australian-professional-standards-for-teachers/standards/overview/career-stages
29 Institutions provide the information required by the accrediting panel on three templates, see, for example, http://www.aitsl.edu.au/verve/_resources/Guide_to_accreditation_process_Final_April_2012_-Template_B.rtf
30 As noted, the list of accredited programmes may be found at http://www.aitsl.edu.au/initial-teacher-education/accredited-programs-list.html

This process of programme accreditation relating to the professional standards and successful programme completion is the quality assurance framework that Australia relies upon to ensure that graduate teachers can teach well generally and, in particular, teach well with ICT. The processes of accreditation and re-accreditation is how Australia ensures that teacher education programmes are providing opportunities for graduating teachers to engage with ICT competencies and develop appropriate pedagogical practice.

6. Impacts and Issues

Given the complex position and nature of teacher education and schooling in the Australian system and its historical antecedents in a colonial structure, the development, evolving implementation, and widespread acceptance of the Australian Professional Standards for Teachers (APST) as a nationally-consistent framework for improving teacher quality, is a very significant achievement. It has been a rigorous process that has taken over a decade to achieve (see Section 3). An indication of the impact of this work is evidenced by the adoption of the career stages by all State, Territory and independent school systems and regulatory authorities, and their acceptance by teachers, professional associations and teacher unions. A formal evaluation of the implementation of the Australian Professional Standards for Teachers (APST) is underway with its final report due in late 2014 (see Section 3, Table A.4).

Further, the APST taxonomy has had a profound impact on university teacher training courses and the course accreditation process (see Section 4). Its position as one of the Programme Accreditation Standards (Standard 1) is a measure of its significance. This, as explained in Sections 4 and 5, is one of the means to align identified ICT competencies with the teacher training curriculum. As noted, this is specifically through those APST which explicitly reference ICT, namely, APST 2.6, 3.4 and 4.5 (see Table A.2).

A further issue impacting on the need to ensure the ICT competency of Australian teachers is the parallel development of the Australian Curriculum,[31] managed by the Australian Curriculum, Assessment and Reporting Authority (ACARA) (see Section 1). All learning areas in the P-10 years embed ICT as a General Capability and many challenges remain particularly relating to ICT pedagogy integration.

At one level, the challenge is the continual advent of emerging technologies that promise new solutions to teaching and learning. At another level, the challenge is to build the capacity of teacher educators and a whole generation of teachers who are not only struggling with basic personal digital literacy but also, and more importantly, ICT pedagogy integration. The 2013 *K-12 Horizon Report,* for example, describes emerging technologies likely to have a profound impact on education in the next one to five years, including cloud computing, mobile learning, learning analytics, open content, virtual and remote laboratories and 3D printing (Johnson et al., 2013) This, of course, is in parallel with coming to terms with the demands of the new national curriculum.

A comparable issue is evident in teacher education. Successive editions of the *Higher Education Horizon Report*[32] point out that many lecturers do not acknowledge the importance of digital literacy and do not use new and compelling technologies in their own teaching. The 'Teaching Teachers for the Future' (TTF) project (see Section 3) attempted to address this issue and successfully

31 The Australian Curriculum may be found, as a digital document, at http://www.australiancurriculum.edu.au

32 A recent example may be found at: http://www.nmc.org/publications/2013-technology-outlook-australian-tertiary-education

engendered substantive change in the ICT in Education (ICTE) capacity of pre-service teachers (Jamieson-Proctor et al., 2012). It also, to a certain extent, redressed the impediments to the broader use of ICT in classrooms and in higher education noted in the literature. The primary aim of the TTF project was capacity building and the systemic embedding of an ICTE dimension in pre-service teacher education curriculum, pedagogies, assessment and professional experience.[33] The TTF project broke new ground in Australian school education and higher education. It showed that all higher education institutions offering teacher education programmes have a clear commitment to ICT pedagogy and to its integration into classrooms all around the country; and provided substantive evidence that large-scale interventions of this nature are effective in building capacity and bringing about change.

A similar commitment is evident in the work of national agencies such as AITSL. They have addressed the dissonance created by many leadership teams, individual lecturers, teachers and student teachers who ask, 'what does ICT pedagogy integration look like,' that is, how might both in-service and pre-service teachers visualise the enactment of the Standards as well as topics from the Australian Curriculum, in their classrooms. One solution that AITSL, in concert with Education Services Australia (ESA) and jurisdictional authorities has offered is through its ongoing development and annotation of the previously-cited Illustrations of Practice[34] (see Section 3). AITSL also provides several programmes/initiatives to help teachers and principals to understand the purpose and use of the APST and ancillary material.[35]

Further, some state government education systems provide self-assessment tools and online learning modules which individual teachers can use to measure, and improve their competency with ICT in the classroom. For example, the NSW government's 'Leading my Faculty' (New South Wales Department of Education and Training, 2009) modules allow teachers to work through structured activities relating to ICT pedagogy. Australian teachers are further supported by government agencies such as Education Services Australia (ESA) providing exemplars and resources for teaching with and about ICT, particularly through the 'Scootle' portal.[36]

The issues faced by Australian teachers and education systems revolve around curriculum change, developing technologies and increased accountability through professional standards. Teachers are not alone in this and systems and universities are scaffolding their development of ICT competencies through resourcing, provision of exemplars and intervention through funded research.

7. Conclusion

There has been an increasing movement in Australian schooling to regard ICT as an integral part of teaching rather than as a separate entity. This is evident in three significant ways:

- ***First***, the wording of the pivotal *Melbourne Declaration* (MCEETYA, 2008) offers ICT as one of a number of integral critical skills needed as a foundation for success. In its Goal 2, the Declaration describes that successful learners, amongst other attributes, will 'have the essential skills in literacy and numeracy and are creative and productive users of technology, especially information and communication technology, as a foundation for success in all learning areas' (p. 8).

33 The resources developed through the TTF project may be accessed at: http://www.ttf.edu.au
34 The Illustrations of Practice can be found at: http://www.teacherstandards.aitsl.edu.au/Illustrations
35 The AITSL learning Centre may be accessed at http://www.learn.aitsl.edu.au
36 Resources may be accessed by Australian teachers through: http://www.esa.edu.au/projects/scootle

- ***Second***, the Australian Curriculum, enacting the advice from the *Melbourne Declaration*, has included ICT as one of its general capabilities, positioning it on a par with literacy, numeracy, critical and creative thinking, personal and social capability, ethical behaviour and intercultural understanding. General capabilities are understood to: 'comprise an integrated and interconnected set of knowledge, skills, behaviours and dispositions that students develop and use in their learning across the curriculum, in co-curricular programmes and in their lives outside school' (ACARA, n.d, para. 2).

  Further, ICT as general capability, building on existing frameworks and a sound basis in the research literature, has been defined in such a way as to encourage students to be 'creative and productive' users. ACARA (2012) explained that:

  > Therefore, ICT capability needs to consider the types of tasks that provide authentic contexts for learning. The range of tasks is categorised into three sets: Investigating with ICT, Communicating with ICT, and Creating with ICT. Students also need the knowledge and skills to use ICT, based on an understanding of the 'nature of the machine'. This is encompassed in the Managing and Operating ICT element of the continuum (p. 3).

- ***Third***, the Australian Professional Standards for Teachers (AITSL, 2011b) does not have a separate category for ICT. This is particularly telling in Standard 3.4, which speaks of resources, including ICT. This sits well with ICT's role as a general capability and opens up, for example, the opportunity to offer a range of digital solutions to standard classroom tasks. This notion of ICT integration across the curriculum is celebrated in the previously-cited ICT Statements developed through the TTF project.

Overall, the lesson to be learnt in what is happening in Australia is that for ICT to become a critical but mainstream component of schooling, it needs to be embedded in any and all descriptors of what teaching and learning is about. Similarly, and perhaps, seemingly contradictory to this, is the APST 2.6 which is simply entitled, Information and Communication Technology (see Table A.2, Section 2). This acknowledges that bringing ICT into a teaching and learning environment does require a differing pedagogy, which transcends simple technical skills or competencies. It asks that the use of ICT expands learning opportunities and provides ways to make content relevant and meaningful. As with the *UNESCO ICT Competency Standards for Teachers* (UNESCO, 2008), it is clear that the intent here is not to replicate the past, but to enable the future.

In conclusion, it is important to note the contribution being made by teacher educators. The new Programme Accreditation Standards (see Section 4) as well as the requirements of TEQSA (see Section 5) are asking tertiary teachers to change their pedagogy and to make better and enhanced use of available technologies. Assembling the components for transformation is complete and, not only the content, but context of initial teacher education and what is expected in tertiary teaching is changing.

This case study has presented a glimpse of teaching and learning in Australia and the role that ICT is being asked to play. It has focused on practising teachers and what is asked of them in terms of new national Standards for registration, professional learning and promotion. It has also looked at initial teacher education (training) where the teachers of tomorrow will gain their understanding of how the classrooms of the future will operate, with ICT critical to much of what students create and how they communicate and demonstrate their learning.

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Reflecting teachers' voices:

Profiling Competency Standards in ICT-enhanced teaching and learning

Reflecting teachers' voices: Profiling Competency Standards in ICT-enhanced teaching and learning

By Heeok Heo (Sunchon National University)[37]

Abstract

The purpose of this case study is to document the process whereby teacher competencies were identified to fulfil SMART Education in Korea, and how the corresponding assessment tool of the teacher competencies was developed (Korean Ministry of Education, 2011). Since 2011, the Korean Ministry of Education announced a Master Plan of ICT use in education, pursuing the vision of 'SMART Education'. SMART Education may not be easily implemented in the traditional educational setting. Rather, implementing SMART Education may require transformation of educational systems in which teachers are one of the critical components (Frost, 2012; Lieberman and Pointer, 2008; UNESCO, 2008). In this regard, the teachers' active participation and professional development becomes more important than ever in actualizing SMART Education as part of the educational reform. To improve the quality of teachers, it is necessary to identify and diagnose their competencies so that professional development is tailored to their competency profiles.

This study conducted literature reviews, expert panel reviews, and interviews to identify core competencies, and factor analysis for validating the diagnosis tool. As a result, 13 competencies and 68 indicators in two categories were identified as the teacher competencies for SMART Education; and a web-based online tool was developed for diagnosing the teacher competencies. More specifically, the teacher competencies for SMART Education consist of a Fundamental domain and a Field Practice domain. The competencies in the Fundamental domain refer to personal attributes, which is the foundation for SMART Education implementation. They comprise of six competencies, namely, Creative problem-solving, Social ability, Flexibility, Technology literacy, Ethics, and Passion. The competencies in the Field Practice domain relate to specific educational tasks and activities intended to implement SMART Education. They consist of seven components, namely Understanding of the future of education, Content expertise, Building relationships with learners, Instructional design and development, Building learning affordance, Evaluation and reflection, and Building collaborative relationships with the community. Four to five Performance Statements were developed for each competency, and these Statements were revised for assessment purposes. Accordingly, 61 questions were developed for teacher competency assessment. The diagnostic tool can be used by teachers to self-assess their competencies and to guide their own professional development for the successful implementation of SMART Education.

37 **Acknowledgement:** This project had been conducted in support of KERIS (Korea Education and Research Information Service), a leading institution in research and development of ICT use in education. The case author would like to express special thanks to co-researchers: Kyu Yon Lim, Hyeonjin Kim and Hyeon Woo Lee.

1. Country Context/Background

1.1 Background Information

The Republic of Korea is a country in the far eastern part of Asia. Table K.1 shows some basic information about the country. According to Korean Statistical Information Service (KOSIS), the population of Korea was 50,423,955 people as of 31 May 2014. Education in Korea, at an estimated annual expenditure of 4.0 per cent of GDP, is largely managed by the Ministry of Education.

Table K. 1: Basic background information about Korea

National Flag	Taegeukgi		
Currency	won (US$1 = 1,127 won) (2012)		
Language	Korean (Writing system: Hangeul)		
Literacy rate	98.3% (2008)		
	Primary schools	**Middle schools**	**High schools**
Number of schools	5,913	3,173	2,322
Number of teachers	181,585	112,690	133,414
Number of students	2,784,000	1,804,189	1,893,303

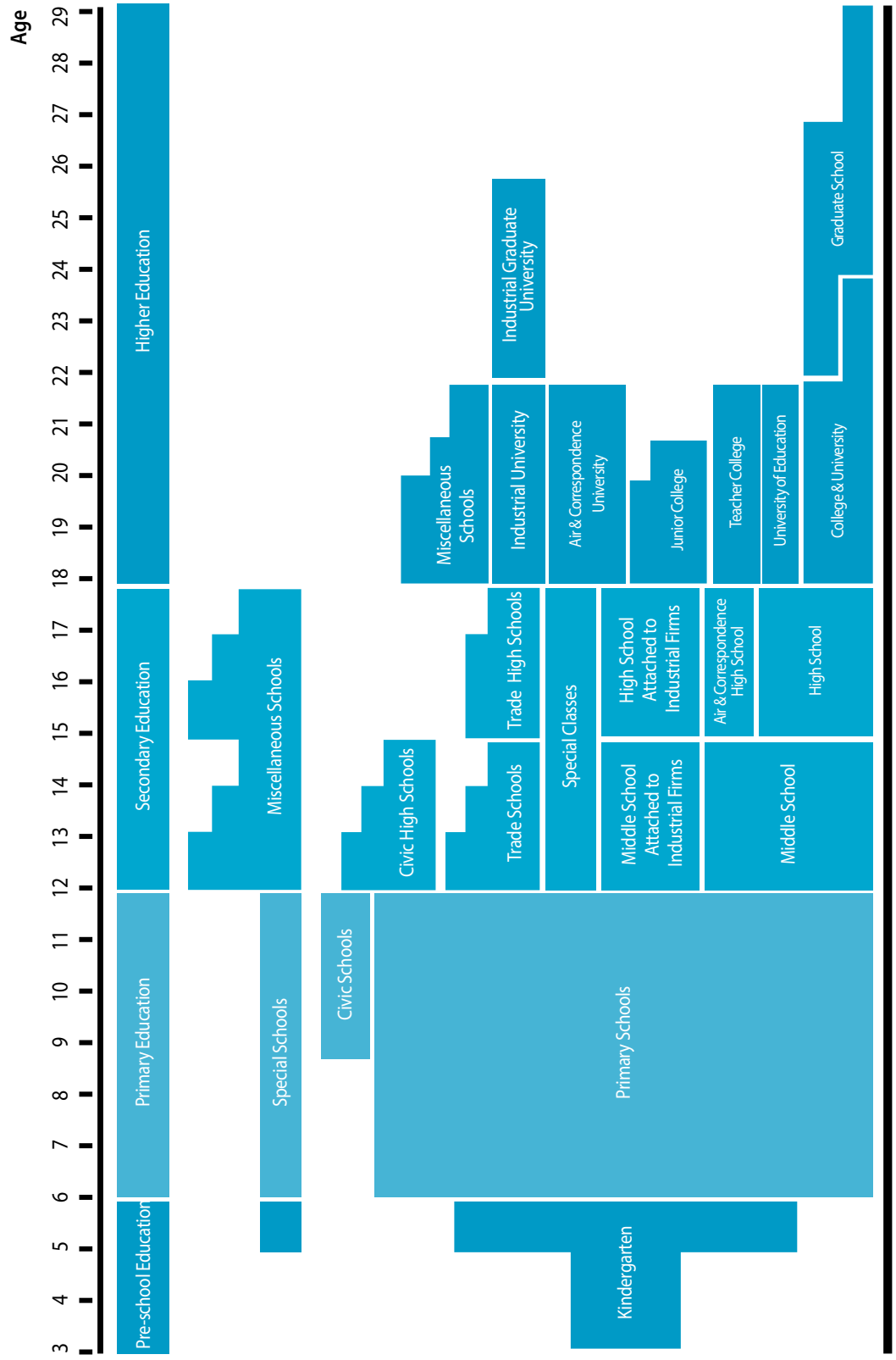
Source: KOSIS (2014).

1.2 Educational Policies and Plans for School Education

In 2011, the Korean government introduced major educational policy reforms with the vision of using creative talents and advanced science and technology capabilities for the future development of Korea. Six major tasks were identified (Korea Ministry of Education, 2011): (1) Expanding creative and character-building education to strengthen public education; (2) Establishing an advanced vocational education system that links education and work; (3) Enhancing the quality of education in higher education; (4) Nurturing world-class science and technology capabilities; (5) Improving the national strategic research and development system; and (6) Enhancing the globalization of education, science and technology.

The education system of Korea is a '6-3-3-4' system of institutions, which covers elementary school, middle school, high school and college or university. Compulsory education extends from age six to 14. Figure K.1 illustrates the school system in Korea.

Figure K. 1: Education system of Korea



Source: Korea Ministry of Education (2013).

1.3 Teacher Education System

Information about the teacher education system in Korea comes from the introductory document provided from the Korean Ministry of Education (Korea Ministry of Education, 2013). The classification and qualifications of teachers are defined in Section 2 of Article 21 of the 'Act on Primary and Secondary School Education'. Teachers are classified into teachers (Grade I and Grade II), assistant teachers, professional counsellors, librarians, training teachers, and nursing teachers (Grade I and Grade II). They are required to meet the specific qualification criteria for each category and be licensed by the Deputy Prime Minister and Minister of Education as regulated by the Presidential Decree.

There are two different systems for training teachers for primary and secondary education. An individual who wants to become a teacher needs to enter a four-year college of education at university level. The teacher training system for primary education is different than that for secondary education. Primary school teachers are trained at universities specialized in education, while secondary school teachers are trained in the college of education at universities in most cases. An individual who wants to become a school teacher in South Korea must take a number of credits in general education as well as in a specific subject at the university level. After graduating from universities, candidates take a nationwide teacher qualifying examination. The purpose of the examination is to recruit and select fully qualified teachers through an objective and fair competition. The candidates can select any cities or provinces to take the examination with the intention of taking a teaching position in the same location. City or provincial authorities are responsible for opening new positions and recruiting competent teachers with teaching certificates for schools. The qualifying exam is divided into two stages. The first stage is to test knowledge about general education and a particular subject. The test at the second stage consists of an in-depth interview for examining teaching aptitude, and the evaluation of lesson plans and teaching practices. After passing the final stage of the examination, the successful applicants (normally half of those who passed the first stage) will be assigned to schools in the cities and provinces that they themselves have chosen.

Special school teachers, school librarians, and nursing teachers are required to be graduates of four-year colleges or junior colleges with relevant majors and teacher training. Part-time teachers must also possess either a 2-year or 4-year college degree with relevant professional training.

Practising teachers can be promoted after undergoing in-service teacher training, which aims to enhance teacher competencies on the basis of various educational theories and practices. In-service training programmes are available for both Grade I and Grade II teachers as well as librarians (Grade I), nursing teachers (Grade I), professional counsellors (Grade I), vice-principals, and principals. Teacher training institutes are established at universities, teachers colleges, local education offices, or some other organisations designated by the Ministry of Education.

2. ICT Professional Development Strategy for In-Service Teachers

The content of this chapter comes from the White Papers published by KERIS (2012, 2013, 2014).

Since 1988, ICTs have been used as important media at schools, and the training of teachers in the use of ICT was implemented on a full scale. Prior to 2000, ICT training had two courses: a regular course for teachers, and a special course for professors and school inspectors. The regular

course initially focused on the understanding of structures and principles of computers and later advanced to promote the improvement of information capability such as word processors, spreadsheets, presentations, Internet use, etc.

The special course was designed for the training instructors in regional education offices, designers of educational content, school inspectors for computer training, etc. In 2001, the Ministry of Education introduced the Plan for ICT in Education for public education. The training programmes consisted of mandatory ICT training provided by the regional education offices, and voluntary ICT training provided by the schools.

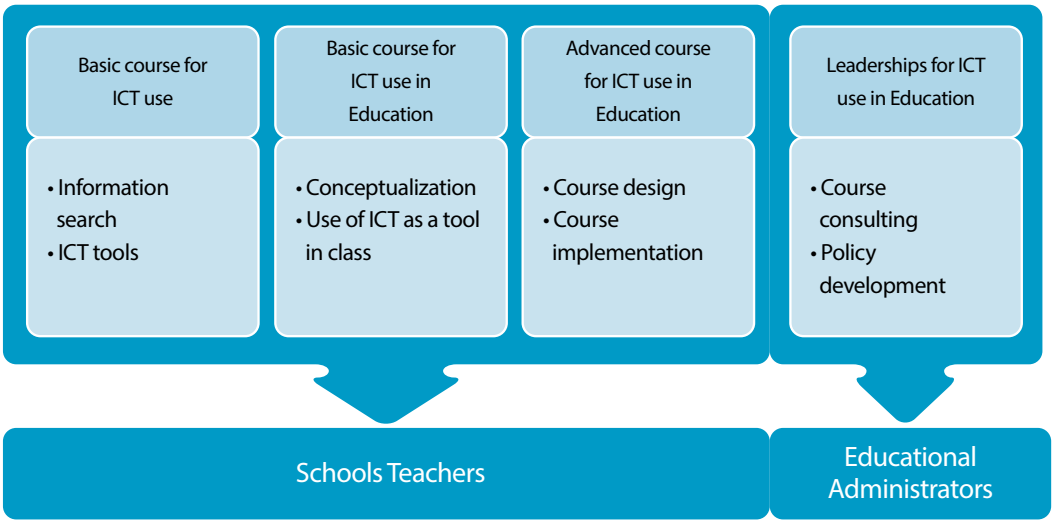
In 2006, the training courses were systematically operated based on the teachers' life cycles and capability levels. New courses in various areas were being developed continuously in line with new developments in the school curriculum and ICT, as well as changes in the educational environment.

In 2008, the 'Development of the Next Generation Training Programme for Teachers' project was launched. The 'Next Generation Training Programme for Teachers' aimed to strengthen the teachers' capability to work effectively in a new educational environment brought about by advances in ICT and a paradigm shift in education.

In addition, the 'Information Strategy Planning for the Consolidated Information System for Teachers Training' was established in view of the need for consolidated information systems to strengthen the teachers' capabilities.

Beginning in 2009, the construction of the Consolidated Information System for Teacher's Training was developed in stages: construction of infrastructure to collect training information, teachers' training status management, and teachers' self-diagnosis of capability and consulting function. Figure K.2 shows a conceptual framework for ICT training in a teacher's professional life cycle.

Figure K. 2: Conceptual framework for ICT training in a teacher's professional life cycle



Source: KERIS (2012).

Currently, professional development of ICT focuses on the development of competencies in using digital textbooks and implementing SMART Education. For example, an online and a mobile diagnostic tool via EDUNET[38] have been established for teachers to self-evaluate their SMART competencies and to obtain feedback. Distance learning programmes for teacher education have been developed, and cover 42% of all teacher training programmes. The duration of each programme is 15 class hours per credit. Lead teachers who can deliver training on the use of digital textbooks, and master teachers who can lead the implementation of SMART Education were identified. Finally, teacher groups for research and development were formed to develop and implement a variety of learning methods and cases on digital textbooks and SMART Education.

3. Development of ICT Competencies for Teachers

A recent study, supported by KERIS in Korea, was conducted to develop teacher competencies for SMART Education. The study was carried out in three stages. The outcome of the study was documented in three different reports. [39]

Stage 1: Competency Modelling of 21st Century Teachers in Korea

Stage 1 aims to identify the core competencies of teachers in order to cope with the educational needs in the 21st century. Based on the analysis of the current status on teacher competency modelling and existing studies, the study conducted a modified 3-round Delphi process. Delphi is a structured communication technique, originally developed as a systematic, interactive forecasting method, which relies on a panel of experts (Keeney, McKenna and Hasson, 2011). In general, the questionnaire of the first round is delivered to acquire responses relevant to the topic. Then the subsequent questionnaires are developed based on the returns from the initial questionnaire, requiring judgment on each item. In this study, the first round of Delphi was replaced by a focus group meeting and Behavioural Event Interviews (BEI) in order to extract expertise from the exemplary field practitioners while maintaining efficiency in data collection.

As suggested by McClelland (1987), the BEI method was adopted in order to identify behaviours associated with significant experiences of each individual teacher by using a number of probing questions. In addition, a literature review was conducted to establish an in-depth understanding of teacher competency. Existing studies related to teacher competencies and professional development in national and international levels were reviewed and analysed to understand current trends of teacher competency development. Common competencies and indicators for teachers were derived from the analysis of the existing studies. The results from the first round produced a set of comprehensive lists of teacher competencies and relevant performance and knowledge indicators. The second and third rounds of the Delphi employed structured survey questionnaires in order to build a consensus among the Delphi panel.

Table K.2 provides an overview of the activities, participants, methodologies, duration, and outputs for this stage.

38 EDUNET, an educational information service, is the largest education portal in Korea and is administered with governmental support. Please refer to http://www.edunet.net/redu/main/mainForm.do for more information.

39 Reports used as sources for Stages described: the information on Stage 1 is from the report by Heo, et al. (2011), the information on Stage 2 is by Kim, Heo and Kim (2012), and the information on Stage 3 of the report is by Heo, et al. (2012).

Table K. 2: Overview information on Stage 1

	Activities	Participants/ accountability	Methods	Duration	Output
Step 1	Forming a research team	MoE, KERIS, educational experts		2 months	A research team
Step 2: Delphi round 1	Analyzing current status on teacher competency modelling and future direction of education Identifying the framework of teacher competencies	Educational experts, policy-makers, school teachers	Focus group meeting, BEIs	2 months	Initial set of teacher competencies
Step 3: Delphi round 2	Rating importance of competencies	Educational experts, policy-makers, school teachers	Delphi questionnaire	1 month	1st revised set of teacher competencies
Step 4: Delphi round 3	Making consensus	Educational experts, policy-makers, school teachers	Delphi questionnaire	1 month	2nd revised set of teacher competencies
Step 5: Confirmation by KERIS	Confirming the set of teacher competencies	Educational experts, policy-makers, school teachers		2 months	Final version of teacher competency set

Delphi round 1

A focus group meeting was conducted in order to discuss the essential abilities for competent 21st century teachers, as well as the current state and future direction of education. The participants for the meeting were selected based on their expertise relevant to the topics. The meeting lasted for two hours with an open-ended discussion. After the meeting, the participants were asked to elaborate their opinions related to the topics. They then sent the descriptions back to the researchers via email within a week.

For BEIs, a one-hour semi-structured interview was conducted with each participant. The participants were selected among Master teachers who were designated by the Ministry of Education based on the current policies for teacher qualifications. Interviewers attempted to uncover their past experiences by asking probing questions. The list of the core interview questions was as follows:

- Please describe your daily life in school. For example, what did you do yesterday?
- More specifically, what do you do to prepare, deliver, and follow-up on your teaching?
- Do you have any struggle in building a relationship with your students? How did you overcome the issues?
- Do you have any problems with your peer teachers or administrators? How did you overcome the issues?
- What are your positive experiences or unpleasant experiences as a teacher?
- What is your teaching philosophy? What did you do to practice this philosophy? Did it work?

As the interviews used the semi-structured questions in order to initiate the participants' reflection, the subsequent questions were different case by case.

The interviews were fully transcribed and analysed in order to seek any indicators of best teachers. All of the relevant behavioural as well as implicit knowledge descriptions were listed in addition to the results from the focus group meeting and literature review on future education and teacher competency.

As a result, 15 teacher competencies with 77 indicators, that is, 51 performance indicators and 26 knowledge indicators were suggested from the first round. Teacher competencies were grouped into two domains: Fundamental and Field Practice. The former included eight competencies of creativity, problem-solving, communication, collaboration, flexibility, technology literacy, integrity and passion; while the latter included seven competencies of expertise in content, rapport building with learners, instructional design and development, classroom management, evaluation and reflection, network building and performance assessment. This result was used to develop a structured questionnaire for the second Delphi round.

Delphi round 2

In the second round, the expert panel was asked to rate the importance of each competency and indicator on a six point Likert-type scale from 'very important' to 'not important'. The panel was also asked to state their personal opinions for revision and improvement of the list of competencies. The survey questionnaire was delivered via email.[40] Finally, 15 competencies and 74 indicators were identified as a result of Delphi round 2, which were used as a questionnaire for the next round.

Delphi round 3

In round 3, each Delphi panel expert received a questionnaire that included descriptive statistical information about how the group responded in the previous round.[41] By presenting the actual responses from others, researchers sought consensus among the group of experts (Jacobs, 1996). In this round, all participants made consensus to all competencies. Researchers decided to end the Delphi process with this round.

Stage 2: Investigation of Exemplary Performance of SMART Education

With the resulting teacher competency set from Stage 1, the researchers moved on to Stage 2 which investigated important behaviours and attitudes that teachers can exhibit in SMART Education. For this, BEIs and a survey study were conducted. Table K.3 provides an overview of the activities, participants, methodologies, duration and outputs for this stage.

Table K. 3: Overview information on Stage 2

	Activities	Participants/ accountability	Methods	Duration	Output
Step 1: Critical Incident Analysis	Identifying teachers' critical experiences	School teachers	Behavioural Event Interviews	1 month	List of critical events conducted by teachers
Step 2: Survey study	Confirming the findings	Educational experts, policy-makers, school teachers	Questionnaire	2 weeks	Behavioural indicators

40 see a sample page of the questionnaire in Appendix 1

41 see a sample page of the questionnaire in Appendix 2

Critical incident analysis

BEIs were carried out with Master teachers who were selected as good performing teachers in SMART Education by the Ministry of Education and Regional Offices of Education in Korea.

Each interview took about one and a half hours with semi-structured questions. Interviewers attempted to uncover the past experiences of the Master teachers by asking probing questions. The list of questions for the interview was as follows:

- What are some of the successful experiences that you had when you applied ICT in your classes? Why do you think they were successful?
- What are some of the unsuccessful experiences that you had when you used ICT in your classes? Why were they unsuccessful?
- How do you design your lessons with technology?
- What are your strengths and weaknesses in the use of ICT in your educational practices?
- What is your teaching philosophy? How do you practice this? Did it work?

The interviews were fully transcribed and analysed in order to identify indicators of good performing teachers. All the relevant teaching behaviours as well as tacit knowledge descriptions were listed. As a result, 40 behavioural indicators of teacher performance in SMART Education and educational needs were identified.

Survey study

An online survey was conducted involving the teachers to validate and confirm the findings of the first two stages of this study. The survey questionnaire consisted of 40 questions about teachers' behavioural indicators derived from the critical incidents of Stage 2, and 39 questions about educational needs for SMART Education using a six point Likert-type scale from 'very important' to 'unimportant' as well as open-ended questions.

As a result, 29 behavioural indicators for SMART Education were identified and validated.

Stage 3: Development of Teacher Competencies for SMART Education

In this final stage, the outcomes derived from Stages 1 and 2 were integrated to identify teachers' core competencies for SMART Education. To achieve this goal, expert panel reviews, interviews and surveys were employed. Table K.4 provides an overview of the activities, participants, methodologies, duration and outputs for this stage.

Table K. 4: Overview information on Stage 3

	Activities	Participants/ accountability	Methods	Duration	Output
Step 1: Integration	Identifying teachers' competencies for SMART Education through integrating the results from Stages 1 and 2	Educational experts, school teachers	Expert panel reviews and interviews	1 month	A set of teacher competencies for SMART Education
Step 2: Validation	Confirming the findings	School teachers	Questionnaire	2 months	Final set of teacher competencies

Integration

The competency set of 21st century teachers from Stage 1 and teachers' behavioural indicators from Stage 2 were integrated into a new set of teacher competencies for SMART Education. To refine the competency set, literature on the future trends of education and SMART Education for the 21st century, competencies of teachers suggested by prior studies, and the best practices of teacher training programmes were reviewed and analysed. Expert panel reviews were also conducted to refine the competency set. Educational experts and school teachers were involved in the review process.

Validation

To validate the competency set, a survey was carried out twice. In the first survey, a questionnaire consisting of 13 competencies and 67 indicators was administered.[42] Two hundred ninety-nine (299) good performing teachers for SMART Education took part in the survey. They were asked to rate the importance as well as their own performance level for each of the indicators on a six point Likert-type scale. The survey was conducted for a period of two weeks via email. The survey results were analysed by factor analysis and regression analysis. As a result, 13 competencies and 61 indicators were identified.

The second survey was conducted using the revised version of the competency set. One thousand sixty-six (1,066) teachers from primary, middle, and high schools took part in the survey. They were asked to rate the importance as well as their own performance level for each of the indicators on a six point Likert-type scale. The survey was conducted for a period of 3 weeks through an online tool. The survey results were analysed by factor analysis and regression analysis.

Through the three-stage research and development, the teacher competencies for SMART Education were identified and finalized.

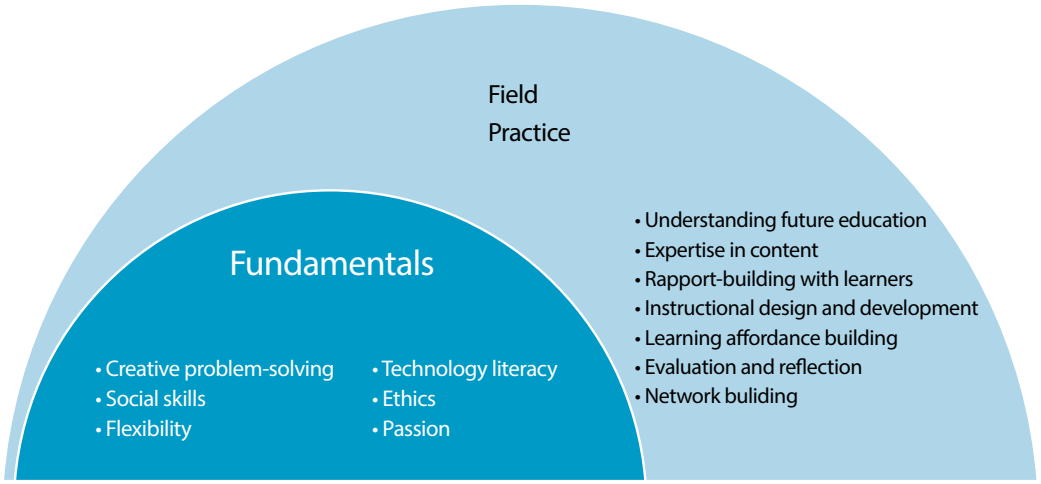
Final Set of Teacher Competencies for SMART Education

The teacher competencies for SMART Education are defined as 'the essential characteristics required for teachers who perform effective education in order to enhance 21st century core competencies of students and innovate education for the future' (Heo, et al., 2012). This definition has included knowledge, skills, and attitudes as well as competencies of teachers needed for effective innovation in education. It also implies to extend the concept of SMART Education to the vision and goal for the future of education rather than limiting it to the use of cutting-edge technologies such as smart devices in education.

More specifically, the teacher competencies for SMART Education consist of a Fundamental domain and a Field Practice domain (see Figure K.3).

42 see a sample page of the questionnaire in Appendix 3

Figure K. 3: Teacher competencies for SMART Education



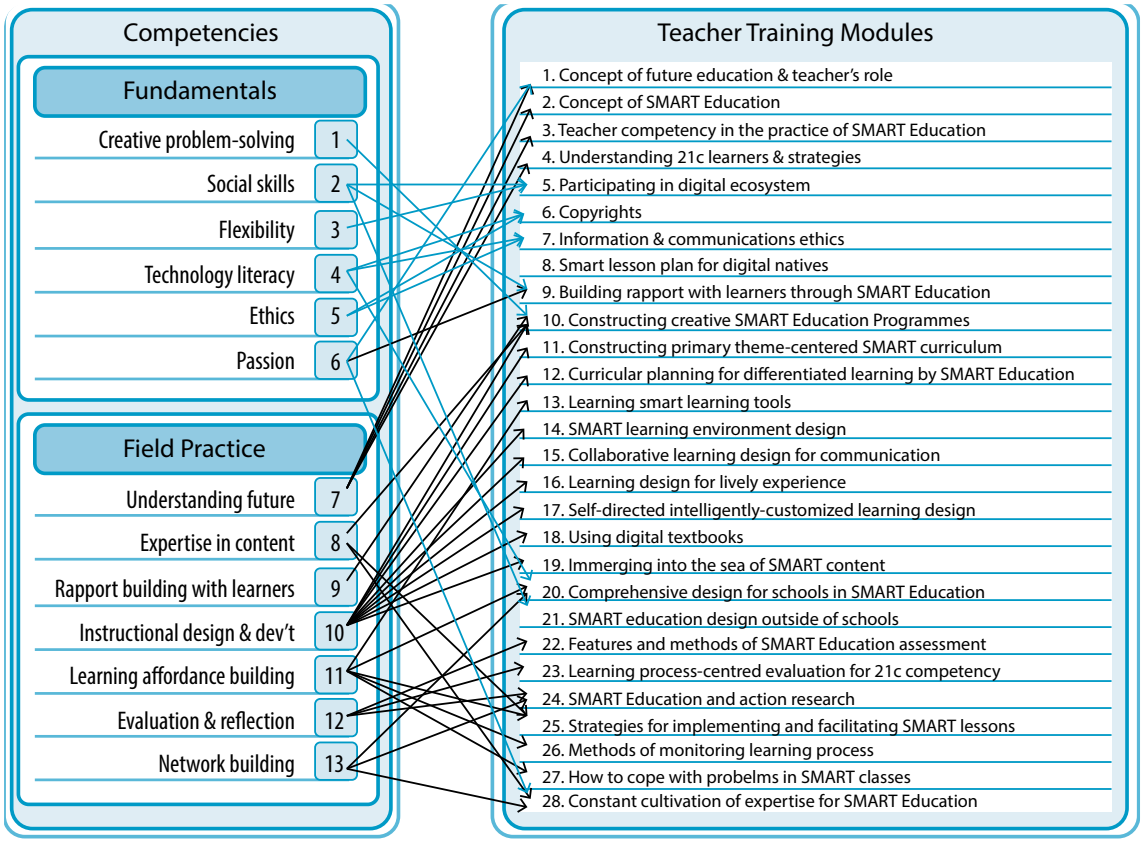
Source: Heo, et al. (2012).

The competencies in the Fundamental domain are personal attributes, which are the foundation for SMART Education implementation. The Fundamental domain consists of six competencies, namely creative problem-solving, social skills, flexibility, technology literacy, ethics and passion. The competencies in the Field Practice domain are specific educational tasks and activities intended to implement SMART Education. They consist of seven competencies, including understanding of the future education, contents expertise, building relationships with learners, instructional design and development, building learning affordance, evaluation and reflection, and building collaborative relationship with the community. Indicators for each competency are presented in Appendix 4.

4. Aligning the Teacher Training Programme with the ICT Competencies

In order to enhance the competencies identified for SMART Education, 28 modules for the teacher training programme were identified as an initial framework and verified by expert reviews. In the review, experts in the educational field were invited to rate the importance and relevance of each module and to suggest additional comments on the training programme. Figure K.4 indicates how the competencies are aligned with the suggested teacher training modules.

Figure K. 4: Suggested teacher training modules aligned with the competencies for SMART Education



Source: Jung (2014).

Each module of the training programme includes key learning topics and main learning methods for implementation which can be used as a guideline for full-scale development (See Table K.5).

Table K. 5: Key learning topics and learning methods in teacher training modules

Module	Key learning topics	Main learning methods
1. Concept of future education and teachers' role	• Societal and educational changes • Future of our schools and classrooms	• Lecture and discussion
2. Concept of SMART Education	• Definition and characteristics of SMART Education • Technologies and educational approaches in SMART Education	• Lecture and discussion
3. Teacher competency in the practice of SMART Education	• Teacher competencies in SMART Education • Identification of the competencies for my educational practices	• Lecture and discussion • Individual practices
4. Understanding 21st century learners and strategies	• Understanding learner competencies in the 21st century • Designing my classes for the competencies	• Lecture • Presentation
5. Participating in digital ecosystems	• Understanding cultural and technological trends in the 21st century • Using recent technologies for my everyday life	• Lecture and discussion • Individual practices
6. Copyrights	• Understanding the copyrights • Designing learning activities for students	• Lecture and discussion

Module	Key learning topics	Main learning methods
7. Information and communications ethics	• Understanding the Information and communications ethics • Designing learning activities for students	• Lecture and discussion • Case analysis
8. Smart lesson plan for digital natives	• Understanding digital natives • Learning design for digital natives	• Lecture and discussion • Individual practices
9. Building rapport with learners through SMART Education	• Communication and class administration • Using SNS tools for building rapport with learners	• Lecture and discussion • Group practices
10. Constructing creative curriculum for SMART Education	• Curriculum development • Redesigning my school curriculum for SMART Education	• Lecture and discussion • Case development
11. Constructing primary theme-centred SMART curriculum	• Using learning projects for SMART Education • Designing learning activities for projects	• Lecture and discussion • Case development
12. Curricular planning for differentiated learning by SMART Education	• Understanding differentiated and adaptive learning • Designing programmes for differentiated and adaptive learning	• Lecture and discussion • Case development
13. Learning smart learning tools	• Using mobile devices and educational applications • Using SNS tools and cloud services	• Lecture and discussion • Individual practices
14. SMART learning environment design	• Using mobile devices for SMART Education • Designing learning activities for my classes	• Lecture and discussion • Case development
15. Collaborative learning design for communication	• Understanding collaboration and communication • Designing collaborative SMART learning	• Lecture and discussion • Case development
16. Learning design for lively experience	• Using augmented reality and QR codes • Designing experiential learning	• Lecture and discussion • Case development
17. Self-directed intelligently-customized learning design	• Understanding online learning • Using online learning for SMART Education	• Lecture and discussion • Case analysis
18. Using digital textbooks	• Understanding digital textbooks • Developing digital textbooks for my classes	• Lecture and discussion • Case development
19. Immersing into the sea of SMART content	• Understanding learning platform for SMART Education • Using contents in the learning platform	• Lecture and discussion • Case analysis
20. Comprehensive design for school systems in SMART Education	• Understanding the diffusion of innovation • Building innovative system for SMART Education	• Lecture and discussion • Case analysis
21. SMART Education design outside of schools	• Building networks with external resources outside of schools • Using external resources for my classes	• Lecture and discussion • Case analysis
22. Features and methods of SMART Education assessment	• Understanding educational evaluation for SMART Education • Using assessment methods for SMART Education	• Lecture and discussion • Practices
23. Learning process-centred evaluation for 21st century competency	• Assessing learning processes • Sharing assessment strategies for SMART Education	• Lecture and discussion • Practices
24. SMART Education and action research	• Understanding action research • Developing reflective notes for implementation	• Lecture and discussion • Case analysis
25. Strategies for implementing and facilitating SMART lessons	• Understanding teacher scaffolding in SMART lessons • Understanding interactive strategies for SMART Education	• Lecture and discussion • Case analysis

Module	Key learning topics	Main learning methods
26. Methods of monitoring learning process	• Understanding monitoring and feedback for the learning process • Designing feedback for successful learning	• Lecture and discussion • Case development
27. How to cope with problems in SMART classes	• Understanding technical limitation • Coping with technical difficulties in SMART Education	• Lecture and discussion • Case analysis
28. Constant cultivation of expertise for SMART Education	• Understanding trends and issues in 21st century education • Developing expertise for SMART Education	• Lecture and discussion

Also, the modular structure allows one to select and organise the modules relevant to a certain purpose of teacher training. Table K.6 explains the suggested programmes by competency levels and themes. For example, if the competency level of the target audience is identified at the beginner level of implementing the SMART Education, 21out of 28 modules can be used for their training according to Table K.6.

Table K. 6: Suggested programmes by competency levels and themes

By level	Relevant modules	By theme	Relevant modules
Beginner level	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19, 22, 23, 25, 26, 27	SMART Education: Do it now	1, 2, 3, 4, 6, 7, 13, 14, 18, 19, 22, 27
Intermediate level	2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27	SMART Education: Focus on essentials	2, 3, 4, 14, 15, 16, 17, 18, 19, 22, 23, 25, 26, 27
Advanced level	2, 3, 4, 6, 7, 10, 11, 12, 13, 15, 16, 17, 18, 20, 21, 24, 28	Learning design in SMART Education	14, 15, 16, 17, 18, 19, 22, 23

Source: Jung (2014).

5. Conclusion

This case study aims to introduce trends and issues in ICT teacher competencies, and specifically to identify teachers' core competencies for SMART Education in Korea. The whole development process of the teacher competencies was divided into three stages. As a result, 13 competencies and 61 indicators were identified as the core competency set for teachers to implement SMART Education.

The competencies in the Fundamental domain represent the essential skills and abilities as well as personality which play a pivotal role in being a good teacher (Korthagen, 2004; Tigelaar, et al., 2004). The competencies in the Field Practice domain contain the skills and abilities that are required in performing SMART Education and educational practices in the 21st century.

Currently, KERIS has been developing an online diagnosis instrument using the teacher competencies for SMART Education. The instrument can be accessed through EDUNET from June 2014 onwards.

Looking ahead, teachers' professional development programmes should be designed in order to develop 21st century teacher competencies. Both pre-service and in-service teacher education must focus on developing 21st teacher competencies, which is required to educate future generations. When developing the training programmes, various learning and teaching methods should be integrated with the aim of competency development. For example, action learning and

case-based learning can be employed for learning content knowledge as well as for developing problem-solving competency. Also, peer consulting and counselling by experienced teachers offer continuing development beyond training in a limited period. Second, the diagnosis instrument can be used for assessing teachers' current competencies and discerning competencies that are needed for further development and enhancement. Diagnosing and evaluating teachers' competencies may be an essential condition in building an adaptive educational service. In many cases, professional development programmes for teachers are developed in order to enhance teachers' knowledge and abilities in specific fields, and implemented without any scientific analysis of their readiness and preferences. Therefore, the competency model and the diagnosis instrument may be used to provide teachers with a tailored training programme and continual professional development. The competency set should also be regularly refined and validated through the process of instrument development.

Appendix 1: A Sample Page of the Questionnaire in the 2nd Round of Delphi Study

Competencies and indicators	Importance					
	Very important					Not important at all
Fundamentals						
Creativity Generate meaningful outcome by applying new ideas or concepts, or by associating current ideas and new ideas.	1	2	3	4	5	6
1. Imagination: Form new ideas to combine personal experience with things which do not exist or have not been experienced.	1	2	3	4	5	6
2. Originality: Develop new ideas that are different from existing ones.	1	2	3	4	5	6
3. Usefulness: Elaborate and evaluate a new idea, and understand the limitations of its application.	1	2	3	4	5	6
4. Diversity: Develop and present new ideas in various ways.	1	2	3	4	5	6
Problem-solving Apply solutions to the given problems by analyzing issues and conditions, employing a variety of thinking procedures, and selecting the appropriate approach.	1	2	3	4	5	6
1. Understanding problems: Analyse and identify the attribute of problems in a given context using appropriate thinking methods.	1	2	3	4	5	6
2. Systems thinking: Analyse how parts of a whole interact with each other to produce overall outcomes within complex systems.	1	2	3	4	5	6
3. Critical thinking: Analyse and evaluate the given conditions, and integrate and interpret the information.	1	2	3	4	5	6
4. Applying solutions to problems: Prioritise the suggested solutions and apply them to solve the problems.	1	2	3	4	5	6
Please describe any competencies and indicators that need to be revised or deleted in this domain.						

Appendix 2: A Sample Page of the Questionnaire in the 3rd Round of Delphi Study

Competencies and indicators	Median	Response range (25% - 75%)	Answer from the 2nd round	Importance					
				Very important					Not important at all
Fundamentals									
Creativity Generate meaningful outcomes by applying new ideas or concepts, or by associating current ideas and new ideas.	6	5-6	6	1	2	3	4	5	6
1. Imagination: Form new ideas to combine personal experience with things which do not exist or have not been experienced.	5	4.8-6	5	1	2	3	4	5	6
2. Originality: Develop new ideas that are different from existing ones.	5	5-6	6	1	2	3	4	5	6
3. Usefulness: Elaborate and evaluate a new idea, and understand the limitations of its application.	5	5-5.5	5	1	2	3	4	5	6
4. Diversity: Develop and present new ideas in various ways.	5	4-6	6	1	2	3	4	5	6
Problem-solving Apply solutions to the given problems by analyzing issues and conditions, employing a variety of thinking procedure, and selecting the appropriate approach.	6	5-6	5	1	2	3	4	5	6
1. Understanding problems: Analyse and identify the attributes of problems in a given context using appropriate thinking methods.	5	5-6	5	1	2	3	4	5	6
2. Systems thinking: Analyse how parts of a whole interact with each other to produce overall outcomes within complex systems.	5.5	5-6	6	1	2	3	4	5	6
Please describe any competencies and indicators that need to be revised or deleted in this domain.									

Appendix 3: A Sample Page of the Questionnaire for Validation

Competencies and indicators	Performance						Importance					
	Strongly agree					Do not agree at all	Very important					Not important at all
Fundamental												
Creative problem-solving Generate new ideas or solutions, apply solutions to given problems by analyzing issues and conditions, employing a variety of thinking procedures, and select appropriate approach.												
Analyze and identify the attribute of problems in a given context using appropriate thinking methods.	1	2	3	4	5	6	1	2	3	4	5	6
Analyze and evaluate the given conditions	1	2	3	4	5	6	1	2	3	4	5	6
Provide various ideas and solutions.	1	2	3	4	5	6	1	2	3	4	5	6
Prioritize the suggested solutions and apply them to solve the problems.	1	2	3	4	5	6	1	2	3	4	5	6
Social skills Interact with others in order for problem solving, outcome generating, and learning.												
Interpret thoughts, emotions and opinions and express personal thoughts and opinions.	1	2	3	4	5	6	1	2	3	4	5	6
Understand and manage personal emotions, motivation and activities in social relationships.	1	2	3	4	5	6	1	2	3	4	5	6
Share knowledge and skills with others in order to achieve a mutual goal.	1	2	3	4	5	6	1	2	3	4	5	6
Establish visions, set goals and inspire and lead people for achieving a shared goal.	1	2	3	4	5	6	1	2	3	4	5	6

Appendix 4: Definition and Indicators for Teacher Competencies

Category	Competency	Definition	Indicator
Fundamental	Creative problem-solving	Generate new ideas or solutions, apply solutions to given problems by analyzing issues and conditions, employing a variety of thinking procedures, and select appropriate approach	1. Analyse and identify the attribute of problems in a given context using appropriate thinking methods. 2. Analyse and evaluate the given conditions 3. Provide various ideas and solutions. 4. Prioritise the suggested solutions and apply them to solve the problems.
	Social skills	Interact with others in order for problem solving, outcome generation and learning	1. Interpret thoughts, emotions and opinions, and express personal thoughts and opinions. 2. Understand and manage personal emotions, motivation and activities in social relationships. 3. Share knowledge and skills with others in order to achieve a mutual goal. 4. Establish visions, set goals, and inspire and lead people for achieving a shared goal. 5. Respect others and work together to accomplish a shared goal. 6. Behave responsibly taking into consideration the benefits to the community
	Flexibility	Actively embrace diversity which exists in society	1. Enjoy and take up the challenges, and understand the new changes in roles, tasks and given conditions, and adapt to the changes. 2. Acknowledge conditions and incidents that are not clear and stable, and behave wisely within the given contexts. 3. Embrace different cultures, acknowledge failure, and keep balanced for better achievement. 4. Participate in a new culture with advanced technologies including smart devices
	Technology literacy	Select and use appropriate technology for collecting, interpreting, using, and generating information	1. Understand critically messages in a wide variety of media modes and forms. 2. Select and use media to express messages relevant to a context. 3. Search, evaluate, use, and create information for the issue or problem at hand. 4. Comply with copyright law for the fair use of educational content. 5. Use smart devices (e.g. smart phones, SNS) to gather and use various information.
	Ethics	Demonstrate truthful and appropriate behaviours involving consistency in goals and means	1. Judge the right and the wrong without any deceit and hypocrisy, and do the right things. 2. Act reasonably, right and just, recognizing individuals' uniqueness and value. 3. Examine personal feelings and thoughts in the previous experience, and improve current performance in order to be a good teacher. 4. Do best as a teacher for the public good.
	Passion	Demonstrate affection and devotion as a teacher	1. Be certain of something good and true. 2. Continue with an unpleasant or difficult situation, experience, or activity over a long period of time. 3. Prepare thoroughly for all work. 4. Work with a strong sense of vocation in education. 5. Do the best job performance as teachers as your contribution to the public.

Category	Competency	Definition	Indicator
Field Practice	Understanding future education	Understand the definitions of future education and the visions of SMART Education	1. Apply the definition and scope of SMART Education in educational practices. 2. Recognize 21st century skills for students in a knowledge-driven society. 3. Figure out educational needs relevant to future society. 4. Predict the features of education in the future and investigate necessary information.
	Expertise in content	Understand and apply knowledge in the subject domain	1. Develop and illustrate appropriate learning goals, and share them with learners. 2. Organize learning content with the consideration of the given conditions, such as the attributes of subject matter, learners, and environment. 3. Deliver content effectively using appropriate presentation methods. 4. Develop expertise in subjects. 5. Inquire and search learning methods and strategies relevant to subjects.
	Rapport building with learners	Build a positive relationship with students in which teacher and students are able to understand each other	1. Facilitate learners to discover their own potential, and let them know teachers' expectations. 2. Be helpful and friendly toward learners, and respect learners' perspectives and behaviours. 3. Be affectionate and show your fondness for learners. 4. Identify learners' needs and conditions, and provide appropriate advice accordingly. 5. Provide support to learners' digital culture and behaviour. 6. Utilize smart devices for building positive relationships between teachers and students.
	Instructional design and development	Design teaching strategies and tactics, and develop teaching materials using smart devices and applications	1. Design coherent instructions in terms of learning objectives, content, methods, media and evaluation. 2. Design instructions involving effective use of technology and develop relevant materials in order to achieve objectives. 3. Design formal and informal teaching and learning activities, and develop relevant materials. 4. Select curriculum and content relevant to SMART Education 5. Implement SMART Education differentiated instruction in subject education. 6. Use advanced technologies and infrastructure in class. 7. Use various learning methods for designing and developing SMART learning. 8. Develop and use digital materials (e.g. digital textbooks, videos etc.).
	Learning-affordance building	Promote meaningful learning experience by organizing classroom environment, teaching and learning activities, and social relationships among students	1. Facilitate and maintain learner motivation by using questions, discussions, practices in which the learners can actively participate. 2. Establish and maintain an atmosphere where learners are able to concentrate on learning. 3. Make careful observation of learners, and provide timely and meaningful feedback. 4. Acquire and manage a variety of educational resources and environments systematically. 5. Help learners to promote a sound mind and body. 6. Maximize the interaction between teachers and students and among students. 7. Use smart tools for encouraging learners' engagement. 8. Cope with negative aspects of smart learning environment.
	Evaluation and reflection	Assess learners' performance and outcome of educational activities, and utilize the result of assessment for improvement	1. Develop strategies for evaluating the learning process and performance, develop measurement instruments, and share evaluation results with learners. 2. Develop strategies for evaluating educational programme outcomes, develop evaluation tools, and reflect on the results for improvement. 3. Develop and implement evaluation for assessing 21st century learners. 4. Use a variety of educational evaluation methods 5. Use smart tools for evaluation.
	Network building	Play a role as a member of the community and build relationships with regional stakeholders and resources	1. Provide learners with a rich learning experience by actively utilizing various resources from the community. 2. Establish positive and cooperative relationships with parents in order to acquire support from parents. 3. Practice a sense of community by participating in various voluntary services for the local community. 4. Recognize current international education issues relevant to teaching, and make an effort to be a part of it.

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Tailoring international competency models to a national context

Tailoring international competency models to a national context

By Jinhua Zhao (South China Normal University) and Yinjian Jiang (Guangdong Polytechnic Normal University)

Abstract

In 2004, the ICT Competency Standards for Primary and Secondary School Teachers were released by the Ministry of Education in China. The Standards have defined the ICT Competency Standards for administrative, teaching, and technical staff in four domains: Awareness and Attitude, Knowledge and Skills, Application and Innovation, and Social Responsibility. In the following decade, as a result of the development of training organisations and institutions, training curriculum and examination syllabus, training materials, test database and certification training institutions, 10 million primary and secondary teachers were trained. This training can be divided into primary, intermediate and advanced levels. As for the elementary level, ICT operation and design, including the development of media resources have been stressed. While the integration of ICT into teaching has been the focus of the intermediate level, at the advanced level, technology-enhanced new ways of learning, such as autonomous learning and cooperative learning had been the primary elements. After 10 years of training, most provinces had already reached the intermediate level, but had not yet entered the advanced level. Owing to the organised training, teachers have changed their ideas and awareness about the application of ICT, and therefore, have improved their ICT competency in classroom teaching, and promoted the transformation of their ways of teaching and learning.

1. Background

1.1 Education Background

According to the statistics, the population in China was estimated at 1.36 billion at the end of 2013 (National Bureau of Statistics of China, 2014). In 2010, the illiteracy rate was at 4.08 per cent, a decrease of 5.08 per cent from the 2002 figure of 9.16 per cent (National Bureau of Statistics of China, 2014). For the first time in China, educational investment as a proportion of GDP, which is 7.79 trillion RMB, reached 4 per cent in 2013 (Education Institute for 21st Century, 2013).

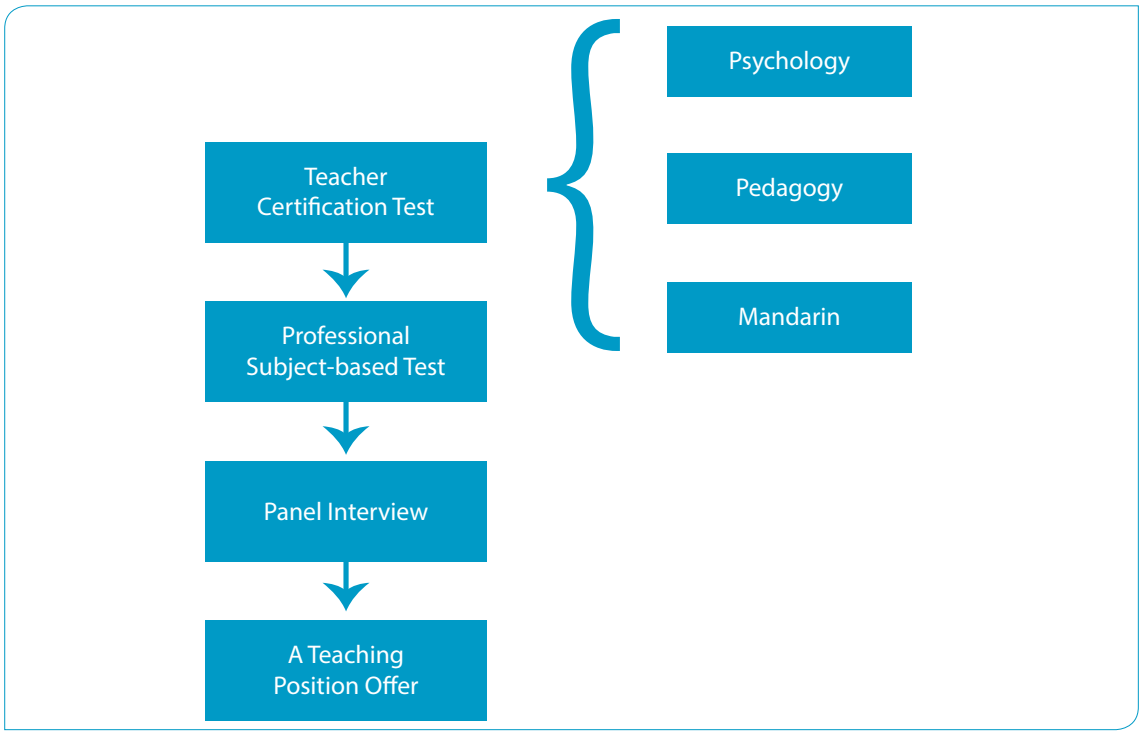
In 2013, the Chinese government issued the National Medium and Long Term Educational Reform and Development Plan (2010-2020) (China Ministry of Education, 2014a). Guided by the Plan, China will, by 2020, have realized the modernization of education, become a learning society, and joined the ranks of superpowers in human resource development. A people-oriented, comprehensive quality education will be implemented to promote students' full development and improve their social responsibilities for serving the country and people. It also aims to inculcate students' innovative spirits and develop their problem-solving skills.

In China, school education covers pre-school, primary, secondary, and higher education. Three- to five-year old students undergo pre-school education, while six- to twelve-year old students receive primary education. Secondary education includes education in junior middle schools (for students aged 13 to 15) and senior middle schools (for students aged 16 to 18). In 2012, China

had 228,500 primary schools and 96,000 secondary schools. There were about 12.6 million primary and secondary school teachers, and 192.8 million primary and secondary school students (China Ministry of Education, 2014b).

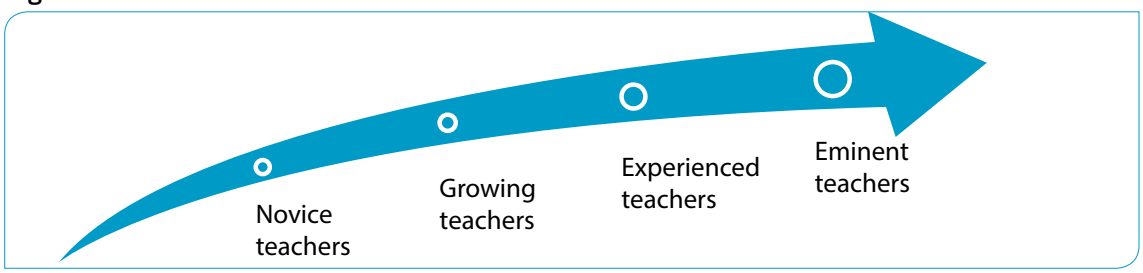
At present, China has already established a well-structured system of teacher certification (China Ministry of Education, 2013a). If one wants to become a teacher at a primary or secondary school, he/she has to pass a strict certification test. After he/she has taken part in tests covering psychology, pedagogy, and Mandarin, he/she is required to undergo a panel interview and a professional subject-based test organized by schools. The flowchart of this process is shown in Figure C.1.

Figure C. 1: Flowchart for the teacher certification test



Generally speaking, it would take ten years or so for a Novice teacher to become an Experienced teacher. Novice teachers (teachers with only one-year service) need to have at least a one year trial period (or internship) before they become Growing teachers (teachers with two to four years' service). The Growing teachers continuously build up their teaching abilities through in-service training, school-based educational research, etc. in the next two or four years to develop into Experienced teachers (teachers with more than five years' service) (Liu, 2004). The Experienced teachers can finally transform into Eminent teachers or Educational Experts as long as they have accumulated various teaching abilities and rich teaching experience (see Figure C.2).

Figure C. 2: Career ladder for in-service teacher



Source: Liu (2004).

In China, teacher colleges and universities are mainly responsible for pre-service teacher training, which spans for three to four years. On the other hand, teacher training schools and teacher universities are in charge of in-service teacher development and training. China has already set up systematic policies and strategies for teacher professional development. With the budget allocated, training time and content for in-service teachers have been increased. In addition, new training approaches, such as network training, school-based educational research, and others, are being deployed. Since the Chinese government has attached great importance to teacher training and teacher professional development, related programmes are rapidly being developed and implemented.

1.2 Background of ICT in Education

In the past 30 years, China has paid increasing attention to ICT in Education, leading to its rapid development. Moreover, information technology has been treated as a revolutionary factor in the field of education. In 2011 the Ministry of Education (MOE) published the 10-year ICT Development Plan (2011-2020) with clear development objectives of ICT in Education (China Ministry of Education, 2012). According to the Plan, by 2020, (1) an ICT learning environment that provides quality educational resources for everyone should be established; (2) an ICT service system for learning society should be formed; and (3) the coverage of broadband network in all areas and schools at all levels should be realized. Thanks to those efforts, the MOE targets that (1) the educational management and integration of ICT in education will be significantly improved; (2) digital educational resources with high quality and a sharing environment will be available; and (3) Standards of ICT in Education will be in place. Obviously, ICT in Education has played a unique and important role in realizing a balanced development of education, promoting education equity and wide sharing of quality education resources, improving quality of education, establishing a learning society, promoting the reform of educational philosophy, and cultivating innovative talents with international competitiveness.

At present, China has particularly emphasized policy-making in ICT in Education. Based on their real status, targeted strategies have been developed by provinces and local governments, according to the macro design made at the national level, to guarantee the effective implementation of those policies.

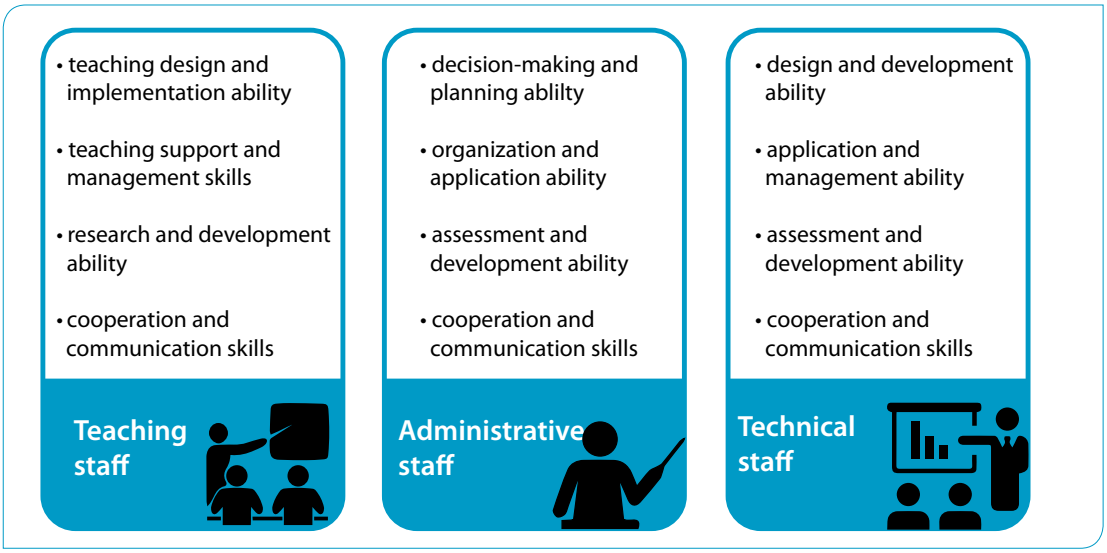
In order to promote teachers' ICT capacity-building, MOE released the ICT Competency Standards for National Primary and Secondary School Teachers in 2004 and Views on Implementation of Upgrading National Primary and Secondary School Teachers' ICT Competency in 2013 (China Ministry of Education, 2004, 2013b). Thanks to those Standards and Views, a new round of upgrading training for more than 10 million primary and secondary school teachers has been carried out to improve teachers' ICT competency, subject teaching and professional development abilities, thus facilitating a new breakthrough in the integration of ICT in Education.

2. ICT Professional Development Strategies for Teachers

2.1 Capacity-building Framework for ICT Staff

In China, high-quality ICT staff has been regarded as the basic guarantee for the successful application of ICT in Education. In practice, it is necessary to equip teaching, administrative, and technical staff with good ethics, technical skills, and strong motivation and commitment (see Figure C.3).

Figure C. 3: Capacity-building framework for different categories of ICT staff



2.2 Strategies to Improve Teachers' ICT Competency

The strategies used to improve teachers' ICT competency mainly include (Zhang, 2009):

(1) Improving teachers' ability to use information technology: It includes establishing and improving Standards of all types of ICT competencies; stressing the integration of training, examination and certification of ICT competencies for primary and secondary school teachers and vocational school teachers; and incorporating evaluation results of ICT competency into teachers' certification system.

(2) Accelerating the establishment of a public service platform of the national network consortium for teacher education to carry out distance education and training for both pre-service and in-service teachers: By 2020, teachers at all levels will meet the Standards of ICT competency. Various approaches and means will be used to guide teachers to use ICT effectively, update their teaching philosophies, and to improve their teaching methods and teaching quality (Liu, 2012).

(3) Designating specialized ICT staff: The responsibilities of ICT professionals should be clarified, coupled with the development of relevant training programmes and corresponding appraisal approaches to ensure that training will be implemented effectively.

(4) Providing ICT competency training: This includes the formulation and improvement of the Standards of teachers' ICT competency, development of relevant training materials and online courses at all levels, and conducting ICT training for teaching, administrative, and technical

staff. By 2015, 12 national and 32 provincial training centres will have been set up, whereby the basic training of teachers and technical staff in both primary and secondary schools will be completed, 30 per cent of primary and secondary school teachers will complete intermediate training, and 50 per cent of administrative staff will complete basic training.

3. Development of ICT Competencies for Teachers

3.1 Background of the Standards Development

In order to improve ICT competency of primary and secondary school teachers and promote teachers' professional development, MOE published ICT Competency Standards for Primary and Secondary School Teachers (trial version) on 25 December 2004 (hereinafter referred to as *t*he Standards) (China Ministry of Education, 2004). It is the first Competency Standards issued by China for primary and secondary school teachers. Based on the results of an overall investigation and extensive consultation of teachers, administrators, and technicians in primary and secondary schools as well as experts and scholars in educational scientific research units, the normative Standards for China were established. The publication and implementation of the Standards is a milestone in the field of teacher education and has had a profound influence on teachers' reform and development as well.

3.2 Process of the Standards Development

MOE officially launched a major research project entitled 'Development of ICT Competency Standards for Primary and Secondary School Teachers in China' in April, 2003. It was implemented by the National Teachers Expert Committee for ICT in Education. More than 40 experts and nearly 20 units and organisations participated in the two years of research. The development of the Standards underwent four stages, namely, (a) design of the framework and content, (b) consultation, (c) discussion and amendment of the first draft, and (d) piloting and improvement of the Standards (shown in Table C.1).

Table C. 1: Development process of the Standards

Serial No.	Main work	Timeline
I. Design of the framework and content Task: The main research team has been set up to design the research framework and content based on a literature review. Meanwhile, three sub-groups with specific assignments, namely 'theory group', 'skill group' and 'application group', been formed. Finally, the first draft of the Standards was produced on the basis of all the research results.		
1	The preliminary plan on how to develop the Standards was proposed by the National Teacher Education Informatiization Expert Committee.	April 2002
2	A research survey was conducted and the survey results were discussed.	The second half of 2002
3	The initial project report of the Standards was composed.	January-February 2003
4	The main research team of the Standards and its sub-groups, ('theory group', 'skill group', and 'application group') were formed. The project of the Standards was initiated in March, 2003.	March 2003
5	The 'theory group' was responsible for the development of the framework for the Standards, terms and definitions to be used, and elaboration on the Awareness & Attitude and Social Responsibility domains.	April-August 2003

6	The 'skill group' was in charge of the research items on Knowledge and Skills.	April-August 2003
7	The 'application group' dealt with the research items on Application and Innovation.	April-August 2003
8	A meeting was organized to share research results and coordinate the relationships and research schedules of sub-groups.	September 2003
9	The research results were collected and organized to produce the first draft of the Standards.	September-October 2003
II. Broad consultation Task: The first draft of the Standards was used as the basis for a broad consultation with various stakeholders, which then resulted in an investigation report.		
10	Interviews with 50 stakeholders in Nanjing, Hefei and Wuhu, including leaders of the Education Bureau, teaching researchers, primary and secondary school principals, key teachers and technical staff.	October-November 2003
11	Interviews with graduates of ICT in Education of the Beijing Normal University and some teachers from the attached middle school of Beijing Normal University	October-November 2003
12	An interview with Pingxiang secondary school teachers in Jiangxi province	November 2003
13	A questionnaire survey and interviews with Teacher Training School, Audio-Visual Education Centre, Bashu Primary School, Education Management School in Chongqing, MaYanyang Secondary School in Beibei District of Chongqing Municipality	November-December 2003
14	A final investigation report was formed based on the results of all those surveys and interviews.	December 2012
III. Discussion and amendment of the first draft Task: Based on the extensive consultation, testing results and the investigation report, the first draft of the Standards was amended and the final draft was formed.		
15	The modified scheme was determined in accordance with the investigation report of the Standards.	December 2012
16	The Standards (trial version) was formed on the basis of the amendment of the first draft.	January-April 2004
17	The Standards were interpreted. In addition, sample implementation cases were collected.	March-June 2004
18	A number of primary and secondary schools were selected and trained to pilot test the Standards (trial version) and further modifications were made. Finally, the Standards (draft for approval) was formed.	May-July 2004
IV. Pilot testing and improvement of the Standards Task: An expert committee meeting was convened to discuss the implementation of the Standards (draft for approval). Further processing and improvement about the preface, general programme, terms and definitions, Sub-Standards were made. The Standards (final version) was introduced for implementation.		
19	A third expert committee meeting was held to discuss the Standards (draft for approval) and its implementation.	August 2004
20	More opinions and views about the Standards (draft for approval) were collected from primary and secondary school teachers.	September-October 2004
21	Further revision was done on the contents of the Standards.	November 2004
22	The Standards was continuously improved, and the final draft was produced for implementation. It included sections on training, examination and certification.	November-December 2004

Design of framework and content

In order to ensure the scientific nature and applicability of the project, a literature review conducted on ICT competency standards at home and abroad was conducted first. Among them, the National Educational Technology Standards for Teachers (NETS-T), National Educational

Technology Standards for Students (NETS-S), and National Educational Technology Standards for Administrators (NETS-A) by International Society for Technology in Education (ISTE), the Standards on Educational Communications and Instructional Technologies (ECIT) by the Association of Educational Communications and Technology (AECT), along with documents from the United Kingdom namely, the Use of ICT in Subject Teaching, Professional Development Standards for Teachers and Trainers, and National Standards for Headteachers, and a few others were examined closely. At the same time, domestic literature such as *Investigation and Analysis of ICT Capacity of Primary and Secondary School Teacher Education*, *ICT Performance Standards of School Teachers*, *Ability and Quality of Educational Technology Class Professional Social Needs Analysis and Curriculum Framework Design*, and *Social Needs Special Survey of Educational Technology Ability and Quality of Personnel* were also studied.

After studying, the expert group proposed an initial idea of developing ICT Competency Standards for Primary and Secondary School Teachers, the framework and items of the Standards were discussed, examined and determined. The main research team was set up, divided into the 'theory', 'skill', and 'application' sub-groups, each with specific tasks. For example, the 'theory group' was in charge of developing the framework for the Standards, terms and definitions to be used, and elaboration on the Awareness & Attitude and Social Responsibility domains. The 'skill group' was given the task of developing items for the Knowledge and Skills domain. The 'application group' focused on developing items for the Application and Innovation domain. The responsibilities of the main research team were to coordinate the relationship and research schedule of those sub-groups, to integrate group research results, and produce the first draft of the Standards.

Broad consultation

After the first draft of the Standards was ready, the research team consulted in seven experimental areas a total of more than 100 primary and secondary schools through interviews and questionnaire surveys. The main results of those consultations are as follows (He, 2005):

- It is necessary and important to develop the Standards.
- Technology has been overemphasized.
- Items of the Standards should be interpreted with a broader perspective rather than in a narrow manner; otherwise, it is not suitable for the actual implementation in real situations.
- There is not much difference among the Standards for the three different categories of personnel. As such, it would be difficult to distinguish the different skills and competencies required of the teachers, administrators, and technicians.
- Some items are redundant.
- Some items cannot be operationalized.
- Introduction and background should be refined.

The Standards were pilot tested in some experimental schools. Based on the feedback received from the consultations and the pilot test, the guidelines for the amendments of the first draft were produced:

(1) The development of the framework and the basic content of the Standards should not be based only on the advanced experience in foreign countries, but also take into account the real conditions in China, such as the large number of school teachers with diverse ICT infrastructure.

(2) On the premise of highlighting ICT in Education, both ICT and traditional media and technology

should be paid attention to.

(3) The description of the Standards should be general for universal application all over the country.

(4) The Standards should embody the different characteristics and needs of the three categories of staff, namely, teaching staff, administrative staff, and technical staff.

(5) For all items in the Standards, the operational performance indicators should be identified as clearly as possible.

(6) For all items in the Standards, the descriptors should be specific and operational, and should not include names of specific software or products of certain companies.

Discussions and amendments of the first draft

According to the guidelines, after many discussions and analyses of the investigation report, the modified scheme was agreed upon and at last the first draft of the Standards (trial version) was developed. At the same time, the Standards (interpretive version) was composed, and implementing cases were collected widely. A number of primary and secondary schools were selected and trained to pilot test the Standards (trial version). Based on the trial results, the Standards (draft for approval) was finally produced.

Pilot test and improvement of the Standards

The MoE held a National Teacher Experts Committee for ICT in Education Meeting to discuss the Standards (draft for approval) and its implementation (China Ministry of Education, 2004). After receiving feedback from some of the primary and secondary school teachers, the preface, general programme, terms and definitions, Sub-Standards of teaching, administrative, and technical staff were further revised. After the revisions and improvements, the Standards (final) was released, and preparations were made for its implementation (including training, testing, certification, etc.). The official ICT Competency Standards for Primary and Secondary School Teachers (2004 edition), was completed in November, 2004 (China Ministry of Education, 2004). On December 25, 2004, the MoE formally published the Standards.

During the process of developing *the Standards*, it was worthwhile to learn a few lessons from the developed countries. For example, some of the lessons learned from the United States can be concluded as follows (He, 2005):

1. One Standard – The same ICT Competency Standards are adopted throughout the country.
2. Two Cases – One implementing case is designed for one subject, and the other implementing case is designed for different subjects.
3. Three Combinations – This refers to (i) the combination of ICT in Education experts and subject specialists, (ii) the combination of the research of ICT Competency Standards and the development of cases, and (iii) the combination of the requirements of ICT Competency Standards and those of curriculum standards.
4. Four Steps – The four steps are: (i) studying the Standards, (ii) developing cases, (iii) carrying out pilot research, and (iv) assessing and testing. The four steps are interconnected with one another, with the previous step laying the foundation and paving the way for the next, and in turn, the next step being the consolidation, deepening, and expanding of the previous step. All in all, the four steps are indispensable.

3.3 Content of the Standards

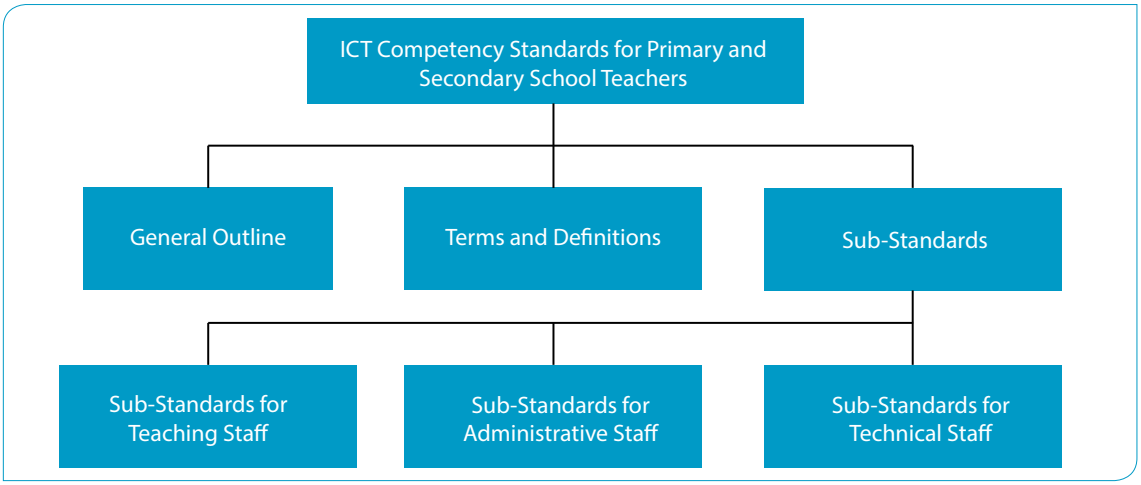
Overall Framework of the Standards

The overall framework of the ICT Competency Standards for Primary and Secondary School Teachers is shown in Figure C.4. The framework has three Sub-Standards for different categories of staff due to their specific areas of expertise and responsibilities.

The Sub-Standards for teaching staff are designed for primary and secondary school teachers, and organisations and institutions handling teacher education, assessment and certification of primary and secondary school teachers.

Teaching is the main job of teaching staff, and teachers have to plan, implement, evaluate and manage their own teaching. On the other hand, administrative staff are not just responsible for regular teaching activities, but also need to plan the development of the curriculum, teacher training, promotion and assessment. They also have to provide more opportunities for professional development and create a favourable environment for inter-school exchanges. They are guided by the Sub-Standards for administrative staff.

Figure C. 4: Overall framework of the Standards



Source: He (2005).

The technicians provide technical support and services to the teachers. They are guided by the Sub-Standards for technical staff.

Main domains of the Standards

There are four main domains in the Standards:

(1) **Awareness and Attitude:** refers to the awareness of information needs, information applications and innovation, sensitivity and insight of information, and interest and attitudes towards information. 'Awareness and attitude' are not only the driving forces of capacity building, but also the motivation to reflect and realise the need for continuous professional development. Therefore, the realisation of the value of ICT in Education is very important in the development of ICT competency.

(2) **Knowledge and Skills**: covers basic theories and methods, basic operational skills, information processing and retrieval, information security and assessment of ICT in Education, and practical knowledge schema and skills of ICT in Education, all emphasizing rich cognitive flexibility when

teachers combine their prior knowledge with their own teaching experience. The practical, tacit knowledge to adjust one's teaching activities to a heterogeneous set of students is extremely complex. Therefore, it is essential for teachers to understand the basic concepts of ICT in Education, theories and methods, and form the knowledge schema in accordance with the practice of ICT in Education. Gradually, teachers will be able to develop their ICT capacities so as to meet the diverse learning needs in the school settings.

(3) **Application and Innovation**: includes instructional design, teaching practice, integration of ICT in Education and curriculum, self-study and collaborative learning, which are at the core of ICT competency. ICT in Education plays a very important part in transforming teachers' roles and practices, such as developing from a mere lecturer to an expert teacher focusing on lifelong development.

(4**) Social Responsibility**: refers to the fair and effective application of ICT in Education for every student and appropriate guidance on students' healthy and legal use of ICT. ICT has brought about a number of opportunities to education, teaching and learning, but it has also brought a whole host of social problems and negative effects. Hence, teachers should use ICT in proper ways and set a good example to their students.

Detailed contents of Sub-Standards

The ICT Competency Standards for Primary and Secondary School Teachers includes three categories of Sub-Standards with four dimensions. The ICT Competency Sub-Standards for teaching staff are shown in Table C.2.

Table C. 2: ICT Competency Sub-Standards for teaching staff

Standards	ICT Competency Sub-Standards for Teaching Staff	
Awareness and Attitude	Recognition of the importance	(1) the recognition of the importance of effectively using ICT in Education to promote education informatisation, educational reform, and the implementation of national curriculum standards; (2) the recognition that ICT competency is a necessary part of teachers' professional competency; (3) the recognition of the importance of effectively using ICT in Education to optimize the teaching process and to use innovative methods.
	Application awareness	(1) the awareness of applying ICT in Education in practical teaching; (2) the awareness of integrating ICT into the curriculum and teaching reforms; (3) the awareness of enriching learning resources by using ICT ; (4) the awareness of new technologies and applying them in teaching.
	Evaluation and reflection	(1) the awareness of the need to evaluate various teaching resources and to reflect on the effectiveness of their use; (2) the awareness of the need to evaluate and reflect on the teaching process; (3) the awareness of the need to evaluate and reflect on teaching effectiveness and efficiency.
	Lifelong learning	(1) the attitudes towards gaining new knowledge and learning about new technologies continuously; (2) the attitudes towards lifelong learning and using ICT to improve professional and personal development.

Standards	ICT Competency Sub-Standards for Teaching Staff	
Knowledge and Skills	Basic knowledge	(1) to understand the basic concepts of ICT; (2) to understand the key theoretical basis of ICT in Education; (3) to master basic theories of ICT in Education; (4) to understand the basic research methods used in the area of ICT in Education.
	Basic skills	(1) to master techniques of information retrieval, processing and use; (2) to master methods of selecting and developing common instructional media; (3) to master general approaches to instructional design; (4) to master ways of managing teaching resources, teaching process and projects; (5) to master techniques of evaluating teaching media, teaching resources, teaching processes and teaching effectiveness.
Application and Innovation	Instructional design and implementation	(1) the ability to state teaching objectives precisely, analyze teaching content, and design effective learning activities based on students' characteristics and teaching conditions; (2) the ability to actively integrate ICT into the curriculum, and explore effective ways of integration; (3) the ability to provide various opportunities for students to use ICT and to be able to guide them; (4) the ability to apply ICT to evaluate students' learning outcomes and teaching processes.
	Teaching support and management	(1) the ability to collect, screen, integrate and apply teaching resources to optimize the teaching environment; (2) the ability to use teaching resources effectively; (3) the ability to organize teaching activities effectively; (4) the ability to manage the teaching process effectively.
	Research and development	(1) the ability to carry out research on ICT-pedagogy integration; (2) the ability to carry out research on the application of ICT in the teaching of a particular subject; (3) the ability to develop ICT competency through 'learning by doing'.
	Cooperation and communication	(1) the ability to communicate with students by using ICT; (2) the ability to communicate with parents by using ICT; (3) the ability to cooperate and communicate with colleagues widely in teaching and research by using ICT; (4) the ability to communicate with administrative staff by using ICT; (5) the ability to cooperate and communicate with technical staff about the design, selection and development of teaching resources by using ICT; (6) the ability to cooperate and communicate with subject specialists, technical experts about ICT in Education ;
Social responsibility	Fair application	To provide equal opportunities to every student regardless of their gender or socio-economic status to use learning resources.
	Effective application	To allow all students regardless of their backgrounds, personalities or abilities to take advantage of learning resources.
	Healthy use	To ensure that every student uses learning resources correctly with the goal of creating a positive learning environment.
	Regulation	To make students aware of the rules and regulations as well as ethics in the use of ICT.

4. Aligning the Teacher Training Curriculum with the ICT Competencies

In order to effectively implement ICT Competency Standards for Primary and Secondary School Teachers, the MoE launched the 'National ICT Capacity-Building Project for Primary and Secondary School Teachers' (the Project for short) in April 2005 (He, 2005). It had three components, namely: training, examination, and certification. The training and examination were based on the Knowledge and Skills domain specified in the Standards. Corresponding certificates were issued to teachers according to their test scores. With the support of educational administration departments at all levels and the National Teachers Education Network Alliance, the Project aimed at training 10,000 national key teachers, 100,000 provincial key teachers, and more than 10 million primary and secondary school teachers in three years. To continuously enhance teachers' ICT competency it is necessary to provide more ICT training opportunities for primary and secondary school teachers.

4.1 Project Description

Overall goals

The ICT competency Standards for Primary and Secondary School Teachers were developed and implemented in three years. From April 2005 to 2007, a comprehensive training initiative for primary and secondary school teachers, including training, examination and certification, was introduced to support teachers in developing their ICT competency.

Specific Results

1. The ICT Competency Standards for Primary and Secondary School Teachers had been developed and institutions were set up to train teachers in ICT competency. In the Chinese context, experts were deployed to develop the Standards. The Standards underwent several rounds of pilot studies, revisions and improvements before these were implemented throughout the country.
2. Relying on the National Teachers Education Network Alliance and provincial education departments, a three-level training programme for key national, provincial, and school teachers was organised. During this period, several national, 31 provincial (one for every province except for Hong Kong, Macao and Taiwan), and many municipal training centres were set up, forming a national training network system.
3. ICT competencies of primary and secondary school teachers were developed and integrated as part of the teacher qualification. Through the three-level training programme and effective integration of ICT in subjects, a group of key teachers with higher ICT capacities (i.e. 10,000 national key teachers, 100,000 provincial key teachers) were trained. These key teachers in turn trained and prepared more than 10 million primary and secondary school teachers for the examination and certification process.
4. A national testing system was established to evaluate the ICT competencies of all primary and secondary school teachers. The testing system was organized and implemented by the National Education Examinations Authority (NEEA). Testing sites were set up throughout China. Over time, a standardized testing model and a rich test database were established. The system used various forms of testing, such as traditional written examination, computer operation, instructional design and implementation, among others, to truly capture the teachers' ICT competencies.

4.2 Project Outputs

The main outputs of the project were as follows:

1. List of descriptors of ICT competencies for primary and secondary school teachers based on the Standards were further refined and became guidelines for the training syllabus and test syllabus
2. Training strategies and syllabi, containing the training philosophy, contents and methods, corresponding training materials were also developed
3. An item bank that consisted of various test items to assess the teachers' ICT competencies based on the training syllabus
4. Certification Standards of training institutes

4.3 Project Implementation

The implementation of the project has the following aspects.

1. Formulation of the training syllabus and development of the training resources

   After the project started in April 2005, the training syllabus and training schedule were formulated. These served as the basis for the preparation of the training resources. The testing syllabus and testing items, on the other hand, were developed based on feedback from the pilot tests.

2. Establishment of the project administrative department, selection of pilot test areas and conduct of training sessions.

   Project lead groups were set up at the central government, in provinces, autonomous regions and municipalities to ensure its smooth implementation. The Central Audio-Visual Hall was responsible for the management and coordination of the project. In May 2005, experts were organized to evaluate the training centres at different levels. Based on the evaluation results, only qualified training centres could conduct teachers' ICT competency training.

3. Issuance of testing syllabus and administration of a unified examination

   In October 2005, Ministry of Education issued the Testing Syllabus of ICT Competency for Primary and Secondary School Teachers. In December, the first proficiency test was administered by the Examination Centre. Since then the test has been held biannually. Candidates who pass the examination are granted an ICT competency certificate.

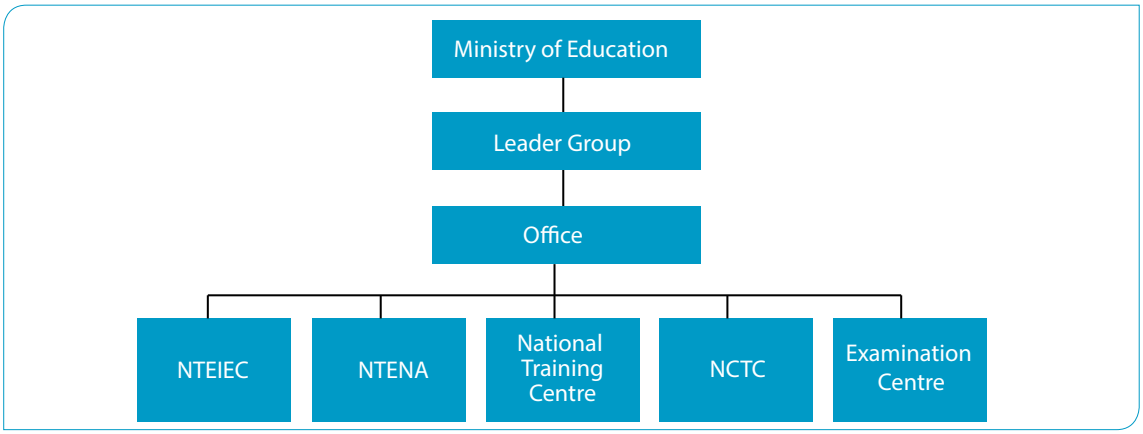
4. Regular project assessment

   Both process and summative assessment were adopted in the project to constantly learn from experience and gather feedback on areas of improvement. In pilot areas, the experts were deployed to guide and evaluate the training, conclude training experience, identify and solve training problems.

4.4 Organisation and Implementation Guarantee of the Project

To provide ICT capacity-building opportunities to teachers, many organisations and institutions were established, as shown in Figure C.5.

Figure C. 5: Structure of organisations and institutions



The responsibilities of these various organisations and institutions are shown in Table C.3.

Table C. 3: Responsibilities of various organisations and institutions

Organisations and Institutions	Responsibilities
Lead Group and Office	(1) in charge of the macro-management and control of the project; (2) formulates relevant policies; (3) evaluates the results of training and testing; (4) checks and supervises related project work.
National Teachers' Experts for ICT in Education Committee (NTEIEC)	(1) responsible for the formulation, interpretation and improvement of the Standards; (2) audits training resources; (3) prepares training syllabus and examines testing syllabus; (4) develops or recommends good training materials.
National Teacher Education Network Alliance (NTENA)	responsible for training millions of primary and secondary school teachers.
National Training Centre	responsible for training trainers in provincial and municipal training centres.
National Certified Training Centre (NCTC) (The Central Audio-Visual Hall)	(1) responsible for formulating certification Standards for national and provincial training centres; (2) responsible for the qualification certification of three– level training centres.
Examination Centre	(1) responsible for setting up the ICT competency examination experts committee; (2) formulates testing syllabus, develop test items and constructs test item banks; (3) in charge of the organisation and management of the test; issues the certificates; (4) formulates relevant policies in line with the self-study exam.

In addition, for the effective implementation of the project, the Ministry of Education formulated a series of security measures, such as strengthening the leadership and establishing training centres, formulating appropriate policies, increasing investments, etc. in order to make the Standards a vital component of the qualification certification for primary and secondary school teachers.

4.5 Training Content and Training Mode

Training content

In recent rounds of training, the project used distance education, new ideas, curriculum, knowledge, and technology to build a learning environment for teachers so as to improve their quality and professionalism. Training content was mainly based on the Standards and the training syllabus.

For example, the Training Syllabus of ICT Competency for Primary and Secondary School Teachers (primary) consisted of training preparation; design of teaching plans; selection of teaching media; collection and integration of teaching resources; unit /topic design, implementation, evaluation, and reflection of lesson plans; training summary and improvement, etc.

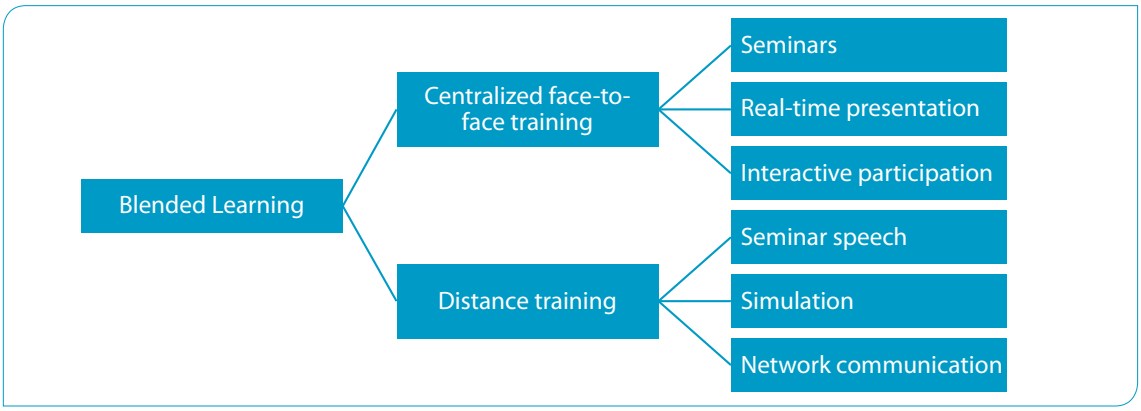
Four new elements were added to the training content:

1. ***New ideas.*** A number of new ideas, such as adapting to new curriculum reform, moral education of youth, quality education, healthy growth of youth, etc. were included in the training.
2. ***New curriculum training.*** According to the principle of 'training before teaching, no training no teaching', teachers were trained purposefully before they conducted new curriculum-based teaching. Training time was no less than 60 hours.
3. ***New knowledge training.*** Teachers were required to expand their knowledge domains and update their knowledge structures with reference to the new scientific achievements and content in the new curriculum.
4. ***New technology training.*** According to the Standards, the focus was on the integration of ICT into classroom teaching so as to improve educational quality.

Training mode

Two training modes were used in teachers' ICT competency training, i.e. centralized face-to-face training and distance training (see Figure C.6).

Figure C. 6: Two types of training modes



Source: He (2005).

The development of teachers' ICT competencies involved teachers expanding their knowledge and skills to use ICT effectively in practical teaching. The following training modes were used:

1. Case discussions were used to raise teachers' awareness, change their attitudes, and sensitize them to their social responsibilities.

   Teachers can experience, observe, analyse, and discuss specific cases to form certain opinions about phenomena or problems in teaching, which would help them develop certain awareness, attitudes, and social responsibilities required by the Standards.

2. Problem-based training was used to gain knowledge and skills.

   Some of the basic theories and concepts on ICT knowledge and skills were introduced, especially operation procedures, common problems, and counter-measures during operation. Trainers would then put forward some critical underlying problems or ask teachers some questions on

their teaching practices so as to help teachers make connections between theory and practice.

3. Training on instructional design.

   Through proper instructional design, teachers could employ their prior knowledge and understanding on the use of ICT in their teaching, thus bridging theory and teachers' experience, and linking concepts and practice. Trainers could guide teachers to carry out systematic instructional design by applying models, analysing the lesson's objectives and content, analysing students' characteristics and needs, applying appropriate teaching methods, selecting assessment methods, choosing appropriate ICT resources, and doing other preparatory work.

   Cases or sample lessons can be used by trainers to help the teacher-designer express his/her implicit knowledge and notions, and make connections between abstract theories and practical situations. Cases are beneficial in exercising the teacher-designer's skills on self-reflection and peer review. Feedback from other teaching and research staff and experts guides the teacher-designer in examining a similar problem from multiple perspectives and in the process, gains a broader knowledge as well as some flexible but appropriate skills.

4. The combination of centralized face-to-face training and school-based research can promote teachers' lifelong learning and continual professional development. This can be done by stressing the following:
   - Teachers should use instructional design in preparing their lessons so that they can apply theory in their practices.
   - Teachers should carry out school-based action research so as to bridge theory and practice.
   - Teachers should practise self-reflection and reconstruction of their own lessons so that they can connect their own tacit knowledge to explicit theory.
   - Teachers should communicate and cooperate among themselves as well as with experts to form a Community of Practice.

5. Assessing Acquired ICT Competencies

ICT competency is one of the prerequisites of job qualification for primary and secondary school teachers. Teachers must participate in the training. Once they complete the training, they have to take part in the national ICT competency examination to obtain their certificates of ICT competency. Those who fail will not be qualified to teach.

As part of the 'National ICT Capacity-building Project for National Primary and Secondary School Teachers', a number of national, 31 provincial, and hundreds of city-level training centres were established for training and certification purposes. In addition, a number of databases consisting of teaching resources, such as training portals, virtual communities, and online schools were set up to provide teachers a variety of ways to improve their ICT competency.

The training project adopted the Quality Monitoring and Process Assessment System of Teachers ICT Competency Training to collect information on training plans as well as feedback from trainers and trainees from different training sites for the purpose of enhancing the training design and implementation.

6. Impact and Issues

6.1 Impact

To ensure the effective implementation of the Standards, 1,000 primary and secondary school teachers were identified as Education Experts. In addition, 10,000 teachers joined in the national study; 100,000 teachers in the provincial study; and 1 million teachers joined in the city-level study. Furthermore, 10 million teachers were targeted to benefit from the recent round of training (He, 2005).

1. Promoting reform of the basic education curriculum

   The basic education reform seeks to cultivate students' innovative spirits and to promote the all-round development of adolescents. For the success of this reform, teachers are required to change their teaching methods and teaching behaviours, with the use of ICT in Education as an important means to facilitate such changes. For the curriculum reform to be successful, it is essential for teachers to integrate ICT in their teaching of various subjects in schools. ICT research would need to look into theories, methods and practices on how to integrate ICT into various subjects effectively.

   The Standards consists of guidelines for teachers on how to make use of ICT from four aspects, i.e. Awareness and Attitudes, Knowledge and Skills, Application and Innovation, and Social Responsibility. It is crucial for teachers to gain a good understanding of ICT in Education, and to use ICT in their daily practices. The Standards target teachers, administrators, and technicians to work together in effectively using ICT in Education.

2. Promoting the development of teachers' professional competency

   ICT competency is an essential professional competency among modern teachers. A modern teacher needs to know more than educational theories and subject knowledge; he/she must also master various teaching methods and use ICT appropriately in the lessons.

3. Directing and regulating teachers' ICT competency training

   Since ICT competency training is a huge market, ICT Competency Standards play an important role in regulating training requirements and training behaviours of all training institutions, whether they are enterprises or public institutions, and in establishing an assessment system. The Standards provide a basis for ICT competency training of primary and secondary school teachers. At the same time it also serves as a foundation for resource development, examination and assessment of ICT competency training for primary and secondary school teachers.

6.2 Issues and Solutions

The Ministry of Education launched the 'ICT Capacity-building Project for National Primary and Secondary School Teachers' to promote the implementation of the Standards. Based on the Standards, a comprehensive system of training, examination and certification was established gradually to facilitate ICT capacity building for primary and secondary school teachers throughout the country. However, due to various practical constraints in China – such as the immense regional differences in infrastructure and teachers' ICT competencies, vast differences among teachers of various subjects, especially between ICT teachers and teachers of other subjects – there were some obvious problems during the implementation of the Standards and teachers' competency training (He, 2005; Huang, Liu, and Zhang, 2005).

1. Hierarchical refinement of the Standards

   Teachers' current ICT competencies vary widely due to their different subjects, ages, professions, and regions. Adopting a 'one size fits all' standard has been difficult to implement. Thus, the Standards need to be refined to accommodate the features of different subjects, varying conditions, and other mediating variables.

2. Approaches to implement teachers' ICT Competency Standards in different regions

   Pilot areas were chosen in view of the diverse circumstances in different regions. Furthermore, training, examinations, and certification were performed systematically and separately for different regions. Since there were significant differences in the ICT infrastructure among schools in different regions, it was essential to identify if the schools have the basic ICT infrastructure before the Standards were applied. For those unqualified places and schools, some preparatory work would have to be done first through school-based research.

3. Promoting and implementing the three categories of the Standards

   Besides the teaching staff, the Standards also applied to the administrative and technical staff. However, this particular implementation had been quite problematic. Generally speaking, in China, the training, examination, and certification for administrative staff lagged behind those for teaching staff. Also, technical staff were in short supply in many schools. Moreover, in some schools, the motivation of some teachers to study and use ICT was low.

   Therefore, the smooth implementation of the Standards would require simultaneous training for teaching, administrative, and technical staff, so that ICT competencies of all related personnel would meet the Standards.

4. Using different forms of training

   A three-tier training, from national to provincial to local training, was carried out. Centralised face-to-face training was adopted in the initial round for key national and provincial teachers. However, in some areas, such as Tibet, it was very hard to use this training approach because of their remoteness and scattered population, thus distance training was used instead. Therefore, school-based and blended training, which combine face-to-face with distance training, were used. In fact, other training approaches need to be further explored and applied, too.

7. Conclusion

The ICT Competency Standards for Primary and Secondary School Teachers is a significant feature in the process of educational reform and development in China. The formulation of the Standards is necessary to accompany this reform. The Standards are the first professional set of Competency Standards for Chinese primary and secondary school teachers, and their promulgation and implementation is a milestone in teacher education. The implementation of the Standards in China has led to the following recommendations:

1. Preparatory work for implementing the Standards

In order to implement the Standards, ICT promotion work needs to be done first. That is to say, the entire Chinese society should have a broad understanding about ICT competency training, while teachers and leaders involved should know the advantages of using ICT in Education, the benefits of taking part in ICT competency training programmes, etc. Second, the funds

for capacity building need to be raised through multiple channels. It is essential that the government allocates funds for capacity building. Third, the coordination of the various training programmes should be managed properly. In China, training is carried out by central, provincial, and local governments as well as private companies, so coordination is very important. All of the training programmes should have the same knowledge-base and skills development so that they can be assessed centrally. Fourth, the training syllabus and examination should be relevant to the needs of practical teaching, and the testing methods should be scientific enough to assess teachers' ICT competencies. Fifth, different types of training modalities should be adopted. Besides face-to-face training, distance training could be used to train teachers in remote areas. In the future, more training modes should be explored and adopted.

2. Clarifying training contents

In the process of training, it was found that many principals, teachers and even heads of training departments were still not quite clear about the training content. For example, some of them did not know the relationship between ICT in Education and IT, and confused ICT competency training with traditional IT training, as well as ICT in Education with IT. If ICT competencies were being viewed as IT ability, then the goals and objectives of the Standards would have been greatly depreciated. Thus, it is very necessary to help all stakeholders understand the training content and to distinguish ICT in Education from IT, ICT competency training from IT training.

3. Focusing on training quality

In the three-tier training, some local authorities did not care about training quality; they were only concerned about the rate of training in their local region. Therefore, the local authorities and teachers should adjust their understanding about ICT capacity building and attach great importance to the training quality.

The successful implementation of the ICT Competency Standards for Primary and Secondary School Teachers and the practical exploration of the 'ICT Capacity Building Project for Primary and Secondary School Teachers' still have a long way to go, and the achievements and difficulties in this process will become the driving force and starting point for the next step. We believe that under the guidance of appropriate national policies, the Standards will be successfully implemented in China.

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Cultivating synergies in enhancing ICT Competencies:

A partnership approach

Cultivating synergies in enhancing ICT Competencies: A partnership approach

By Mary Hooker (Global e-School Communities Initiatives [GeSCI])

Abstract

Teacher development remains a major challenge for the implementation of technology enhanced learning as the extremely rapid growth and turnaround in new technology and knowledge content mean that this emergent field is changing faster than education personnel can track it (Coolahan, 2002; Chinein, 2003). The *UNESCO ICT Competency Framework for Teachers (ICT-CFT)* launched in 2008 and updated in 2011 presents a framework to help educational policy-makers and curriculum developers identify the skills teachers need to harness technology in the service of education.

Since 2010 the Global E-Schools and Communities Initiative (GeSCI)[43] has supported Ministries of Education in partner countries of Rwanda, Kenya, Tanzania, Nigeria, and Ghana in the critical tasks of contextualization and piloting of the *UNESCO ICT-CFT* involving teachers, teacher educators and policy-makers across mainstream education and TVET sectors.

This case study examines the development and implementation of the *ICT-CFT* in GeSCI partner countries of Tanzania and Kenya in the 'Strengthening Innovation and Practice in Secondary Education' (SIPSE) project[44] that was launched in July 2013 as a two year pilot initiative. The SIPSE project is a GeSCI, MasterCard and Ministry of Education partnership programme conceptualized to enhance teacher capacity in ICT competencies and skills to teach science, technology, English and mathematics (STEM) subjects in secondary schools for a 21st century context, and to increase access to quality of teaching and learning materials. As such, the initiative was a partnership co-sponsored and co-driven project that integrated collaboration between partners, Ministries, and national institutions at every stage. The project focus was to inform national policy for ICT integration and standards development in teacher education. The project used blended learning methodologies to build the capacity of 12 teacher educators (Master Trainers) and 120 secondary STEM teachers from 20 schools (6 STEM teachers in each school) across the two project countries during its two year pilot implementation.

1. Case Study Countries

Kenya and Tanzania have been making remarkable progress putting in place national ICT in Education policy frameworks and implementation strategies that specify the use of ICT in

43 Global e-Schools and Communities Initiative (2013) Home page. GeSCI is an International Non-Government Organisation (INGO) set up under the auspices of a United Nations (UN) Information and Communication Technology (ICT) Task Force in 2004 as a designated body to provide demand-driven assistance to developing countries seeking to harness the potential of ICT to improve access to and quality and effectiveness of their education systems

44 Read more on the GeSCI, MasterCard Foundation and Ministry of Education SIPSE Partnership Programme at: http://gesci.org/media-info/news/single/news/detail/News/mastercard-foundation-and-gesci-introduce-stem-teachers-to-new-mobile-learning-platform/ and http://www.mastercardfdn.org/groups-announce-nearly-18-million-in-funding-for-secondary-education-in-developing-countries/

teacher education. It is in this context that opportunities and challenges for the development and implementation of ICT competency frameworks for teachers in both countries will be examined. The first section briefly describes the background of the Kenya and Tanzania case study countries. The country profiles encompassing demographic and socio-economic indicators are briefly introduced. The aim is to explore in this and the following sections the factors that are leading to or inhibiting the adoption of ICT in Education, in teacher education, and in national development.

1.1 General overview

The Republic of Kenya and the United Republic of Tanzania (also known simply as Kenya and Tanzania) are both located in Eastern Africa with borders on the Indian Ocean. Kenya occupies a landmass of 569,250 sq. km with a population in 2013 of almost 44 million, and an annual population growth rate of 2.7 per cent. Tanzania covers an area of 945,087 sq. km with a population in 2013 estimated at 49 million, and an annual population growth rate of 3.1 per cent (UIS, 2011; UNESCO 2013/2014). There is a common pattern of population breakdown between both countries where: in Kenya some 42 per cent of the population is below 15 years, and 2.7 per cent above 65 years (CIA, 2014); and in Tanzania some 44 per cent of the population is aged below 15 years, some 4 per cent is aged 65 years and above, and the median age of Tanzania's population is 18 years (Tanzania National Bureau of Statistics, 2012).

1.2 Kenya

Kenya is considered to be the largest and most diversified economy in East Africa, described by some sources as a 'linchpin country for the growth and stability of the entire region' (USAID, 2013b). The country is a major economic, financial, communication, and transportation centre in East Africa. Agriculture, tourism, manufacturing industry and investment, and growth in the rapidly expanding telecommunications sector are the mainstay and drivers of the economic base (Swarts and Wachira, 2009; Kenya Open Data, 2011).[45]

1.3 Tanzania

Tanzania is a country that is richly endowed with natural resources, pursues sound economic policies, and has attractive investment policies. The agricultural sector plays an important role in the economy in employing approximately 80 per cent of the workforce, accounting for half the GDP and providing 85 per cent of exports. The role of communications, financial services, tourism, construction, manufacturing, and the retail trade are emerging as expanding sectors and drivers of economic growth and development (World Bank, 2014).

Table KT.1 presents some selected socio-economic indicators of the case study countries based on the Human Development Index (HDI) from the *UNDP Human Development Report* for 2015.

45 Figures from the Kenya Open Data Initiative (2011) indicate that nearly 30 per cent of Kenyans are Internet users and more than 80 per cent use mobile phones – a phenomenon that is 'changing the way Kenyans communicate and do business'

Table KT. 1: Key socio-economic indicators for Kenya and Tanzania

Key Education Indicators for the Case Studies	Kenya	Tanzania
Population	45.5 million	50.8 million
Languages	English, Swahili, and some 42 local dialects	Kiswahili, English, and some 100 different local dialects
GDP (in US Dollars Billions)	120.0	82.2
GDP per capita (in US Dollars)	2,705	1,718
Human Development Index	145 (out of 188 countries)	151 (out of 188 countries)
Population vulnerable to poverty (%)	29.1	21.5
Internet users (% of population)	43.4	4.9

Source: UNDP (2015).

2. Enabling Education Policy Environments

The integration of ICT in Education and teacher development requires enabling vision and policy environments where technology is used as part of a holistic approach for education and development. The education and ICT policy environments of the country case studies are briefly examined below.

Table KT.2 presents some selected education indicators of the case study countries based on the education indicators from the *UNDP Human Development Report* for 2015 and the *UNESCO Education for All Global Monitoring Report* for 2015.

Table KT. 2: Key education indicators for Kenya and Tanzania

	Key Education Indicators for the Case Studies	Kenya	Tanzania
1	Youth literacy rate (both sexes) (% aged between 15 and 24)	82	75
2	Gross enrolment ratio Secondary (both sexes) (% of secondary school age population)	67	33
3	Public expenditure on education (% of GDP)	6.6	6.2
4	Mean years of schooling (of adults) (years)	6.3	5.1
5	Expected years of schooling (of children) (years)	11.0	9.2
6	Satisfaction with education quality	68	40

Source: Row 1: UNESCO (2015). Rows 2-6: UNDP (2015).

2.1 Kenya Education and Development Vision and Policy

Kenya is working towards becoming a knowledge-based economy and society by implementing its Vision 2030 for social, cultural, political and economic development (Kenya Ministry of State for Planning, National Development and Vision 2030, 2008). Education and training in Kenya lie at the heart of national vision and development, and are seen as the core strategy for building human resources necessary for employment and wealth creation (Swarts and Wachira, 2009). The launch of the Kenya Education Sector Support Programme (KESSP) (2005 to 2010), free primary education (FPE) (started in 2003), and free secondary education (FSE) (started in 2008) have resulted in major breakthroughs in expanding education access and equity at primary and secondary levels – with primary net enrolment increasing from 62 per cent to 83 per cent, and lower secondary gross enrolment increasing from 65 per cent to 91 per cent between 1999 and 2010 (UNESCO, 2012a). As can be seen from Table KT.2, the successes of the FPE and FSE and KESSP interventions

are manifested in the level of youth literacy, the expected years of schooling and the level of satisfaction with the quality of provision which are reasonably high in each case. Challenges remain however, with almost one million children still out of primary school in Kenya, and growing concerns about the quality of provision under the pressures of rapid expansion (UNESCO, 2012a).

2.2 Tanzania Education and Development Vision and Policy

In Tanzania the National Vision 2025 envisages development towards a society of high quality livelihoods and a strong and competitive economy – where education is considered as 'a strategic agent for mind-set transformation and for the creation of a well-educated nation' (URT, 2002, p. 19). In recent decades Tanzania, like Kenya, has made remarkable progress in education provision and outreach. The launch of the Primary Education Development Plan (PEDP) in 2001 and the Secondary Education Development Plan (SEDP) in 2004 have resulted in expanding education access and equity at primary and secondary levels. As a result, total enrolment grew by 16.2 per cent in primary and 310.0 per cent in secondary education between 2004 and 2013. What is significant is the tremendous growth in secondary education (330.4 per cent in Form 1-4 and143.6 per cent in Form 5-6) where primary education has stabilized after achieving UPE (Tanzania Prime Minister's Office, Regional Administration and Local Government, 2014). However, Table KT.2 shows a performance that is slightly lower than Kenya in relation to the combined gross enrolment ratio, the mean years of schooling for adults, and the expected years of schooling for children. In Tanzania as in Kenya, there are growing concerns of the capacity of the education system to provide inclusive and quality education, and to train adequate and competent teachers under the pressures of rapid expansion (World Bank, 2010).

2.3 Opportunities and Challenges

The biggest challenge for Kenya and Tanzania may lie in their greatest asset – the burgeoning population of youth. The success of *Education for All* policies have created new problems where unprecedented large cohorts of young people are now completing the first cycle of basic education. The pressure on governments is to provide either further opportunities for education, or to create employment for the thousands of graduates who enter the labour force every year. There is a further urgent need to increase access to appropriate skills training in order to enable individuals to find work/ or to create work in the formal or informal 21st century economies (King and Palmer, 2010; UNESCO, 2012a, 2012b; World Bank, 2012, 2013).

3. Education Systems and Teacher Education Provision

The education and teacher education structures in Kenya and Tanzania are presented below with details of progression and provision.

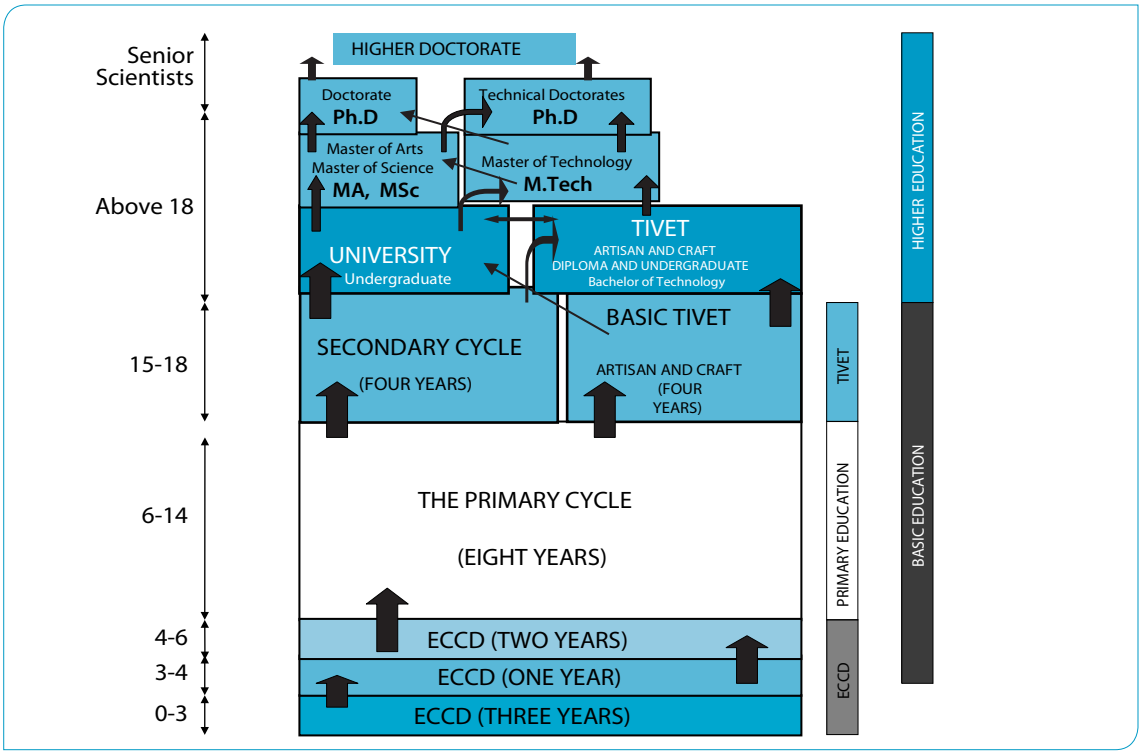
3.1 The Kenya Education System

The formal education system in Kenya comprises of early childhood education, eight years of compulsory schooling in primary education, four years in secondary education, and a minimum of four years at the university, depending on the degree pursued. This is widely referred to as the '8-4-4' system, which has been operational since 1985. Other education and training programmes include Technical, Industrial, Vocational and Entrepreneurship Training (TIVET), special needs

education, adult and non-formal education (Kenya Ministry of Education, Science and Technology, 2008).

Progression from primary to secondary school, and from secondary to university is through selection on the basis of performance in the national examinations for the Kenya Certificate of Primary Education (KCPE) and the Kenya Certificate of Secondary Education (KCSE), respectively, which are administered by the Kenya National Examinations Council. Figure KT.1 is a graphical representation of graduation at various levels and ages in the education system, where the different levels integrate both horizontally and vertically (Swarts and Wachira, 2009).

Figure KT. 1: Structure and organisation of education and training in Kenya



Source: Kenya Ministry of Education, Science and Technology (2005*a*).

3.2 The Tanzania Education System

The formal education system in Tanzania consists of seven years of primary education, four years in lower secondary (Ordinary or O Level), two years in senior secondary (Advanced or A Level), and a minimum of three years in tertiary or university education. Early childhood education lies partly with the Ministry of Community Development, Gender and Children, and the Ministry of Education, with the latter focusing on the pre-primary level. Special education is offered as part of the formal system through: special schools, which cater to children with special learning needs; integrated units, which cater to children with special learning needs but are attached to regular schools; and inclusive schools, which cater to children with special learning needs in a regular classroom but are assisted by specialized teachers.

The non–formal education (NFE) system comprises mostly of adult literacy implemented under the Integrated Community-Based Adult Education (ICBAE). Programmes targeting out-of-school children and youth are offered through the Complementary Basic Education in Tanzania (COBET) Centres. COBET graduates have the opportunity to join in the formal education.

3.3 Teacher Education in Kenya and Tanzania

Teacher education in Tanzania and Kenya can be broadly categorized in pre-service (PRESET) and in-service (INSET) modalities of provision. In both countries the two main institutions involved in the pre-service preparation of teachers are the universities and the teacher training colleges.

Universities:

- In Kenya, the public and private universities offer bachelor of education degrees in arts and sciences, as well as post-graduate training for secondary school teachers. In this four year training, trainee teachers are required to specialize in two subjects they can effectively teach once deployed to schools. There are student teachers who take ICT as one of their specialization subjects. However, ICT integration in the teaching process is yet to be fully implemented even though the universities offer e-learning.
- In Tanzania, the universities train graduate teachers who are posted to teach in senior secondary schools and in TCs. It was reported that graduate teachers are prone to leave teaching for other forms of employment early in their careers. Attrition rates in this cadre of graduate teachers have been noted to be in the range of 15 per cent or greater (Swarts and Wachira, 2010). This means that although a substantial number of teachers may be graduating from the universities, these may not all take teaching jobs. This also means that the majority of secondary school teachers are diploma holders.

Teacher Training Colleges (TTCs):

- In Kenya, there are some 22 public and 50 private primary teacher-training colleges offering two-year certificate courses for teaching in primary schools, and one offering a two-year diploma course to non-graduates for teaching in secondary schools. Around 18,700 trainees graduate from public colleges every two years. Teachers from public TTCs are supposed to be posted to public primary schools. A shift from having primary school teachers teach all subjects to a specialization in two subjects was effected from 2005 in an effort to improve quality of teacher training. The curriculum has since been tailored to child-centred approaches to teaching and learning.
- In Tanzania, there are 34 public teacher colleges of which 18 offer certificate courses in education for primary school teaching, and 16 offer diplomas in teacher education for teaching in lower secondary schools. However, due to the shortage of teachers in the country, teachers in the latter category usually end up teaching senior secondary as well. Student teachers trained for secondary schools specialize in two subjects, whereas in the certificate course, they are trained in all subjects. Teacher competencies have not been defined at the certificate and diploma levels of teacher education.

In-service Provision:

- In Kenya, there are numerous providers of in-service programmes among national institutions. One of the biggest providers of in-service is the Centre for Mathematics Science and Technology Education in Africa (CEMESTEA). CEMESTEA is a public institution with a mandate to provide and coordinate INSET for practicing teachers of Mathematics and Science in Kenya and the African region. The centre coordinates in-service education and training through a network of 108 district centres for its secondary level INSET programmes, and 18 regional centres for its primary level INSET programmes.
    - The Teacher Service Commission (TSC) is an independent commission with a mandate

for capacity development and quality assurance of all teacher in-service and professional development programmes for primary and secondary levels.

  - The Kenya Education Management Institute (KEMI) is a corporate entity with a mandate to improve quality of education by enhancing the capacity of education managers through effective and efficient training, research and consultancy services. Teacher training institutes, universities, and the Ministry of Education Science and Technology (MoEST) provide in-service courses on a needs basis, whether as a stand-alone institutional provision or in partnership with other providers.
  - One of the key areas of focus for all institutional providers is to work with partners to meet annual government targets for in-service provision for all teachers. The critical issue is quality assurance and harmonization of in-service materials that are aligned with national educational strategies and objectives, as well as institutional objectives to ensure provision of quality teacher professional development and whole school development.

- In Tanzania, the in-service training of teachers does not tend to be regularized, and is reported to be taking place in an ad hoc, and uncoordinated manner (Komba and Nkumbi, 2008). Professional development of teachers has not been incorporated in the strategic plans at any level and has not been budgeted for. Pocket training takes place in Zonal Training Centres (Zonal Teacher Colleges), Regional Training Centre (Nucleus Schools), and Teacher Resource Centres (TRCs).
- In both case study countries, there are no systematic efforts in the provision of in-service for teachers in ICT skills, other than a tendency for one-off training of teachers conducted in parallel with small- or large-scale technology deployments. This form of skills upgrading tends to be fragmented, and not geared towards addressing the identified needs of practicing teachers for ICT integration in professional and classroom practices (Swarts and Wachira, 2009, 2010). However, it has been observed that ICT use in teacher in-service training has been evolving both as a reaction to current initiatives in mass technology deployments, and a shift towards policy coherence initiatives for the integration of ICT in teacher education pre- and in-service.

3.4 Summary Overview of Institutions and Provision

Tables KT.3 and KT.4 provide a summary of key statistics in the Kenya and Tanzania education and training sectors in relation to the number of schools, teachers and students at all levels of the education systems.

The tables present a summary overview of education systems that are in rapid expansion. They reflect trends moving towards a shift in demand from universal primary to universal secondary education. In parallel, they reveal emerging scenarios of growing demands for more teachers, and of more options for provision of teacher education. In Kenya, the Ministry of Education Statistics in 2008 recorded a shortfall of some 47,000 teachers at primary level, and 17,000 teachers at secondary level (Kenya Ministry of Education, Science and Technology, 2008). In Tanzania, the government estimates in 2007 recorded a requirement of some 45,000 additional teachers to meet demand, resulting from the exponential growth in student populations from primary to secondary level (Hare, 2007). Teachers of mathematics, science and language (especially English) are in short supply. Many schools have no teachers for some science subjects, and failure rates for these subjects are high (World Bank, 2010).

In this context, many experts in the national and international fields of teacher development and ICT believe that the thoughtful use of new forms of ICTs can be exploited to strengthen and enhance teacher development programmes, address access issues and improve the quality of educational delivery (Leach, 2008; Nihuka and Voogt, 2009; Gacicio, 2013). Yet, effective technology

integration into teachers' classroom practice has not been widespread (Le Baron and McDonough, 2009). The issue is complex where the need is to equip educators and administrators with expertise for ICT integration from a system perspective to support both whole school development, that will in turn support the pedagogical integration of ICT in classroom practice (Gakuu et al., 2011).

Table KT. 3: Kenya key statistics in the education and training sector

Level of Education	No. of Institutions		Total Number		
	2013 public and private	2014 public and private	Students/Pupils 2013 ('000)	Students/Pupils 2014 ('000)	Number of Teachers
Pre-Primary	**40,145**	**40,211**	2,865.3	3,019.9	88,188 (2014)
Primary Schools	**28,026**	**29,460**	9,857.6	9,950.7	317,477 (2014)
Secondary Schools	**7,834**	**8,734**	2,104.3	2,331.7	118,608 (2014)
Teachers Training Colleges Primary	**22 Public 101 Private**	**24 Public 101 Private**	10,792 7,392	10,971 8,352	N/A
Teachers Training Colleges Diploma	**2**	**2**	694	1,007	N/A
Universities	**65 public/ private universities 2012/2013**		271,142 (public) 90,246 (private)		

Sources: Kenya Ministry of Education, Science and Technology (2014); Kenya Ministry of Development and Planning (2013).

Table KT. 4: Tanzania key statistics in the education and training sector

Level of Education	No. of Institutions		Total Number					
	Public	Non-governmental	Students/ Pupils Total	Male	Female	Teachers/ Educators/ Lecturers Total	Male	Female
	2013							
Pre-Primary Education Centres			1,026,466 (969,683 public)	512,798 (483,720 public)	513,668 (485,963 public)	12,377 (9,900 public)	3749 (3.399 public)	8, 628 (6,501 public)
Primary Schools	**15,576**	**767**	8,231, 913 (8,033,926 public)	4,066,287 (3,965,572 public)	4,165,626 (4.048,354 public)	189,487 (179,322 public)	91,253 (85,525 public)	98,234 (93,797 public)
Secondary Schools	**3,528**	**1,048**	1,728, 534 (1,450,689 public) (Forms 1 – 4)	888,323 (757,587 public) (Forms 1 – 4)	840,211 (693,102 public) (Forms 1 – 4)	73,407 (58,252 public)	49,552 (37,451 public)	23,855 (20,799 public)
			75,522 (58, 190 public) (Forms 5 – 6)	50, 868 (41, 661 public) (Forms 5 – 6)	24,654 (16, 529 public) (Forms 5 – 6)			
	2010							
Teachers Colleges	**34**	**58**	25,814	14,578	11,236	1,745	1,665	80
Technical and Vocational Institutions	**21**	**900**	166,786	91,688	75,098			
Universities	**11**	**20**	169,124	106,615	62,509			

Sources: URT (2010a); URT (2014).

In the following section, ICT policy and strategy frameworks are examined in terms of their scope and limitations for ICT use in education and teacher professional development.

4. Context of the ICT Professional Development Strategies and Frameworks

ICT teacher professional development policies and strategy, whether defined or in development, are critical tools for mapping a holistic approach for ICT use in teacher education. The following sections examine the parameters of emerging policies and strategies in the case study countries in relation to the areas of ICT in Education and teacher education.

4.1 ICT in Education Policy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The Governments of Kenya and Tanzania see the potential for the use of ICT to improve access to, quality, relevance and management of education provision. Both countries have developed policies and strategies for integrating ICT in their education systems.

In Kenya, the ICT4E policy is integrated in both the National ICT and Education Policies. The National ICT Policy (Kenya Ministry of Information Communications and Technology, 2006) emphasizes the use of ICT to modernize and improve the education and training system by expanding access to training resources, accelerating the spread of science and technology, improving the quality of training and the level of ICT literacy, as well as responsiveness to societal requirements in Kenya. In addition, Kenya has been implementing the National ICT Strategy for Education and Training developed in 2006 (Kenya Ministry of Information Communications and Technology, 2006). This is in response to educational priorities outlined in the National ICT Policy and the Kenya Education Sector Support Programme, along with the need to recognize ICT as a universal tool for education and training that can provide 'capabilities and skills needed for a knowledge-based economy' (Kenya Ministry of Education, Science and Technology, 2006, p. 5). In 2014, the Kenya ICT Masterplan 2014-2017 was launched, where ICT in Education is identified as a flagship project.

In Tanzania, the National ICT Policy (URT, 2003) recognizes the role that ICT can play to 'enhance education, including curriculum development, teaching methodologies, simulation laboratories, lifelong learning and distance education and for teaching of not only ICT, but of all subjects and specializations.' Furthermore, a distinct framework for linking ICT and basic education has been developed in the form of the ICT Policy for Basic Education (Tanzania Ministry of Education and Vocational Training, 2007), which recognizes the use of ICT in Education as a tool that 'will empower learners, teachers, educators, managers and leaders to use ICT judiciously and effectively for expanding learning opportunities' (p. 2).

4.2 Building Teacher Capacity

Teacher quality is the most important factor for delivery of learning outcomes. A McKinsey and Company (2007) report observes that 'the quality of an education system cannot exceed the quality of its teachers' (p. 16). The urgent need is for pre-service and in-service providers to equip teachers with expertise for ICT integration in teaching and learning that goes beyond the acquisition of technological skills. This section looks at the strategies and initiatives for building teacher capability in ICT use in administration and classroom practice in the case study countries.

Kenya

In Kenya, the National ICT Strategy for Education and Training (Kenya Ministry of Education, Science and Technology, 2006) includes critical features which specify how ICTs are to be used for building capacity in pre-service and in-service teacher education. The focus is to establish model institutions that will be used to demonstrate integration of ICT in teaching and learning; to train teachers on integration techniques in the context of classroom practice; and to sensitize education managers on the importance of ICT integration. The aim is to build capacity of universities and colleges to equip teachers in pre-service programmes with ICT skills up to certificate, diploma and degree level. In in-service, the focus is to develop school-based capacity for at least one teacher in each school to teach ICT, support ICT literacy and integration, and basic maintenance of ICT equipment. In 2015, a Digital Literacy Programme was unveiled by the Kenya Ministry of ICT through the National ICT Authority. It identified the adequate training and preparation of primary school teachers on the use of ICT as one of the four pillars of the programme (Kenya ICT Authority, 2015).

Kenya has implemented a number of ICT in teacher education training initiatives including:

- The multi-partnership education programme led by USAID (2006 – 2012) for ICT integration in pre-service teacher training in primary teacher training colleges. The programme integrated infrastructure inputs from CISCO for networking of TTCs, INTEL Teach and Microsoft curricula that have been vetted by the Kenya Institute for Curriculum and Development for the use of ICTs and training of technicians (USAID, 2013a).
- The African Union NEPAD multi-partner demo project that equipped six secondary schools with state-of-the art ICTs and provided teacher training and learner content (NEPAD, 2014) also.
- The massive in-service programme conducted in 2013-2014 by the MoEST through KEMI and TSC that trained 150 Master Trainers, who in turn trained some 60,000 teachers to kick off the integration of ICT in the Presidential 'Laptop Programme' initiative for primary schools (Daily Nation, 2013).
- The development in 2013 by the Kenya Institute of Curriculum Development (KICD) of a national ICT integration training manual 'to help facilitators prepare teachers for the roll out of the national ICT integration laptop programme in primary schools' (Kenya Institute of Curriculum Development, 2013, p. iv).
- The MoEST collaboration with UNESCO in the launch and implementation in 2015 of the Kenya ICT Competency Framework for Teachers (KICT-CFT) pilot initiative. The project encompassed an online teacher training course for primary teachers based on the *UNESCO ICT-CFT* competencies. It was developed using Open Education Resources (OER) drawn from all over the world. It was designed to extend the ICT Integration Course developed for Primary School teachers (Kenya Ministry of Education, Science and Technology and UNESCO, 2015).

- The MoEST collaboration with GeSCI for planning and developing ICT in Education and training initiatives, including ICT use in the TVET sub-sector where: (1) in 2011, a TVET ICT baseline survey was carried out; (2) in 2012, a contextualized framework of ICT Competency Standards for Teachers in Kenya's TVET institutions was developed; (3) and, in 2013, a strategy for the integration of ICT in TVET programmes was developed (Kenya Ministry of Education, Science and Technology and GeSCI, 2013).

Tanzania

In Tanzania, there have been concerted and on-going efforts to build teacher ICT competencies and skills in pre-service and in-service teacher training programmes. In 2005, the deployment of ICT in the teachers colleges (TCs) was prioritized by the Ministry of Education and Vocational Training (MoEVT), and ICT use in TC programmes was first implemented as a joint initiative with the support of the Swedish International Development Agency (Sida). Currently, ICT programmes are being implemented in 34 teachers' colleges (TCs) with the aim of facilitating tutors and student teachers to integrate and use ICT as a teaching and learning tool. Diploma colleges offer courses on ICT at diploma level, which are information and communication technology (Academic) and information computer studies (Methodology).

In Tanzania, there have been several on-going initiatives that have been integrating ICT in teacher development, inclusive of the following examples: the Ministry of Education and Vocational Training (MoEVT) and IICD partnership collaboration project on Teacher Professional Development using ICT, implemented through the Bright Education Trust Fund (BETF), to develop school-based capacity on ICT-supported teaching and school administration (Tilya, 2007); the ICT-Connect and national Teacher Education Department partnership project that has enabled informal professional learning opportunities and communities of practice through connecting the teacher training college network to a platform for mutual activities (Tilya, 2007); the 'Badiliko' British Council and Microsoft project that uses a digi-hub model to provide resource outreach and a professional development cascade programme for educators to hundreds of schools (British Council, 2015); and the multi-partner collaboration between the MoEVT, the Open University of Tanzania (OUT), the University of Dar-es-Salaam (UDSM) and the Mid Sweden University (MiUn) on an m-learning secondary teacher education project that provides access to pedagogy and subject-specialized education training (Bakari and Nykvist, 2009).[46]

In this context, the government has made efforts to define a roadmap for streamlining the multiple ICT in teacher education initiatives. In 2009, the MoEVT, with assistance from GeSCI, facilitated the development of a *Framework for ICT Use in Teacher Professional Development in Tanzania* elaborating a development path with vision, goals, resource requirements, and outcomes for ICT integration in teacher education. In 2013, the partnership facilitated a multi-stakeholder development of the Tanzania Beyond Tomorrow strategy (E-Learning Africa, 2015) with a human resource development component that clarifies the need for a clear framework for pre-service, induction, and in-service ICT professional development of educators.

46 The MoEVT and UNESCO collaboration on the development of ICT Competency Standards for Teachers in Tanzania based on the *UNESCO ICT-CFT* and likewise included a focus on harnessing OER to develop the curriculum and teacher training modules (Tanzania Ministry of Education and Vocational Training and UNESCO, 2015).

4.3 Towards a Framework for ICT Use in Teacher Professional Development

The Kenya and Tanzania case study ICT professional development strategies and programmes describe, in broad terms, national and local efforts for building teacher ICT capability: from basic literacy skills, to ICT use in management and administration, to content development and pedagogical integration of ICT in practice. However, the desired outcomes for ICT in teacher education can only be achieved if the overall strategies are comprehensive and realistic. What is needed is a framework that can align national and local initiatives and programmes into a continuum approach for building teacher capacity systematically through different levels of ICT competency from pre-service to in-service programmes.

In 2013, GeSCI, in partnership with the MasterCard Foundation, and working in collaboration with the Kenya and the Tanzania Ministries of Education, introduced the globally benchmarked *UNESCO ICT Competency Framework for Teachers (ICT-CFT)* (2011) into the partnership teacher development project for 'Strengthening Innovation and Practice in Secondary Schools' (SIPSE) in Kenya and Tanzania. The SIPSE project was conceptualized to enhance teacher capacity in ICT competencies and skills to teach science, technology, English and mathematics (STEM) subjects in secondary schools for a 21st century context, and to increase access to, and quality of the teaching and learning materials.

The adoption of the *UNESCO ICT Competency Framework for Teachers* in SIPSE presented a number of advantages for promoting the innovative and transformative practices that underpin the SIPSE project as listed in Table KT.5.

Table KT. 5: Advantages of an ICT competency framework for teachers in professional development

Innovation at classroom level	A competency framework in the SIPSE project can focus ICT integration on innovative and transformative practices at the classroom level of STEM teaching and learning; where technology integration changes content as well as pedagogy (what students learn as well as how they learn)
Innovation at systemic level	A competency framework in the SIPSE project can focus ICT integration on transformative practices at the systemic level: leading to changes in the organisational and structural features of ICT course provision in pre-service and in-service in case study countries
Clarity	The certification on ICT competency requirements for STEM teaching and learning will be clear for SIPSE course countries.
Confidence in course materials	The Ministry, partners and course stakeholders can be confident in course development and materials that are aligned to agreed and transparent ICT Teacher Competency Standards

The following section outlines the processes involved in operationalising the *ICT-CFT* in SIPSE, and more explicitly the processes involved in contextualizing, prioritizing and operationalising *ICT Competency Frameworks for Teachers* in Kenya (*ICT-CFTK*) and Tanzania (*ICT-CFTT*) in-service programmes.

5. Development of ICT Competencies for Teachers

Competency in technology integration is the basis for effective change. ICT competencies or standards are descriptions of what a qualified teacher should know and be able to do with technology in educational settings.

5.1 An Overview of the SIPSE ICT-CFT National Task Forces – Kenya and Tanzania

The national task force in each country is made up of representatives from national and school levels affiliated to teacher education policy and programmes, e.g. educational policy-makers in the areas of teacher education and curriculum development for STEM, and teacher educators in the areas of STEM specialist areas from pre-service and in-service institutions (universities, TEIs, and schools). The national task forces, together with other key expert parties, are responsible for validating the contextualized competency recommendations, and providing assistance to on-going development of curriculum mapping, to the identification of OERs and the development of modules for the project teacher development blended learning courses.

Kenya National Task Force

1. Ministry of Education, Science and Technology (MoEST) – 1 representative
2. Kenya Institute of Curriculum and Development (KICD) in charge of teacher education curriculum – 1 representative
3. Teacher Service Commission – 1 representative
4. Centre for Mathematics, Science and Technology Education in Africa (CEMESTEA) in charge of in-service teacher education curriculum in mathematics and science for primary and secondary – 1 representative (and SIPSE Master trainer)
5. Secondary school ICT champion teachers and specialists in Science, Technology, English, and Mathematics subject teaching – 5 representatives (and SIPSE Master Trainers)

Tanzania National Task Force

- Ministry of Education and Vocational Training (MoEVT) – 1 representative
- Tanzania Institute of Education (TIE) in charge of teacher education curriculum – 1 representative
- Teacher colleges represented by teacher education specialists in STEM teacher education – 6 representatives (and SIPSE Master trainers)

5.2 An Overview of the *UNESCO ICT-CFT*

The *UNESCO ICT Competency Framework for Teachers (ICT-CFT)* (2011) promotes a teacher development model for effective ICT integration across six education system domains of policy, curriculum and assessment, pedagogy, ICT, organisation and administration, and teacher development. It provides a continuum of approaches to enable teachers to move from *applying* (Technology Literacy) to *infusing* (Knowledge Deepening) to *transforming* (Knowledge Creation) stages of ICT integration. It is a framework that gradually develops teacher capability to use ICT as a natural tool for supporting and transforming everyday practice (UNESCO, 2011; Commonwealth of Learning, 2012).

Figure KT. 2: UNESCO ICT Competency Framework for Teachers

	Technology Literacy	Knowledge Deepening	Knowledge Creation
Understanding ICT in Education	Policy awareness	Policy understanding	Policy innovation
Curriculum and Assessment	Basic knowledge	Knowledge application	Knowledge society skills
Pedagogy	Integrate technology	Complex problem-solving	Self management
ICT	Basic tools	Complex tools	Pervasive tools
Organisation and Administration	Standard classroom	Collaborative groups	Learning organisations
Teacher Professional Learning	Digital literacy	Manage and guide	Teacher as model learner

Source: UNESCO (2011).

5.3 Development of ICT Competency Frameworks for Teachers in Kenya and Tanzania

The *ICT-CFT* presents a holistic view of ICT teacher competencies that goes beyond basic e-literacy. It provides a comprehensive framework of competencies needed by 21st century teachers. However the *ICT-CFT* is a theoretical framework. This section presents the processes involved in the operationalisation of the *ICT-CFT* in SIPSE in-service programmes for teachers in Kenya and Tanzania. The operationalisation processes involved five principal stages: needs assessment and situational analysis, contextualization and prioritization of competencies, curriculum mapping based on *ICT-CFT* priorities, module development based on ICT competency priorities, and assessment and evaluation of the competency piloting in in-service courses (See Table KT.6 for an overview).

Table KT. 6: Stages of ICT-CFT operationalization

	Activities	Participants/ accountability	Methods	Duration	Output
Stage 1	Situational and needs assessment analysis	Ministries and departments, universities, TEIs, TVEs, schools, etc.	Literature review, questionnaire, focus group discussion, interview, surveys	2 months period	Instruments Situation analysis report
Stage 2	Contextualisation and prioritisation of ICT competencies	Policy-makers focusing on teacher education, teacher services, teacher educators, TEIs and universities	*ICT-CFT* Roadmap tool; Development-priority survey and matrix tools	2 days period	*ICT-CFT* Roadmap contextualised competency framework for teachers in Kenya (*ICT-CFTK*) and in Tanzania (*ICT-CFTT*); Prioritized competencies for module development
Stage 3	Curriculum mapping using *ICT-CFT* priorities	National task force and partner experts	*ICT-CFT* curriculum review and mapping tools	2 weeks period	National curriculum reviews Curriculum mapping for in-service training
Stage 4	Module development using *ICT-CFT* and *TPACK*	National task force and partner experts	OERs and *ICT-CFT* and *TPACK* frameworks	4 months period	Modules for 2 levels of ICT competencies
Stage 5	Assessment and evaluation	Master trainer team from national task force	Lesson observation; Lesson plan assessment tools	Ongoing	Certification for 2 levels of competency attainment

Summary of activities for SIPSE *ICT-CFT* implementation:

SIPSE year 1 implementation

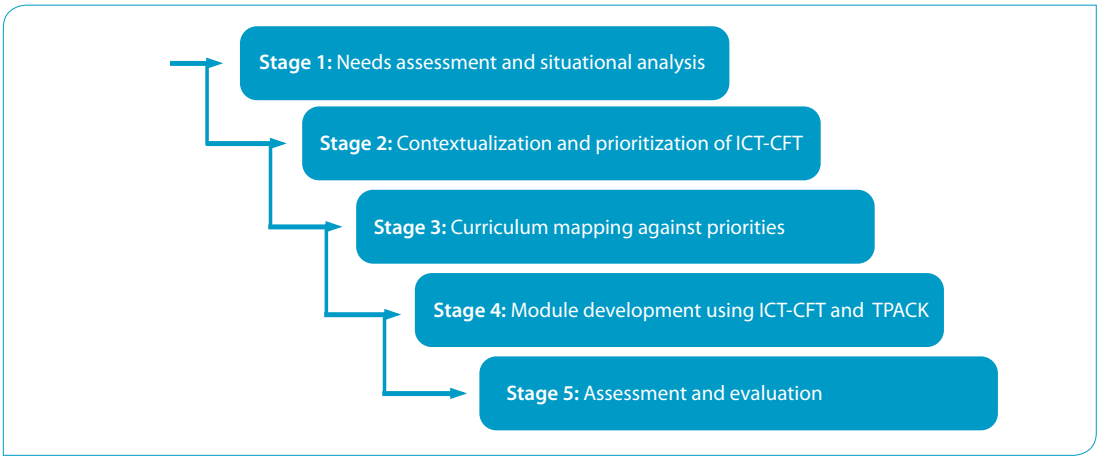
1. Situational and needs analysis,
2. *ICT-CFT* contextualization and prioritization,
3. Pre- and in-service curriculum review, and SIPSE curriculum mapping based on prioritized *ICT-CFT* competencies, identification of OERs, development of SIPSE modules for Technology Literacy and Knowledge Deepening levels,
4. Deployment of SIPSE modules for Technology Literacy (TL) level – workshops, e-learning and m-learning, and school-based project by teacher teams (school review),
5. Monitoring of three levels of SIPSE professional development impact in year 1
   - Level 1 - teacher reaction to TL modular training delivered via workshops and online
   - Level 2 - teacher self-assessment pre and post TL modules
   - Level 3 - teacher application of TL level learning (measured via observation of classroom practice, lesson review)

SIPSE year 2 implementation

1. Deployment of SIPSE modules for Knowledge Deepening (KD) level – workshops, e-learning and m-learning, and school-based projects by teacher teams (lesson planning, teaching and reflection in teacher design teams, school planning for ICT integration),
2. Monitoring of five levels of SIPSE professional development impact in year 2
   - Level 1 - teacher reaction to KD modular training delivered via workshops and online
   - Level 2 - teacher self-assessment post KD modules
   - Level 3 - teacher application of KD level learning (measured via observation of classroom practice, lesson review)
   - Level 4 - school organisation and culture (school support for ICT integration – leadership, school culture, ICT across the curriculum, teacher professional development resources and infrastructure)
   - Level 5 – student attitudes and dispositions towards ICT use in STEM teaching and learning
3. Evaluation – external evaluation of project impact at five levels of teacher professional development

The Competency Framework operationalisation in Tanzania and Kenya was set up to be a more collaborative process of competency consensus that is the norm of competency setting in education systems. The flow of the Competency Framework operationalisation is shown in Figure KT.3.

Figure KT. 3: Flow Chart of ICT-CFT implementation roll-out



Stage 1: Needs assessment and situational analysis

GeSCI has conducted ICT in Education needs assessments and situational analysis in Kenya (Swarts and Wachira, 2009; Kenya Ministry of Education, Science and Technology and GeSCI, 2010) and in Tanzania (Swarts and Wachira, 2010; Hooker, Wachira, and Verma, 2011). The following goals were specific to the assessment of the teacher education landscape in each country with a view to piloting the *ICT Competency Framework for Teachers*:

a) A scan of the ICT teacher development landscape looking at existing ICT teacher training policies, strategies, programmes, Standards (if any), curriculum, content, delivery mechanisms, evaluation and assessment, among others, both at in-service and pre-service levels. This scan would be used to determine the contribution of ICT Competency Standards in Kenya and Tanzania;

b) A stakeholder analysis and determination of key national counterparts for the ICT in Teacher Education initiatives in consultation with the Ministries of Education;

c) Determining at what level (primary, secondary or tertiary, including vocational training) to pilot the *ICT Teacher Competency Framework for Teachers*, in alignment with country needs and objectives;

d) Identifying teacher training institutions to target for piloting the *ICT-CFT* and tools.

The needs analysis was conducted in two phases: a desk review followed by the country field studies.

Desk Review: The purpose of this stage was to generate a knowledge base about the general status of ICT in Education and teacher development in Kenya and Tanzania. This stage consisted of reviewing existing literature, reports, comparable work done in other countries, websites and available data.

Field Survey: This stage, conducted over a period of two weeks, collected more in-depth data and information about the ICT in Education and teacher development landscapes in Kenya and Tanzania, gathering information through interviews and consultation with actors from the education and teacher development national sectors, agencies and institutions. The key tools used during the field research were:

- **Interviews** conducted with key informants in Ministries, national institutions and agencies, state

colleges and local schools for a duration of between 45 minutes to one hour;

- **Focus group discussions** conducted with lecturers, teachers, student teachers and students;
- **Surveys** on stakeholder importance and prioritization ratings of the teacher competency standards enumerated in the *UNESCO ICT-CFT;*
- **Questionnaires** to verify status of ICT infrastructure in Colleges of Education and schools.

See the complete field research tool set in Appendix 1.

Stage 2: Contextualization of the *UNESCO ICT-CFT* Framework

The contextualization of the *ICT-CFT* involved a two-step process:, as discussed in the next sections

5.4 Formulation of a Roadmap Tool for ICT Competency Standards for Teachers

The goal of developing a Roadmap tool was to have a baseline framework ready for facilitating the contextualization processes in Tanzania and Kenya. The Roadmap was thus the starting point of the contextualization process. The steps involved in the formulation of the Roadmap were:

a) **Reviewing competencies from around the world:** Various international and national frameworks were consulted during the creation of the Roadmap tool. The frameworks reviewed during the Roadmap development were:
   - ISTE: National Educational Technology Standards for Teachers (NETS-T)
   - UNESCO: *ICT Competency Framework for Teachers*
   - Australia: *ICT Competency Framework for Teachers*
   - Dutch ICT Knowledge Base
   - *Teachers Competencies and Qualifications Framework for EU countries*
   - ICT-enhanced Teacher Standards for Africa
   - *South African ICT Teacher Development Framework*[47]

b) **ICT Teacher Competency Roadmap:** Restructuring of the *UNESCO ICT Competency Framework for Teachers* to create an ICT Teacher Competency Roadmap tool involved analysing each of the UNESCO competency development approaches (Technology Literacy, Knowledge Deepening, and Knowledge Creation) and system domains (Policy, Curriculum, Pedagogy, ICT, Organisation and Management, and Teacher Development).
   - Each competency domain was divided into sub-domains (e.g. Policy - Policy Awareness; Classroom Practice).
   - A progression path was mapped of key performance indicators and benchmarks to describe increasing levels (Emerging, Applying, Proficient and Transformative levels) of teacher attainment in the full implementation of each competency sub-domain and approach.
   - A number of gaps were identified where there was not a relevant UNESCO Statement for a particular sub-domain. New Statements were drafted, which were consistent with the nearest UNESCO Competency Statement.
   - A new Emergent level was added to the *ICT-CFT* so that the Roadmap would be more inclusive to schools and institutions that were just beginning to engage with ICT – a stage

47 References: Commonwealth Department of Education Science and Training (2002); eQSF (2010); Australia Department of Education (2013); Government of South Africa (2007); Van der Linde, D., et al. (2009); UNESCO International Institute for Capacity Building in Africa (IICBA) (2009); UNESCO (2011).

that was evident in a significant number of education institutions and schools during the needs analysis (Table KT.7).

Table KT. 7: Extract from the ICT Teacher Competency Roadmap

			Emergent	Technology Literacy	Knowledge Deepening	Knowledge Creation
Competency domains and sub-domains		Performance Indicators Teachers…	Emerging Teachers…	Applying Teachers…	Proficient Teachers…	Transformative Teachers…
Policy and Vision	Policy Awareness	research, evaluate and support school and national policy and vision for ICT integration across all subject areas.	identify and discuss local, national and global policies for technology integration in education and development.	contribute to the development of a shared school vision and planning for ICT integration that is based on national policy.	collaborate with others to plan and implement a new and more effective approach to integrate new ICT across all subject areas.	embed school, district and national policy in ICT integration by applying it in their daily work and engaging with students in innovative and exemplary practice.
	Classroom Practice	design, adapt and develop classroom practices and school programmes to implement national ICT and education reform policies.	create lesson plans with a basic reference to school and/ or national ICT policy and practice.	identify key characteristics of classroom practices and specify how these characteristics serve to implement policies (TL.1.a.).	explain and analyse the principles of using ICT in Education - describe how these principles can be put into practice in their own teaching - analyse what issues arise in implementing these principles, and how those issues can be addressed. (KD.1.a.).	design, implement, and modify school/ institutional level education reform programmes that implement key elements of national education reform policies. (KC.1.a).

Note. Enumerated Statements refer to competencies in the *UNESCO ICT-CFT*.

a) **Four levels of competencies:** All in all, the Roadmap has four levels of teacher competencies:[48]

- In the Emerging stage, the teacher development focus is on the use of ICT as an add-on to the traditional curricula and standardized test systems. Teachers and learners are discovering ICT tools and their general functions and uses, and the emphasis is on basic ICT literacy and skills.
- In the Applying stage, the focus is on the development of digital literacy and how to use ICT for professional improvement in different disciplines. This involves the use of general as well as particular applications of ICT.
- In the Proficient stage, the teacher development focus is on the use of ICT to guide students through complex problems and manage dynamic learning environments. Teachers are developing the ability to recognise situations where ICT will be helpful, and choosing the most appropriate tools for a particular task, and using these tools in combination to solve real problems.
- In the Transformative stage, the learning situation is transformed through the use of ICT. This is a

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48 Note: The Roadmap has 4 levels compared to the *ICT-CFT* framework, which has 3 levels. The first level is additional to the *ICT-CFT* - a Technology Initial level prior to the Technology Literacy level. This is an emerging level that many stakeholders agreed for inclusion during the needs assessment consultations. This was to reflect a level of e-readiness that teachers and schools perceived they needed to go through to prepare in undertaking the ICT competency-based capacity building.

new way of approaching teaching and learning situations with specialized ICT tools. Teachers are themselves master learners and knowledge producers who are constantly engaged in educational experimentation and innovation to produce new knowledge about learning and teaching practice.

The Roadmap is a tool that can be used to **contextualize or tailor development paths for ICT use in professional development** to a particular country, its policies and its educational conditions.

See the complete Roadmap and performance indicators in Appendices 2 and 3.

5.5 Contextualizing competencies through a consensus building process

In Kenya and Tanzania, two-day national workshops were held as part of the SIPSE partnership project, for an introduction to and country contextualization of the *ICT-CFT* Roadmap.

a) The workshops were attended by participants representing key stakeholders in teacher education in each country, e.g. educational policy-makers in the areas of teacher education, teacher service commissions and curriculum development for STEM subjects; and STEM teacher educators in the areas of pre-service and in-service institutions (universities, TEIs and In-service providers). During the workshops, the MoE and GeSCI partner teams served as informants, facilitators, and resource providers rather than having a direct role in contextualizing the competencies.

b) The key workshop activities for competency contextualization and prioritization were as follows:

- **Familiarization:** Facilitation team interactive presentation and discussion of the *ICT-CFT* Roadmap; the focus in the discussion was to examine the *ICT-CFT* Roadmap domains and performance indicators in the context of global trends towards ICT competencies and standards in education and teacher education (see Roadmap and performance indicators in Appendices 2 and 3).
- **Review:** Participant review of various international and regional ICT competency frameworks; the focus in the review was to examine and discuss competency features and characteristics that would be appropriate for country contexts; whether the competencies should be generic or subject-specific; whether they should be targeted at pre-service or in-service; whether they should be developed for teachers, administrators or teacher educators, or any other group; how the contextualized competencies might be used and owned, as well as obstacles to their use (see the Competency Review Tools in Appendix 4).
- **Contextualization:** Participant use of 'Standards for Standards' tool for contextualizing *ICT-CFT* Roadmap competencies; the focus in the contextualization was to use the tool criteria of clarity, scope and relevance to assess whether the Roadmap of ICT Teacher Competencies were clear, sufficient in terms of content, and applicable and relevant to the participant teacher development contexts; and then to modify the competencies based on the participant assessment and suggestions for improvement and localization of the competencies (see the Contextualization Tool in Appendix 5).
- **Prioritization:** Participant use of a 'Development Priority Scan' tool containing 26 performance criteria drawn from the *ICT-CFT* Roadmap; the focus was to enable participants to identify where they think their teachers are in terms of their ICT development level on each performance criterion (Emerging, Applying, Proficient, or Transforming level), and where they want their teachers to be in terms of selecting 3 or 4 priority performance criteria (out of the 26) that

should be the focus of professional development courses (see the Development-Priority Tool in Appendix 6).

- **Competency Priority Matrix:** A matrix was developed from an analysis of the development-priority scanning among stakeholders (policy-makers, educators, teachers, principals) in the national workshops and surveys; the matrix presented a mapping of competencies rated by stakeholders to be at high/ low levels of development and priority.

Table KT.8 shows the ICT priority competencies identified for the SIPSE course implementation in Kenya and Tanzania. All the competencies that were rated as high in priority (whether they were high or low in development) were selected as the focus competencies for the SIPSE teacher in-service course on ICT use to support STEM teaching and learning.

Table KT. 8: ICT teacher competency priorities for SIPSE course focus in Kenya and Tanzania

DEVELOPMENT	LOW PRIORITY	HIGH PRIORITY
HIGH	**Quadrant III: High Development, Low Priority** • Pedagogy: Student experience • ICT: Communication and collaboration • ICT: Educational software • Org and Management: Leading ICT integration • Org and Management: Acceptable and appropriate uses	**Quadrant IV: High Development, High Priority** • Curriculum and assessment: Curriculum planning • Pedagogy: Planning • ICT: Productivity tools • ICT: Authoring tools • ICT: Internet • Org and Management: Teacher Understanding • Org and Management: Classroom management
LOW	**Quadrant I: Low Development, Low Priority** • Curriculum and assessment: Assessment • Curriculum and assessment: Communication and collaboration • Curriculum and assessment: Special needs education • Pedagogy: Communication and collaboration • ICT: Administration • Professional Development: Informal learning	**Quadrant II: Low Development, High Priority** • Policy: Policy awareness • Policy: Classroom practice • Curriculum and assessment: Learning environment • Curriculum and assessment: Student experience • Pedagogy: Problem based learning • Pedagogy: Project based learning • Professional Development: Planning • Professional Development: Teacher awareness
	LOW	HIGH
	PRIORITY	

Note: items in each quadrant presented as 'domain: sub-domain'

Stage 3: Curriculum Review

The next stage focus is on curriculum review of pre-service and in-service teacher development programmes using curriculum mapping tools that draw on contextualized and prioritized competencies.

a) **Curriculum review and improvement:** Curriculum review can be a lengthy and expensive process, depending on how it is structured. In a world where change is accelerating, it is desirable to have shorter curriculum review cycles informed by continuous informal reviews, as the curriculum is a 'work-in-progress' and needs to be responsive to changing circumstances and emerging needs of students and society.

b) *UNESCO ICT-CFT* **Review Tool:** In the Kenya and Tanzania SIPSE project, the adoption of the *UNESCO ICT-CFT* was a useful tool to carry out a short and focused informal curriculum review. An example of the curriculum review template can be found in Appendix 7. The template presents a review process that requires an examination of teacher development curriculum and syllabus goals, priorities, learning outcomes, pedagogy, assessment practices and teacher preparation in relation to how these could be enhanced or improved with the integration and

use of the *ICT-CFT* and its six system competency domains.

c) **STEM Curriculum Review - Kenya and Tanzania:** The existing curriculum for secondary teacher education in Kenya and Tanzania was reviewed by the national teams, as in: the pre-service diploma course curriculum of the Kenya Institute of Curriculum Development;[49] the in-service curriculum for mathematics and science of the Kenya Centre for Mathematics, Science and Technology Education;[50] and the diploma course for secondary education of the Tanzania Ministry of Education and Vocational Training.[51] The teams identified a tendency for separate guidelines in curriculum syllabuses for ICT use in subject teaching, and the need for ICT to be integrated into curriculum orientations for supporting content and pedagogy. See Table KT.9, an example of curriculum review and improvement for ICT integration in Kenya in-service mathematics and science syllabuses.

Stage 4: Module Development and Deployment

The following phases of module development were completed over a four-month period during and after the national task force team consultation workshops in Kenya and Tanzania. The development phases involved processes that built on the analysis coming out of the ICT teacher competency contextualization, prioritization, and curriculum review. The module development and deployment phases involved processes of module curriculum mapping, identification and assessment of appropriate OERs, guided writing and review, and piloting and evaluation of the first iteration of the SIPSE modules.

The following section presents an overview of these phases.

a) **Curriculum Mapping for Module Development:**

Based on the analysis of the ICT competency prioritization and national teacher education ICT curriculum mapping gaps, a first draft of a curriculum framework can be mapped to outline broad themes and competencies for the development of pre-service or in-service modular courses that are informed by priorities and needs.

Table KT.10 shows part of the *SIPSE Curriculum Framework* that was developed from the stakeholder prioritized competencies for in-service professional development. The Framework scaffolds 'curriculum pathways' to take teachers through three levels of ICT competencies – starting from a level of ICT basic competency (Emerging), to an applying ICT competency level (Technology Literacy), to a proficient ICT level (Knowledge Deepening). Due to time constraints, the pilot course development focused on the first three levels.

49 http://www.kicd.ac.ke/
50 http://www.cemastea.ac.ke/
51 http://www.moe.go.tz/index.php?option=com_docman&task=cat_view&gid=369&Itemid=618

Table KT. 9: Curriculum review and improvement - in-service and mathematics

Curriculum / Syllabus Domains	Content	Pedagogy	Technology		Technology Gaps
	Curriculum/syllabus subject content – priorities, outcomes, topics & special needs	Teaching & learning methodologies/ approaches & strategies	ICT tools available, which could be used to support content & pedagogy	Prioritized ICT teacher competencies / skill requirements to support content & pedagogy	How can ICT tools/ teacher competencies be improved to support subject syllabus content & pedagogy?
Teacher professional learning priorities for the subject	• Trends in teaching STEM • Student-centred teaching and learning • Team-building • Work-planning • Evaluation & assessment	• Research (online) • Role play • Group work	• Education software • Web 2.0 tools • Templates • Simulations	ICT productivity & authoring competencies: • Knowledge & skills to design content using ICT tools	ICT needs to be integrated into the subject curriculum orientations for supporting content and pedagogy; Teacher basic and advanced teacher competency skills for use of office productivity tools/ online tools for ICT production; Knowledge of software & Internet search engines – • Learning management software platforms; • Online survey software; • Open Education Resources; presentation software; • Projectors/ LCD
Expected teacher professional learning outcomes in the subject	• Classroom management • Resource utilization • Student centred learning • Evaluation	• Presentations • Demonstrations	• Wi-fi/ wi-max • Office tools/ soft wares • N computing/ thin client • Online assessment forms	Curriculum - student experience competencies: • Incorporating presentations, demonstrations, simulations • to combine inputs targeting specific content	
Subject topics that lend themselves for learning with/ through ICT	Examples from Biology, Chemistry & Physics • Biology – excretion & homeostasis; genetics; reproduction; respiration; growth & development; nutrition • Chemistry – Electrochemistry, organic chemistry, structure & bonding; metals; radioactivity • Physics- mechanics, optics, modern physics, electricity	Simulations and demonstrations addressing abstract concepts in a particular subject	• Simulations • Videos • Animations • Presentations	ICT Internet: • evaluation of Internet web resource to support learning	
Special Needs requirements to be considered	Not defined in the syllabus	Not defined in the syllabus	• Use of ICT resources to address science and mathematics teaching objectives and students with special needs • Software - Presentation software, Internet, Bluetooth • Hardware, cameras, microphones, data projectors, smart phones, computers	ICT Educational Software: • Evaluate and use educational software to support students' knowledge acquisition, thinking, reflection, planning & creative processes	

Table KT. 10: SIPSE curriculum pathways, mapping three Levels of Teacher ICT Competency Development

Key Curriculum Areas	Emerging	Technology Literacy	Knowledge Deepening
Policy Awareness	Teachers identify and discuss local, national and global policies for technology integration in education and development.	Teachers contribute to the development of a shared school vision and planning for ICT integration that is based on national policy.	Teachers discuss and work collaboratively with others for vision and planning implementation that focuses on exploring new and more effective approaches for ICT integration across all subject areas in the school.
	→	→	→
Curriculum and Assessment – Curriculum Planning	Teachers explain how existing curriculum objectives and assessment procedures can include the use of technology to support student learning and outcomes.	Teachers match specific curriculum Standards to particular software packages and computer applications, and describe how these Standards are supported by these applications. (TL.2.a.)	Teachers design units and classroom activities that integrate in a structured way a range of ICT tools and devices to support student learning.
	→	→	→
Pedagogy-Planning	Teachers select and use hardware and software best suited to particular learning experiences, and plan student learning experiences for appropriate use of these tools.	Teachers describe how didactic teaching with ICT can be used to support students' acquisition of school subject matter knowledge (TL.3.a.), incorporate appropriate ICT activities into lesson plans, so as to support students' acquisition of school subject matter knowledge. (TL.3.b.)	Teachers design unit plans and classroom activities so that students engage in reasoning with, talking about, and using key subject matter concepts, while they collaborate to understand, represent, and solve complex real-world problems, as well as reflect on and communicate solutions. (KD.3.d.)
	→	→	→
ICT - Internet	Teachers explore and demonstrate the use of the Internet for search and retrieval of information.	Teachers describe the Internet and the world wide web, elaborate on their uses, elaborate on their uses, describe how a browser works, and how to access a website through the use of URLs (TL.4.e.) and a search engine (T.L.4.f.)	Teachers evaluate the accuracy and usefulness of web resources in support of project-based learning with the subject area. (KD.4.b.)
	→	→	→
Organisation and Administration – Classroom Management	Teachers use whole class instruction as predominant teaching style for technology-based learning activities.	Teachers identify the appropriate and inappropriate social arrangements (whole class, small groups, and individual activities) to use with various technologies. (TL.5.c.)	Teachers create flexible classroom learning environments that integrate student centred activities and flexibly apply technology to support collaboration.
	→	→	→
Teacher Development-Planning	Teachers investigate and reflect on research and professional practice for using digital tools and resources to support student learning needs.	Teachers use ICT to enhance their productivity. (TL.6.a.)	Teachers use ICT to access and share resources to support their activities and their own professional development. (KD.6.a)

b) Mapping Module Curriculum Objectives, Content and Pedagogy Strategies:

The next phase of module curriculum mapping outlines the identification of high-level objectives, proposals for content and pedagogical strategies for each curriculum competency domain.

Table KT.11 shows a part of the Technology Literacy level curriculum mapping of objectives, content, and pedagogy proposals by national teams in each domain of the SIPSE prioritized competencies. The ICT competency domain underpins all domains, and was therefore not specified as a separate area for curriculum mapping by national teams.

Table KT. 11: Technology Literacy module curriculum objectives, content and pedagogical strategies mapping

Module and Unit Title	Objectives	Proposed Content	Teaching and Learning Strategies with Proposed Activities
Policy Awareness	Teachers should be able to discuss and work collaboratively with others for vision and planning implementation that focuses on exploring new and more effective approaches for ICT integration across all subject areas in the school.	Identification of policy documents. Methods of collaboration, Approaches for ICT integration.	Explanation of policy documents, discussion on methods of collaboration, a group activity on approaches for ICT integration.
Curriculum and Assessment- Curriculum Planning	Teachers match specific curriculum Standards to particular software packages and computer applications, and describe how these Standards are supported by these applications. (TL.2.a.)	Concepts and processes in the STEM subject areas. Function and purpose of subject-specific software tools.	Discussion of key concepts and processes in respective STEM subject areas. Planning activities to explore the functions and purpose of STEM subject-specific tools.
Pedagogy – Planning	Teachers should be able to describe how didactic teaching with ICT can be used to support students' acquisition of school subject matter knowledge (TL.3.a.), incorporate appropriate ICT activities into lesson plans, so as to support students' acquisition of school subject matter knowledge. (TL.3.b.)	What it means to be an exemplary teacher. Role of ICT in teaching and learning. Understanding the technology, pedagogy and content (*TPACK*) model and its application to teaching and learning; Use of ICT in work planning and lesson presentation.	Teacher exposition on the concept of good teaching strategies with technology, *TPACK*. through think - pair and share, cumulative talk, discussion strategies, 5 levels of questioning to promote higher order thinking, etc.
Organisation and Administration - classroom management	Teachers should be able to identify the appropriate and inappropriate social arrangements (whole class, small groups, and individual activities) to use with various technologies. (TL.5.c.)	Concept and meaning of appropriate social arrangements in ICT use; How students learn; and the role of group work, pair work, individual work in relation to ICT.	Facilitators exposition on basic understanding of the concepts' social arrangements; Discussion tasks and reporting, demonstrations and simulations of some of the social arrangements.
Teacher Development - Planning	Teachers should be able to use ICT to enhance their own productivity. (TL.6.a)	Teachers use ICT resources in content preparation of their teaching areas.	Strategies to build ICT into daily routines such that every subject has an ICT integrated lesson at least once a week, test and assignment preparation, etc. Students to access more information on same content, exploring more skills, using blended ICT tools, such as the Internet.

This process allows for module development in the next phase to weigh the different priority Focus Areas and determine the number of modules and notional hours for course development, whether in online or workshop or blended learning modalities of pre-service and/or in-service delivery.

c) **Open Education Resources Identification:** Guided by the curriculum mapping, the national teams and experts can conduct Internet searches for potential resources. The focus in such searches is to locate OERs that can be aligned to the module objectives, content and pedagogy strategies identified by the curriculum mapping. Several existing OER websites and teacher development courseware were shared to make the search easier for identifying OERs for the SIPSE module development and related materials for ICT use in STEM subject teaching.

d) **Course Guided Writing:** User guides of instructional design are developed to guide teams in the development of the course modules to: (a) lay out the recommended learning pathway through the selected ICT teacher competency priorities, and OER resources identified by the national teams; and (b) identify a sequence of teacher learning and application activities.

The SIPSE course centred on modular development to cover the broad theme of ICT use in STEM. From the national team curriculum mapping, a series of ten modules were developed in four months, as follows:

- ICT and Didactic Approaches in STEM Teaching and Learning
- ICT and Teacher Productivity
- ICT and Curriculum Standards in STEM Teaching and Learning
- ICT in Schools – from national policy to classroom practice
- ICT in the Lab and Classroom
- Problem-Based Learning and ICT in STEM Teaching and Learning
- Collaboration, Professional Learning Networks, and ICT
- ICT subject specific tools and software for STEM teaching and learning
- ICT and Project-Based Learning
- School Planning for ICT Integration

Following a review of the first module iteration by curriculum development and Master trainer teams, a set of five modules were developed from the module database to launch the SIPSE short five-month in-service pilot programme. The modules were designed to cover two levels of ICT teacher competency, namely: Technology Literacy level – three modules; and Knowledge Deepening level – two modules. Teachers were given a pre-course workshop to cover the emerging level of ICT competency basis skills.

The five course modules for the pilot programme covered the following topic areas:

- **Module 1** – ICT and Didactic Teaching – focus on practice and drill of ICT tools, and introduce presentation, spreadsheet and word processing tools;
- **Module 2** – ICT and STEM Curriculum Standards – focus on presentation of ICT tools;
- **Module 3** – ICT in the Classroom and the Computer Lab – focus on simulation tools; special unit on national policies and their impact on education;
- **Module 4** – Problem-Based Learning – focus on concept and mind mapping ICT tools;
- **Module 5** – Project-Based Learning – focus on STEM Subject Specific ICT Tools and Webquest.

See Appendix 8 for a more detailed overview of the five SIPSE module topics and content.

A key component of the SIPSE instructional design was the integration of technology, pedagogy and content knowledge (*TPACK*) [52] features in the module development. Each of the five modules contains information and activities that are structured into four units for building teachers' *TPACK* at Technology Literacy and Knowledge Deepening competency levels - as in:

- Unit 1 presents exemplary curriculum materials in the form of technology-enhanced STEM case studies and lesson plans (content knowledge focus);
- Unit 2 examines pedagogical strategies that can support student understanding and knowledge around STEM concepts (pedagogical knowledge focus);
- Unit 3 builds teacher capacity in the use of the course ICT toolkit – from basic to advanced

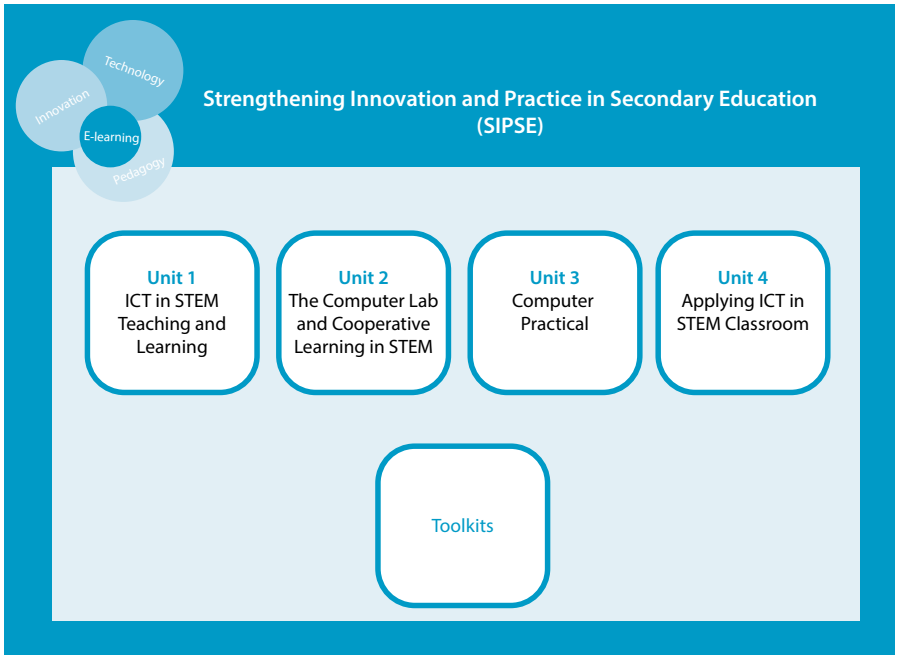
52 http://www.tpack.org/

skills levels (technology knowledge focus);

- Unit 4 centres on teachers' application of technology, pedagogy and content knowledge in classroom activities, lesson planning and resource development (technology, pedagogy and content knowledge application focus).

The overall purpose is to assist teachers to see what ICT-CFT competencies can look like in practice and to put them into practice. See Figure KT.4 and Appendix 9 for a more detailed example and overview of a SIPSE module unit set illustrating the underpinning *TPACK* instructional design to develop ICT teacher competencies that can support STEM teaching and learning in practice (*TPACK-ICT-CFT*-in-Practice).

Figure KT. 4: SIPSE CD overview of module units - *TPACK* and ICT-CFT in practice



e) **Module Piloting:** The five modules have been piloted in 20 schools working with 120 teachers in Kenya and Tanzania in 2014 . The schools were selected based on criteria that equally divided representation between urban and rural and boys and girls schools. The modular coursework ran over a period of 15 weeks (three weeks for each module) in two cycles of professional development for (a) Technology Literacy level competency development (modules 1, 2 and 3), and (b) Knowledge Deepening competency development (modules 4 and 5). Feedback based on Master trainer and teacher feedback on the online course, workshops, school visits and classroom observations has been collected and collated to inform revisions to the course modules and resources.

f) **Platform Development:** As the course modules have been designed to be delivered through a blended approach of face-to-face (f2f) workshops and online learning, e-learning and m-learning platforms and CDs were developed to enable various conduits of access by teachers and Master tutors/trainers to the modules. Communication tools (discussions forums/ chats) were used on the platforms to encourage and nurture SIPSE teacher peer-to-peer engagement, knowledge exchange, networking and professional learning communities within and between SIPSE schools and across case study countries.

Stage 5: Assessing/Evaluating Acquired ICT Competencies

The *SIPSE Contextualized ICT Competency Framework for Teachers* in Kenya and Tanzania define what teachers should know and be able to do with technology in STEM teaching. Outcomes are defined by performance indicators or descriptors of achievement at the application (Technology Literacy) and proficiency (Knowledge Deepening) stages of the teacher's progression path of competency development over the five modules. However, it is important to clarify that success in attaining the general progress indicators will depend on the teachers' support system at the SIPSE secondary school level. This would describe a support system that is based on shared vision and strong leadership for ICT integration in the school curriculum and assessment that is linked to national policy for ICT in Education and teachers' professional development. This would require supportive policies on ICT planning and budgets, technical support and other such conditions to be defined and clarified by school level stakeholders. Without such a support system in place, it is very difficult for teachers to attain a transformative competency level for ICT use in classroom practice. An important component in the SIPSE assessment is the whole-school development for ICT school policy and planning that is linked to the *ICT-CFT* competency domains on awareness and application of ICT policy in school and classroom practice.

Assessment Framework

The SIPSE course will provide teacher certificates by GeSCI as evidence that teachers have completed each cycle of Technology Literacy and Knowledge Deepening competencies successfully. The certificates will be credited within the national Teacher Service Commission (Kenya) and Teacher Education Department (Tanzania) Standards Frameworks of evidence for renewal of professional registration and for promotion.[53]

To this end, the course assessment will focus on the minimum requirements of teacher participation on course online activities, such as discussion forums and chats, formative assessments of teacher course 'portfolios', classroom observations and school review, and policy projects as follows:

1. The minimum criteria to complete the SIPSE course are the following:
   a) Teacher participation in and contribution to one content topic chat per module.
   b) Active participation in and contribution to one discussion forum topic per module.

2. The formative assessment covers the following assessment activities
   a) A minimum of one classroom observation for each cycle – where the observation is assessed using a *TPACK* observation framework tool (Appendix 10). Each teacher receives a minimum of one classroom observation to be carried out by the Master Trainer task force team in each cycle of competency training. Each individual teacher classroom observation accounts for 25 per cent of marks (two observations

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53 Teacher Service Commission, Kenya at: http://www.tsc.go.ke/index.php/our-services/hr/promotion
Teacher Education Division, Tanzania at: http://www.moe.go.tz/index.php?option=com_content&view=article&id=1594&Itemid=592

in total covering two cycles of competency development).

b) A teacher portfolio for each competency cycle – teachers collate the two best items they have prepared from each module - lesson plans/activities/ teaching and learning materials/ reflection journal. The materials form the final portfolio to be assessed using a technology, pedagogy and content knowledge lesson review framework (Appendix 10). Each individual teacher lesson review accounts for 20 per cent of marks (two lesson reviews per cycle).

c) A teacher group school project to assist whole school review and development of ICT policy, vision and planning - the processes involve different stages of ICT school visioning, review, SWOT analysis, priority identification and planning based on SIPSE ICT School of Excellence criteria domains for school leadership and vision, ICT across the school curriculum, ICT school culture, ICT professional development, and ICT infrastructure and resources (Appendix 10). Each teacher group school project review accounts for 10 per cent of the marks.

Evaluation Framework

The evaluation of the SIPSE professional development for ICT use in STEM sets out to measure the impact of the course work *ICT-CFT* and *TPACK* frameworks that have defined module development and implementation. The project uses an adaptation of Guskey's (2002) framework for evaluating professional development programmes where information is collected and analysed at five levels of implementation. The focus is to systematically assess the impact of the SIPSE course from the f2f teacher capacity building workshops to the online course and teacher community platform (level 1), to the teacher self-assessment of their ICT and *TPACK* competencies (level 2), to school support (level 3), to teacher application of competencies in classroom practice (level 4), to student learning (level 5). Teacher self-assessment and student survey tools form part of the additional assessment tools to measure impact (Table KT.12).

Table KT. 12: Evaluation of five levels of project professional development impact

M&E Level	M&E Tools
First level – teacher reaction	Workshop and online module evaluation through an online survey to gather information on teachers' initial satisfaction
Second level – quality of learning	Teacher online self-assessment and e-diary / e-portfolio artifact tools programme in their professional practice
Third level – school organisation support	A school visit protocol which is an interview protocol for school administrators (school heads and heads of department) School review based on SIPSE Schools of Excellence Criteria
Fourth level – teacher application	*TPACK* classroom observation protocol is a tool to assess teacher application of their *TPACK* in classroom practice
Fifth level – student learning and attitude	Student survey tool is a questionnaire to assess the project influence on student learning and attitudes towards technology use in STEM classes.

Source: Adapted from Guskey (2002). Tools available as Appendix 10; online tools accessible.[54]

54 Online survey: https://www.surveymonkey.com/r/3RWKC37
Online self- assessment: https://www.surveymonkey.com/r/GHR6L3W
School visit protocol: https://www.surveymonkey.com/r/2XV2XNT
Classroom observation protocol: https://www.surveymonkey.com/s/LYP5CMH
Student survey: https://www.surveymonkey.com/r/2NKJBRD

6. Impact and Issues

6.1 Impact

The SIPSE course is still in implementation and the assessment and evaluation processes of data collection and analysis have not been finalized. The expected end of the SIPSE course and model evaluation will be May 2015.[55] However, it is possible to present some impact assessment based on the evaluation of the first cycle of module implementation to develop teachers' ICT competencies at the Technology Literacy level.

The SIPSE course provision online via e-learning and m-learning platforms, offline CDs and PDF options for printing the modules, the intensive process of school visits, classroom observations and co-reflection with teachers by the Master trainer teams, have created a significant impact on teachers' perceptions and practice on the value of technology integration and the potential for change in school practice.

The teachers' workshop and online evaluation feedback as well as the chats and discussion forum engagement by the teachers would suggest that the course materials in the first cycle seem to be appropriate. The materials seem to enable teachers to meaningfully engage with exploring the use of ICT to support their STEM teaching and learning.

The evidence from school visits and classroom observations confirms teachers' emerging confidence with and utilization of ICT in the classroom and school management adjustments to support the use of ICT across the curriculum. The latter was evidenced in a number of the project schools showing management commitment to revamping ICT infrastructure and resources to facilitate teachers' use of ICT in the lab and classrooms; and to providing teachers with modems and Internet time to encourage online course attendance.

6.2 Issues and solutions

'Teachers out there are doing great work despite their busy schedules. What I suggest is that one of the outputs of this part of the SIPSE project is to collect, make a few adjustments and consolidate these lessons plans, together with their accompanying resources/URLs and make a manual of SIPSE ICT integrated lesson plans.'

Master Trainer 1 - Observation from School Visits

'I was observing lessons in one school which had problems. But I am happy that the teachers have now embraced the use of technology. I think many of our schools we were dealing with were at the emerging stage of ICT and few of the teachers were ahead. How will we sustain ICT Integration after the end of the training and project? You could think of the impact after five years (when) we see if they have reached the infusion stage of Knowledge Deepening.'

Master Trainer 2 - Observation from School Visits

55 Update: The SIPSE pilot ended after this case study was written. Monitoring and evaluation reports have been completed. The reports were presented in a policy brief and served as a basis for regional and national policy forum dialogue in Kenya and Tanzania on issues and opportunities for ICT integration in teacher professional development and whole school development. A full report on the regional and national forums inclusive of monitoring and evaluation appendix briefs can be accessed online at: http://sipseonline.gesci.org/GESCI2015/SIPSE%20Forum/FORUM%20DOCS/SIPSE%20KE%20TZ%20policy%20forums%20full%20report%20%20June%202015.pdf

For many school heads and teachers, the first cycle of the Technology Literacy course implementation has been a fast-tracked experience – where they are trying to cope with new ideas while maintaining their work practices for alignment with school requirements. The lesson plan reviews and classroom observations in the first wave of school visits demonstrate teachers who are trying to apply knowledge and skills – but who may need more support – whether from Master Trainers, other teachers in their schools, or from school heads. The issue may also be one of better access to course materials via traditional hard copies or CDs of the course modules as well as the online e-learning and m-learning platforms. Many teachers simply do not have time to access courses online and may not be comfortable with multiple learning path formats associated with online instructional design. The non-mandatory status of continuous professional development courses also presents challenges in terms of teachers' commitment.

The school cultures do not necessarily provide space for teachers to experiment with new tools and materials – where there is constant pressure to prepare students for exams and to cope with large classes and heavy teaching loads. Preparation of class materials using technology is also demanding on teachers in the initial phase, and requires enabling conditions to support teachers through the change process.

The special module addition at the end of the first cycle for whole school review and vision for ICT integration has had a positive impact in bringing together management and teacher actions and synergies for ICT integration at the school level. The ICT school review and planning activity will be key to addressing questions on shifting teachers' capacity from an Emerging stage to the Technology Literacy and Knowledge Deepening stages of the *ICT-CFT*. The teachers need adequate and sustained support and resources at school level so that they can continue to experiment and take the risks necessary for innovative practice. This would put a strong emphasis on school review and planning as critical tools for supporting both course implementation and the longer term sustainability of the *ICT-CFT* teacher development model and approach.

7. Conclusion

Teachers play a pivotal role in adopting ICT into classroom practice. However, very often teacher development for technology integration has been neglected or focused more on immediate concerns when new technologies are introduced into education systems (Mueller, et al., 2008). There is a need for a deeper development and evaluation focus on frameworks, such as the *UNESCO ICT-CFT* that can enable more rigorous approaches for the adoption of ICT in teacher development programmes and classroom practices.

This case study has explored how the *UNESCO ICT-CFT* can be adapted, contextualized and implemented in in-service provision based on the experiences of the *ICT-CFT* implementation in the 'Strengthening Innovation and Practice in Secondary Schools (SIPSE)' project in Kenya and Tanzania.

Several lessons emerged from the first phase of the *ICT-CFT* implementation in the SIPSE project. Some of these lessons are outlined below and some lessons continue to emerge as the SIPSE project enters the second phase of *ICT-CFT* implementation.

- The *UNESCO ICT-CFT* is an excellent point of reference to provide guidelines for planning ICT teacher education programmes whether to prepare pre-service teachers or to facilitate in-service teachers' professional development.

- The country level needs assessment research and stakeholder consultation workshops are critical processes for building ownership and capacity for contextualizing and aligning the *ICT-CFT* to national education and teacher development policies and objectives.
- There is a need for more elaborate capacity building on the *ICT-CFT* as it cannot be assumed that teacher education stakeholders have the necessary capabilities to contextualize, adapt and develop modules and implement courses that are aligned to the framework.
- The integration of a *TPACK* instructional design in the *ICT-CFT* modular development helps to situate teachers' competency development firmly in pedagogical practice (*TPACK* and *ICT-CFT*-in-practice).
- There is a need to recognize the national and school level essential conditions that are necessary to enable teachers to explore, apply and develop ICT competencies and skills in teaching and learning practice.
- In the case of Knowledge Deepening and Knowledge Creation ICT teacher competency levels, national and school level ICT policy and culture environments are critical factors in supporting teachers to do the necessary experimentation and risk taking for developing these higher order ICT competencies and innovative practices.
- The development of the course materials is enhanced if the module outputs meet the real needs of teachers as they attempt to apply their knowledge and skills in the often complex and messy environments of school and classroom contexts. The SIPSE five-level monitoring and evaluation processes with built-in tools for continuous review and learning can enable timely feedback for course readjustment to meet the needs of the teachers and the challenges of the contexts in which they work.

Appendix 1: Situational and Needs Analysis Survey Instruments

Appendix 1A: Interview Protocol

ICT Competency Standards for Teachers in Tanzania/ Kenya

Purpose of the interviews

Primary objective of mission is a needs assessment is to understand the landscape of ICT in Education and Teacher Development

Interview Protocol

1. Six areas
    a) Mandate – institutional/ organisational related to Education, Teacher Development & ICT
    b) Actors – Who is involved?
    c) Policy and objectives – Education, Teacher Development & ICT
    d) Resources – ICT/non-ICT available/ required for ICT in Education / Teacher Development
    e) Regulatory frameworks – formal & informal for ICT/Teacher Development
    f) Community – public/private networks in ICT in Education & Teacher Development
2. Training needs

    In your opinion, what is the most important ICT training need for a teacher in Tanzania/ Kenya?
3. ICT Competencies for Teachers

    If you went into the classroom of a good teacher who is using ICT in his/her practice, what would you see?
4. Wrap up

Appendix 1B: Focus Group Protocol

Lecturer / Teacher Focus Group Discussions	Student Teacher/ Secondary Student Focus Group Discussion
Question 1 – Policy issues • What are the most important factors which encourage you to use ICT in your instructional/course activities?	Question 1 – Policy issues on ICT access • How important is ICT in your daily lives/ in your learning? • What do you think about the use of ICTs in teacher education /learning today (Is it a necessity or a luxury?
Question 2 – Curriculum • *Have you explored opportunities to use ICT in your curriculum/ for instructional purposes?* • *How do you use it?*	Question 2 – Curriculum • Is the ICT on offer in the College of Education programmes/ school programmes relevant to your future professional needs?
Question 3 – Pedagogy • *If you went into a lecture hall/ classroom of a good lecturer/instructor who was using technology, what would you see?*	Question 3 – Teaching and Learning • Do you use ICT in your courses/ subjects? • What ICTs are used in your courses/ subjects? (collect on flip chart)
Question 4 – Infrastructure • *What are the non ICT/ ICT resources that you use in teaching and learning? What resources that you need?*	Question 4 – Infrastructure • How far is it the College of Education/ school job to help you to work with technology? • Why do you think that?
Question 5 – Organisation & administration • How does the administration support ICT use for your teaching function/ your specialized area?	Question 5 – Organisation & administration • How do you think the College of Education / school should support you in using technology?
Question 6 – Professional Development • Can you get access to ICT specific training support? • Have you been on ICT courses for teachers? • What further training do you feel you need?	Question 6 – Student Development • What technology applications do you understand easily / not understand? • Is there any technology in your course-work that you do not get involved with? Why, why not? • What help do you need to improve your skills in using technology in your course-work/ learning?

Appendix 1C: Importance-Prioritisation Survey

ICT Teacher Competency Standards for Tanzania

The table below lists the six ICT Teacher Competency Standard domains of policy, curriculum, pedagogy, ICT, organisation & management and teacher development, which are based on the UNESCO framework.

Prioritizing ICT-Teacher Competencies

1. How important are each of the ICT Teacher Competency Standards for you as a lecturer/ teachers? (Please tick as appropriate).
2. Use the stickers provided to identify the top three priorities you would like the 'ICT Teacher Competency Standards for Tanzania' project to focus on in the pilot phase (Red sticker 1st priority; Green sticker 2nd priority; Yellow sticker 3rd priority)

ICT Teacher Competency Standard Domains		Important	Moderately important	Not important
Policy	**Policy awareness** Awareness of national/institutional ICT in Education policy			
	Classroom practice Applying national/ institutional ICT policy in the classroom			
Curriculum and Assessment	**Curriculum Planning** Using ICT tools for course design and lesson planning			
	Learning Environment Using ICT tools in design of teaching & learning activities			
	Student experience Using ICT tools to support student understanding of subject concepts & their applications			
	Assessment Using ICT for formative & summative assessment and to provide students with feedback on progress			
	Communication & collaboration Using ICT communication and collaboration tools to access and source information and to connect students to the world outside the classroom			
	Special Needs Education Using ICT resources and assistive technologies to address special educational needs			

ICT Teacher Competency Standard Domains		Important	Moderately important	Not important
Pedagogy	**Planning** Using ICT to design teaching & learning unit plans and activities			
	Problem-based learning Using ICT to identify complex, real-world problems and structure them in a way that incorporates key subject matter concepts and serves as the basis of student projects.			
	Student experience Using ICT to design and implement collaborative, project-based unit plans and classroom activities			
	Project-based learning Using project-based learning and ICT tools to support student thinking and social interaction			
	Communication & collaboration Using open-ended tools and subject-specific applications to support student collaboration			
ICT	**Productivity tools** Using open-ended software packages appropriate to subject matter areas			
	Authoring tools Using an authoring environment or tools to design offline and/or web resources			
	Internet Using web resources in support of project/problem-based learning			
	Communication & collaboration Using search engines, social media websites and email to find people & resources for collaborative projects			
	Administration Using ICT to manage, monitor and assess progress of student projects & progress			
	Student learning Using ICT to enable student communication and collaboration with students, peers and the wider community			

ICT Teacher Competency Standard Domains		Important	Moderately important	Not important
Organisation and Administration	**Teacher understanding** Using computers, radio, television and other digital resources within the classroom and/ or the school so as to support and reinforce learning activities and social interactions.			
	Leading ICT integration Playing a leadership role in supporting innovation and continuous learning in the school community			
	Classroom management Identifying the appropriate social arrangements (whole class, small groups, and individual activities) to use with various technologies.			
	Acceptable & appropriate uses Developing procedures and policies for ethical, responsible and appropriate use of ICT to support teaching & learning			
Teacher Development	**Planning** Using ICT to enable staff access to e-learning courses for professional development			
	Teacher awareness Using Virtual Learning Environments to link staff to external experts & communities			
	Informal learning Using ICT to enable staff to actively contribute knowledge and to share information and resources that can be used to support classroom practices, research and professional development.			

Appendix 1D: ICT Infrastructure Questionnaire

1. Facilities and hardware

How many computers are in the institution? (total approximate number). . . . . .

How many computer labs are there? . . . . . .

How many computers in average per computer lab? . . . . . .

What % of them is connected to the Internet? . . . . . .

1.1 Computers

Brand and specifications	Numbers		% Functioning
	Branded (i.e. Compaq, IBM)	Clones (unbranded)	
Desktops Pentium I and below			
Desktops Pentium II or III			
Desktops Pentium IV and above			
Others (i.e. Macs)			
Laptops, notebooks or netbooks			
Don't know			

1.2 If you have servers please describe them (brand, hardware specifications)

. . . . . .

. . . . . .

1.3 How were the computers acquired? Through (Select all applicable)

NGO(s) ☐ Private vendor(s) ☐ School ☐

Church ☐ Private donor(s) ☐ PTA ☐

Ex-students ☐

Donations ☐ I do not know ☐

Other (specify): . . . . . .

1.4 Which operating Software(s) are in use in the institution? (Select all applicable)

Windows (specify): 95 ☐ 98 ☐ ME ☐

XP ☐ Vista ☐

Dual boot operating system ☐

Linux ☐ Specify distribution(s): . . . . . .

Others (Specify): . . . . . .

I do not know ☐

1.5 Which office application software is in use in the Institution?

Office 97 ☐ Office 2000 and above ☐ Open Office ☐

Others (Specify): .....

I do not know ☐

1.6) Are the operating systems (Software) licensed?

Yes ☐
No ☐
Some ☐
Don't know ☐

1.7) How were the Operating Systems (Software's) and Application Software Acquired?

Bought by school ☐
Donated ☐
Came with the machine ☐
Installed by the Technician from a personal copy ☐
Don't Know ☐

Others (Specify): .....

1.8) Are there any set standards (minimum versions, languages, technical, etc.) for software and or digital content? If so, please describe.

.....

.....

1.9) Which of the following software are used in your institution?

Software in use	Yes (Please name some if the answer is Yes)	No
Educational softwares		
School management software		
Statistical software		
Engineering software		
Accounting software		

2. Connectivity

2.1 Are the computers networked? . . . . . .

If yes, which is the network operating system? . . . . . .

2.2 Is there a central server or more? YES/NO

If yes, what is it used for? (tick all that apply)

- Data storage ☐
- Content and software storage ☐
- Proxy server ☐
- Security ☐
- Data cache ☐
- Centralized network management ☐
- Content filtering ☐
- I do not know ☐

2.3. Internet

Are the computers connected to the Internet? YES/NO . . . . . .

All the PCs have access ☐ or Some of the PCS have access ☐

Only teachers have access ☐

Only admin have access ☐

Access is available only some days or for limited time ☐

I do not know ☐

If yes, what is the technology type?

Internet connection arrangement		Speed/ bandwidth
• dial up(telephone)	☐	
• leased line(fiber optics)	☐	
• 3G (cell phone)	☐	
• ISDN/ADSL	☐	
• broadband via cable	☐	
• wireless	☐	
• satellite	☐	

3. Policy

3.1 Does your school/department have formal (written policies or plans) regarding:

Policy, plan or guideline regarding	Yes	No
User password, security recommendations, etc		
Content filtering		
Correct use of the equipment		
Rules for the use of the equipment (i.e. teachers have priority, etc)		
Preventive maintenance		
Users rights and duties		
IT technician duties		
Use of ICTs in other subjects other than ICT		

4. Maintenance

4.1 How often are the computers maintained (tick below as appropriate)

Routine schedule	Preventive maintenance	Curative maintenance
Monthly		
Quarterly		
Half yearly		
Yearly		
When they break down		
Never		

4.2 Who repairs and maintains the equipment?

- Me / My team ☐
- An external company ☐
- The hardware providers ☐

5. Professional development

5.1 What type of training do you have in order to perform your job? (check all that apply)

- Self-taught ☐
- Learned by doing ☐
- Took Private courses without certification ☐
- Took Private courses with certification (i.e. MS, Cisco) ☐
- Tertiary level diploma ☐
- University level diploma ☐

5.2 How do you keep your skills up-to-date?

- Self-learning and learn by doing ☐
- School/ Institution provides training ☐
- Pay for courses privately ☐
- I am doing or continuing my formal education (university level) ☐

6. ICT Usage

6.1 Do you have ICT tools for ICT Integration in teaching in learning in your institution?

YES ☐ NO ☐

If Yes, which are the tools available?

. . . . . .

. . . . . .

6.2 In your opinion, how are ICT used by teachers and students for the purpose stated below?

ICT use in teaching & learning	By teachers	By students
Communications		
Content development		
Instructional purposes		
Lesson preparation		
Personal use (emails)		
Professional development (online courses)		
Project-based learning		
Research		
Other		
Support for Assignments		

6.3 Is the computer lab open after schools hours or over the weekends?

	Yes	No
After school hours		
Over the weekends		

7. Funding of ICT related activities at the institutional level

7.1 Is there a budget line for ICT related activities?

If yes which ones:

Software acquisition ☐

Hardware maintenance ☐

Hardware acquisition ☐

Professional development ☐

Other ☐

I do not know ☐

Appendix 2: ICT-CFT Roadmap

POLICY

	PERFORMANCE INDICATOR	EMERGING	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
	Teachers…	**Teachers…**	**Teachers…**	**Teachers…**	**Teachers…**
Policy Awareness	research, evaluate and support school and national policy and vision for ICT integration across all subject areas.	identify and discuss local, national and global policies for technology integration in education and development.	contribute to the development of a shared school vision and planning for ICT integration that is based on national policy.	discuss and work collaboratively with others for vision and planning implementation that focuses on exploring new and more effective approaches for ICT integration across all subject areas in the school.	help embed school/ district/ national policy and vision for ICT integration by applying it in their daily work and engaging with students in innovative and exemplary practice.
Classroom Practice	contribute to discussion of education reform policies and participate in the design, implementation and revision of programmes to implement these policies.	create lesson plans with a basic reference to school and/ or national ICT policy and practice.	identify key characteristics of classroom practices and specify how these characteristics serve to implement policies. (TL.1.a.)	explain and analyze the principles of using ICT in Education. Describe how these principles can be put into practice in their own teaching. Analyse what issues arise in implementing these principles and how those issues can be addressed. (KD.1.a.)	design, implement, and modify school/ institutional level education reform programmes that implement key elements of national education reform policies. (KC.1.a)
Statements in the rubric sets that are enumerated refer to the *UNESCO ICT-CFT*					

CURRICULUM

	PERFORMANCE INDICATOR	EMERGING	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
	Teachers…	**Teachers…**	**Teachers…**	**Teachers…**	**Teachers…**
Curriculum Planning	use their knowledge of their subject area, of teaching and learning strategies and technology to advance student learning, creativity and knowledge building.	explain how existing curriculum objectives and assessment procedures can include the use of technology to support student learning and outcomes.	match specific Curriculum Standards to particular software packages and computer applications and describe how these Standards are supported by these applications. (TL.2.a.)	design units and classroom activities that integrate in a structured way a range of ICT tools and devices to support student learning.	design units and classroom activities that integrate a range of ICT tools and devices to help students acquire the skills of reasoning, planning, reflective learning, knowledge building and communication. (KC.2.c.)
Learning Environment	identify authentic problems and technology tools that can support learning environments for enabling student understanding of key subject- specific concepts.	research and discuss ways in which technology tools and resources can enable students to explore questions and issues in areas of interest and subject specific areas.	select and demonstrate the use of technology resources that enable students to explore issues and key concepts and processes in areas of interest and subject specific areas.	identify key concepts and processes in the subject area, describe the function and purpose of subject-specific tools and how they support students' understanding of these key concepts and processes and their application to the world outside the classroom. (KD.2.a.)	identify and discuss how students learn and demonstrate complex cognitive skills, such as information management, problem solving, collaboration, and critical thinking. (KC.2.a.)
Student Experience	design or adapt relevant learning experiences that use digital tools to respond to student learning needs and anticipate difficulties.	research and discuss ways that digital tools and resources can help students plan and manage their work and related research.	help students acquire ICT skills within the context of their subjects or courses. (TL.2.b.)	help students use ICT to acquire the skills of searching for and managing information in their subjects or courses.	help students use ICT to acquire the skills of searching for, managing, analyzing, evaluating and using information. (KC.2.b.)
Assessment	provide students with technology-based formative and summative assessments to assess their understanding of key subject matter content and ICT skills.	research technology-based formative and summative assessments and explain how they can be used to inform teaching and learning.	use ICT to assess students' acquisition of school subject matter knowledge using both formative and summative assessments. (TL.2.c.)	develop and apply knowledge- and performance-based rubrics that allow teachers to assess students' understanding of key subject matter concepts, skills and processes. (KD.2.b.)	help students develop both knowledge- and performance-based rubrics and apply them to assess their own understanding of key subject matter and ICT skills. Help students to use these rubrics to assess other students' work. (KC.2.e.)
Communication and Collaboration	select and use digital media to communicate and collaborate with students, peers and parents.	research and demonstrate the use of digital resources for basic levels of correspondence and communication with students, parents and peers.	use digital media to communication information and ideas to students, peers and peers.	select and use the most relevant, facilitative and effective media for enabling students to communicate to the world outside the classroom.	help students use ICT to develop communication and collaboration skills. (KC.2.d.)
Special Educational Needs	use ICT diagnostic tools, assistive technologies and ICT resources to address students with special educational needs.	demonstrate the use of ICT to enhance the learning opportunities of students with special educational needs.	use ICT to support development of literacy and numeracy for students with special educational needs.	use ICT diagnostic tools, assistive technologies and ICT resources to address curriculum objectives with students with special educational needs.	embed ICT in all aspects of special educational needs teaching and learning and use ICT in all aspects of special educational needs assessment.
Statements in the rubric sets that are enumerated refer to the *UNESCO ICT-CFT*					

PEDAGOGY

	PERFORMANCE INDICATOR	EMERGING	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
	Teachers…	Teachers…	Teachers…	Teachers…	Teachers…
Planning	design or adapt unit plans and classroom activities to engage students in exploring real world issues and solving authentic problems using technology tools and resources.	select and use hardware and software best suited to particular learning experiences and plan student learning experiences for appropriate use of these tools.	describe how didactic teaching with ICT can be used to support students' acquisition of school subject matter Knowledge (TL.3.a.), incorporate appropriate ICT activities into lesson plans so as to support students' acquisition of school subject matter knowledge. (TL.3.b.)	design unit plans and classroom activities so that students engage in reasoning with, talking about, and using key subject matter concepts while they collaborate to understand, represent, and solve complex real-world problems, as well as reflect on and communicate solutions. (KD.3.d.)	design online materials and activities that engage students in collaborative problem solving, research, or artistic creation. (KC.3.b.)
Problem- Based Learning	promote, support and model problem-solving and knowledge creation while teaching students with the support of technology tools and resources.	research and explain technology-based learning activities to engage students in authentic problem solving based on real-world issues.	identify or design complex, real-world problems and structure them in a way that incorporates key subject matter concepts and serves as the basis of student projects. (KD.3.b.)	design online materials that support students' deep understanding of key concepts and their application to real world problems. (KD.3.c.)	explicitly model their own reasoning, problem-solving, and knowledge creation while teaching students. (KC.3.a.)
Student Experience	engage students with the support of technology in project plans and activities for collaborative problem solving, research, creative thinking and innovation.	research and demonstrate hardware and software resources best suited to particular subject areas.	use presentation software and digital resources to support instruction. (TL.3.c.)	implement collaborative, project-based unit plans and classroom activities, while providing guidance to students in support of the successful completion of their projects and their deep understanding and key concepts. (KD.3.f.)	help students design project plans and activities that engage them in collaborative problem-solving, research or artistic creation. (KC.3.c.)
Project-Based Learning	promote project-based learning using technology tools and resources to support student social interaction, collaboration and reflection on their own learning.	explain how existing learning resources and students use of digital tools to research and collect information online could be used to support project-based learning.	use collaborative, project-based learning and ICT tools to support key subject matter concepts and processes.	describe how collaborative, project-based learning and ICT tools can support student thinking and social interaction, as students come to a deeper understand key concepts, processes, and skills in the subject matter and their application and use to solve real world problems. (KD.3.a.)	help students reflect on their own learning (in project-based collaboration). (KC.3.e)
Communication and Collaboration	structure lessons to incorporate multi-media production, web production and publishing technologies to support student knowledge production and communication with other audiences.	explore the use of digital tools and resources for sharing information and projects among student groups inside and outside of the school.	communicate and collaborate with students and other stakeholders to share information and to promote projects for enhancing creativity, innovation and improved learning.	structure classroom activities so that open-ended tools and subject-specific applications will support students in their reasoning with, talking about, and use of key subject matter concepts and processes while they collaborate to solve complex problems. (KD.3.e.)	help students incorporate multimedia production, web production, and publishing technologies into their projects in ways that support their ongoing knowledge production and communication with other audiences. (KC.3.d.)
Statements in the rubric sets that are enumerated refer to the *UNESCO ICT-CFT*					

ICT

	PERFORMANCE INDICATOR	EMERGING	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
	Teachers…	**Teachers…**	**Teachers…**	**Teachers…**	**Teachers…**
Productivity Tools	demonstrate ability to use ICT production tool functions to support students' innovation and knowledge creation.	describe how existing learning could be designed or adapted to include student's use of technology tools to research and collect information online and to create a digital product.	describe and demonstrate the basic tasks and uses of word processors, such as text entry, editing text, formatting text and printing (TL.4.b), describe and demonstrate the purpose and basic features of presentation software and other digital resources. (TL.4.c.)	operate various open-ended software packages appropriate to their subject matter area, such as visualization, data analysis, role-play, simulation and online reference. (KD.4.a.)	describe the function and purpose of ICT production tools and resources (multimedia recording and production equipment, editing tools, publication software, web design tools) and use them to support students' innovation and knowledge creation. (KC.4.a.)
Authoring Tools	set up authoring environments to promote student knowledge construction and development of innovative products.	research and discuss ways students can use digital tools and resources to enhance creative and innovative thinking.	describe the purpose and basic function of graphic software and use a graphic software package to create a simple graphic display. (TL.4.d)	use an authoring environment or tools to design offline and/or online materials. (KD.4.c.)	enable students to use ICT authoring tools to demonstrate creative thinking, construct knowledge and develop innovative products.
Internet	develop student capacity to critically evaluate the accuracy and usefulness of web resources to support learning goals and strategies.	explore and demonstrate the use of the Internet for search and retrieval of information.	describe the Internet and the World Wide Web, elaborate on their uses, and describe how a browser works and use of URL to access a website (TL.4.e.), use a search engine. (TL.4.f)	evaluate the accuracy and usefulness of Web resources in support of project-based learning with the subject area. (KD.4.b.)	empower students to critically evaluate the accuracy and usefulness of Web resources in support of their own learning goals and learning strategies.
Communication and Collaboration	use common communication and collaboration technologies to access information, people and resources for solving selected problems and for developing local and global collaborative projects.	research and demonstrate effective use of ICT resources for communicating and collaborating with students and peers.	create an email account and use it for a sustained series of email correspondence (TL.4.g.), use common communication and collaboration technologies, such as (email), text messaging, video conferencing, and web-based collaboration and social environments. (TL.4.K.)	use search engines, online databases, (social networks), and email to find people, resources for collaborative projects. (KD.4.g)	engage students to use the network to support student collaboration within and beyond the classroom. (KD.4.h)
Administration	use technology software to manage, monitor and assess development and progress of student learning and projects.	explore and demonstrate the use and benefits of student management systems for attendance and student records.	use networked record keeping software to take attendance, submit grades, and maintain student records. (TL.4.j.)	use a network and appropriate software to manage, monitor, and assess progress of various student projects. (KD.4.d.)	describe the function and purpose of virtual environments and knowledge building environments (KBEs) and use them to support increased knowledge and understanding of subject matter and the development of online and face- to-face communities. (KC.5.a.)

Education Software	evaluate and use educational software to support students' knowledge acquisition, thinking, reflection, planning and creative processes.	describe the function and purpose of tutorial and drill and practice software and how they support students' acquisition of knowledge of school subjects. (TL.4.h.)	locate off-the- shelf packages, tutorial, drill and practice software and Web resources for their accuracy and alignment with Curriculum Standards and match them to the needs of specific students. (TL.4.i.)	use ICT to communicate and collaborate with students, peers, parents, and the larger community in order to nurture student learning. (KD.4.e.)	describe the function and purpose of planning and thinking tools and use them to support students' creation and planning of their own learning activities and their continuous reflective thinking and learning. (KC.5.b.)
Statements in the rubric sets that are enumerated refer to the *UNESCO ICT-CFT*					

ORGANISATION & MANAGEMENT

	PERFORMANCE INDICATOR	EMERGING	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
	Teachers…	**Teachers…**	**Teachers…**	**Teachers…**	**Teachers…**
Teacher Under-standing & leadership	exhibit a leadership role in creating a vision for technology infusion into curriculum and classroom practice.	use technology tools and resources for research and lesson planning linked to classroom practice.	integrate the use of a computer laboratory into ongoing teaching activities. (TL.5.a.)	place and organize computers and other digital resources within the classroom so as to support and reinforce learning activities and social interactions. (KD.5.a.)	play a leading role in creating a vision of what their school might be like with ICT integrated into the curriculum and classroom practices. (KC.6.a.)
ICT Integration	seek and participate in shared decision making for use of ICT in school planning and the development of technology skills in others.	use supplementary technology-based learning resources to engage students in critical thinking, creativity and problem solving activities.	manage the use of supplemental ICT resources with individuals and small groups of students in regular classroom so as not to disrupt other instructional activities in the class. (TL.5.b.)	manage student project-based learning activities in a technology- enhanced environment. (KD.5.b.)	play a leading role in supporting innovation in their school and continuous learning among their colleagues. (KC.6.b.)
Classroom Management	address learner diverse needs by using learner centred strategies and managing individual, group and class access to ICT resources.	use whole class instruction as predominant teaching style for technology- based learning activities.	identify the appropriate and inappropriate social arrangements (whole class, small groups, and individual activities) to use with various technologies. (TL.5.c.)	create flexible classroom learning environments that integrate student centred activities and flexibly apply technology to support collaboration.	enable students to independently use technology resources to manage their own learning goals, plan learning strategies, and evaluate their progress and outcomes.
Acceptable & Appropriate Use	advocate, model and teach procedures and policies for safe, ethical and responsible use of technology and the Internet.	research and discuss effective practices for the safe, ethical, legal and healthy use of technology and the responsible care and handling of hardware, software and information resources.	model acceptable use policies for technology resources including strategies for addressing threats to security of technology systems, data and information.	advocate, develop and teach procedures and policies for safe, ethical, responsible and appropriate use of technology and the Internet, including copyright, privacy issues, cyberbullying and security of systems, data and information.	facilitate and engage students in developing a system for promoting and monitoring safe, legal and ethical use of digital information and technology.
Statements in the rubric sets that are enumerated refer to the *UNESCO ICT-CFT*					

PROFESSIONAL DEVELOPMENT

	PERFORMANCE INDICATOR	EMERGING	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
	Teachers…	**Teachers…**	**Teachers…**	**Teachers…**	**Teachers…**
Planning	evaluate current research and practice to make effective use of ICT in support of their own professional development and student learning.	investigate and reflect on research and professional practice for using digital tools and resources to support student learning needs.	use ICT to enhance their productivity. (TL.6.a.)	use ICT to access and share resources to support their activities and their own professional development. (KD.6.a)	continually evaluate and reflect on professional practice to engage in ongoing innovation and improvement. (KC.6.c.)
Teacher Awareness and Participation	participate in local and global learning communities to explore creative applications of technology and share and discuss good practices.	share ideas and resources with other teachers in the school on using ICT and related teaching and learning strategies to enhance student learning and the teaching profession.	actively participate in online professional communities for teachers to discuss and share effective uses of technology resources in teaching and learning.	use ICT to access outside experts and communities to support their activities and their own professional development. (KD.6.b.)	use ICT resources to participate in professional communities and share and discuss best teaching practices. (KC.6.d.)
Informal Learning	support, experiment with and continuously learn and use ICT to build professional learning communities working toward creating new knowledge.	identify ICT resources and strategies for contributing to the effective and dynamic teaching and learning and the reform and self-renewal of the teaching profession and educational community to support various subject areas.	use ICT resources to support their own acquisition of subject matter and pedagogical knowledge. (TL.6.b.), identify and manage Internet safety issues. (TL.6.c.)	use ICT to search for, manage, analyze, integrate, and evaluate information that can be used to support their professional development. (KD.6.c.)	contribute to the effective use of technology to enhance teaching and learning by conducting action research, evaluating outcomes and sharing the results locally, nationally and globally.
Statements in the rubric sets that are enumerated refer to the *UNESCO ICT-CFT*					

Appendix 3: ICT-CFT Performance Indicators

Overview of the ICT-CFT Performance Indicators

The competences are organised under six domains: Policy, Curriculum, Pedagogy, ICT, Organisation and Management, and Teacher Development.

3.1 Policy

Teachers exhibit knowledge and understanding of the intentions of local, national and global policies regarding the goals, objectives, Standards and strategies for ICT use in education and classroom practice. **Teachers…**

a) research, evaluate and support school and national policy and vision for ICT integration across all subject areas.

b) contribute to discussion of education reform policies and participate in the design, implementation and revision of programmes to implement these policies.

3.2 Curriculum and assessment

Teachers use their knowledge of curriculum content, assessment and technology to facilitate experiences for enabling student understanding of subject-specific concepts, research, collaboration and communication. **Teachers…**

a) use their knowledge of their subject area, of teaching and learning strategies and technology to advance student learning, creativity and knowledge building.

b) identify authentic problems and technology tools that can support learning environments for enabling student's understanding of key subject-specific concepts .

c) design or adapt relevant learning experiences that use digital tools to respond to student learning needs and anticipate difficulties.

d) provide students with technology-based formative and summative assessments to assess their understanding of key subject matter content and ICT skills.

e) select and use ICT effectively to communicate and collaborate with students, peers and parents.

f) use ICT diagnostic tools, assistive technologies and ICT resources to address curriculum objectives and students with special educational needs.

3.3 Pedagogy

Teachers use their knowledge of methods and processes of teaching and learning and the use of technologies to engage students in authentic problem solving, inquiry and project-based learning experiences that support social interaction, collaborative knowledge production, innovation and communication. **Teachers…**

a) design or adapt unit plans and classroom activities to engage students in exploring real world issues and solving authentic problems using technology tools and resources.

b) promote, support and model problem-solving and knowledge creation while

teaching students with the support of technology tools and resources.

c) engage students with the support of technology tools and resources in project plans and activities for collaborative problem solving, research, creative thinking and innovation.

d) promote project-based learning using technology tools and resources to support student social interaction, collaboration and reflection on their own learning.

e) structure lessons to incorporate multi-media production, web production and publishing technologies to support student knowledge production and communication with other audiences.

3.4 ICT

Teachers use their knowledge about various technologies, from low-tech technologies such as pencil and paper to high-tech technologies such as the Internet, digital video, radio and software programmes to support teaching and learning strategies, student knowledge construction and continuous reflective learning. **Teachers…**

a) demonstrate fluency in ICT production tool functions and use to support students' innovation and knowledge creation.

b) set up authoring environments to promote student knowledge construction and development of innovative products.

c) develop student capacity to critically evaluate the accuracy and usefulness of web resources to support learning goals and strategies.

d) use common communication and collaboration technologies to access information, people and resources for solving selected problems and for developing local and global collaborative projects.

e) use technology software to manage, monitor and assess development and progress of student learning and projects.

f) evaluate and use educational software to support students' knowledge acquisition, thinking, reflection, planning and creative processes.

3. 5 Organisation & management

Teachers exhibit leadership in the school and professional communities by promoting effective use of technology for student centred learning in individual group and whole class teaching and learning. **Teachers…**

a) exhibit a leadership role in creating a vision for technology infusion into curriculum and classroom practice.

b) participate in shared decision making for use of ICT in school planning and the development of technology skills in others.

c) address learner diverse needs by using learner centred strategies and managing individual, group and class access to ICT resources.

d) advocate, model and teach procedures and policies for safe, ethical and responsible

use of technology and the Internet.

3.6 Teacher development

Teachers continuously evaluate use of technology to improve their own professional learning, participate in local and global learning communities and become lifelong learners contributing to the effectiveness and regeneration of the teaching profession. **Teachers…**

a) evaluate current research and practice to make effective use of ICT in support of their own professional learning.

b) participate in local and global learning communities to explore creative applications of technology and share and discuss good practices.

c) support, experiment with and continuously learn and use ICT to build professional learning communities working toward creating new knowledge.

Appendix 4: Review ICT Standards from around the World

Group Exercise 1a: Examining ICT Standards/Competency Documents

In small groups, look at the Standards/ competencies given to your group – Africa (SA & Regional), Europe (eTQF & DCU), US & Australia (ISTE & Australia) and consider these questions for reviewing the Standards:

- Who are these Standards written for?

- What are the strengths of the Standards?

- What are the weaknesses?

Group Exercise 1b: An ICT Competency Framework for Teachers in Kenya

In small groups, examine the general *ICT Competency Standards for Teachers Framework* and consider these questions for contextualizing the Standards for teachers in Kenya:

Key Issues/Discussion Points

1. Which ICT standards do we want to develop in Kenya — generic standards or technical/subject specific standards? Why?

2. Could a continuum of Standards - Technology Literacy, Knowledge Deepening, Knowledge Creation - provide an appropriate professional development pathway for teachers in Kenya? Explain why it would or would not be appropriate.

3. Do we want a continuum of ICT Standards to cover different teacher levels from beginning teachers, to practicing teachers, to advanced teachers to other actors/roles? How would this work?

4. Do we want standards that are applicable for national level, regional level and/or international level accreditation? Explain which level would be appropriate and why.

5. Who would be the custodian and implementers of the developed Standards at national level?

Reporting: One group gives a brief account discussion. Each of the other groups in turn may point to points of agreement and divergence. It may be useful to discuss reasons for divergence.

Appendix 5: Contextualisation of 'Standards for Standards'

'Standards for Standards' – Towards a Contextualized ICT Competency Framework for Teachers

Group Exercise 2:

Under each domain, there are Competency Performance Statements which describe what a teacher should know and be able to do in a progression path of ICT use in teaching and learning.

Step 1: Please review the domains assigned to your group using criteria of **relevance, clarity** and **coverage** to assess each group of Competency Performance Statements and progression paths.

Step 2: Please provide comments/suggestions for modification of the Statements and progression paths for the Kenya country context.

Domain Reviewed	Policy

Step 1: Relevance, clarity and coverage

Relevance	Comments
Examine the domain by competency performance indicators and Statements for the different levels of progression: • Do the competencies have relevance for the KENYA country contexts? • Are the Statements adequate to what teachers need to know/ need to be able to do with technology in school and classroom practice? *Your group could think of what an ideal teacher using ICT would look like and brainstorm that teacher's ICT competencies for the domain under review. Check these qualities against the competencies in the domain.*	

Clarity	Comments
• Are the Statement progressions between the different levels of emerging, Technology Literacy, Knowledge Deepening, and Knowledge Creation clear?	
• Will the Competency Statements be clear and understandable to student teachers, new teachers, practising teachers, administrators and teacher educators who will use them? *In your group you could read the Competency Statements for the domain under review in pairs – as if you are a student teacher or a practising teacher or an administrator. You can then highlight any words or terms that are unclear and that may need modification for your educational context.*	
• Will it be possible for teacher educators to use the competencies to evaluate teacher practice? • Will it be possible for teachers to use the competencies for self-assessment of their practice?	

Coverage	Comments
• Is there something missing? Are there competencies/ domains that should be added for the KENYA educational context?	

• Are there competencies/domains that are not useful for the KENYA country contexts and should be excluded?	

Step 2: Suggestions for modification

If you have any **suggestions for modifications** and/or **rewording** (changes, additions, or deletions) to make the Competency Statements and progressions clearer, more relevant or more comprehensive for the KENYA country context, use the highlighted space below each competency sub-domain set to enter the group suggestions:

Competency Sub-Domains	PERFORMANCE INDICATOR	EMERGING	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
	Teachers…	Teachers…	Teachers…	Teachers…	Teachers…
Policy Awareness	research, evaluate and support school and national policy and vision for ICT integration across all subject areas.	identify and discuss local, national and global policies for technology integration in education and development.	contribute to the development of a shared school vision and planning for ICT integration that is based on national policy.	discuss and work collaboratively with others for vision and planning implementation that focuses on exploring new and more effective approaches for ICT integration across all subject areas in the school.	help embed school/ district/ national policy and vision for ICT integration by applying it in their daily work and engaging with students in innovative and exemplary practice.
Suggestions for modifications					

Other Remarks:

. . . . . .

. . . . . .

Appendix 6: ICT-CFT Development –Priority Scan

The ICT Competency Framework for Teachers – Development/ Priority Scan

- Rate each Competency Statement in terms of how you see the *ICT professional development level* of teachers in your country by circling the corresponding number
- Circle and number the *top three ICT teacher competency priorities* that you would want to focus on in an initial phase of professional development in your country

  (1 = 1st priority; 2 = 2nd priority; 3 = 3rd priority)
- Use the stickers provided to post your top three ICT teacher competency priorities on the wall charts

  (Red sticker = 1st priority; Green sticker = 2nd priority; Yellow sticker = 3rd priority)

Competency Statements	Development Level			
	Emergent Level	Technology Literacy Level	Knowledge Deepening Level	Knowledge Creation
Policy	**Beginning**	**Applying**	**Proficient**	**Transformative**
Policy awareness Teachers research, evaluate and support school and national policy and vision for ICT integration across all subject areas.	1	2	3	4
Classroom practice Teachers design, adapt and develop classroom practices and school programmes to implement national ICT and education reform policies.	1	2	3	4
Curriculum and Assessment	**Beginning**	**Applying**	**Proficient**	**Transformative**
Curriculum Planning Teachers design or adapt units or classroom activities that incorporate a range of ICT tools and devices to promote student learning.	1	2	3	4
Learning Environment Teachers identify technology tools that can support learning environments for enabling student's understanding of key subject-specific concepts.	1	2	3	4
Student experience Teachers design or adapt relevant learning experiences that incorporate digital tools to promote student research and understanding.	1	2	3	4
Assessment Teachers provide students with technology-based formative and summative assessments to assess content and technology skills and knowledge and use results to inform learning and product development.	1	2	3	4

Competency Statements	Development Level			
	Emergent Level	Technology Literacy Level	Knowledge Deepening Level	Knowledge Creation
Communication & collaboration Teachers select and use digital media to communicate and collaborate with students, peers and parents.	1	2	3	4
Special Needs Education Teachers use ICT diagnostic tools, assistive technologies and ICT resources to address curriculum objectives and students with special educational needs.	1	2	3	4
Pedagogy	**Beginning**	**Applying**	**Proficient**	**Transformative**
Planning Teachers design or adapt unit plans and classroom activities to engage students in exploring real world issues and solving authentic problems using technology tools and resources.	1	2	3	4
Problem-based learning Teachers promote, support and model problem-solving and knowledge creation while teaching students with the support of technology tools and resources.	1	2	3	4
Student experience Teachers engage students in project plans and activities for collaborative problem solving, research, creative thinking and innovation.	1	2	3	4
Project-based learning Teachers promote project-based learning using technology tools and resources to support student social interaction, collaboration and reflection on their own learning.	1	2	3	4
Communication & collaboration Teachers structure lessons to incorporate multi-media production, web production and publishing technologies to support student knowledge production and communication with other audiences.	1	2	3	4
ICT	**Beginning**	**Applying**	**Proficient**	**Transformative**
Productivity tools Teachers demonstrate fluency in ICT production tool functions and use to support students' innovation and knowledge creation.	1	2	3	4
Authoring tools Teachers set up authoring environments to promote student knowledge construction and development of innovative products.	1	2	3	4

Competency Statements	Development Level			
	Emergent Level	Technology Literacy Level	Knowledge Deepening Level	Knowledge Creation
Internet Teachers develop student capacity to critically evaluate the accuracy and usefulness of web resources to support learning goals and strategies.	1	2	3	4
Communication & collaboration Teachers use common communication and collaboration technologies to locate information, people and resources for developing local and global collaborative projects.	*1*	2	3	4
Administration Teachers use technology software to manage, monitor and assess development and progress of student learning and projects.	1	2	3	4
Educational software Teachers evaluate and use educational software to support students' knowledge acquisition, thinking, reflection, planning and creative processes.	1	2	3	4
Organisation & Management	**Beginning**	**Applying**	**Proficient**	**Transformative**
Teacher understanding Teachers exhibit a leadership role in creating a vision for technology infusion into curriculum and classroom practice.	1	2	3	4
Leading ICT integration Teachers participate in shared decision making for use of ICT in school planning and the development of technology skills in others.	1	2	3	4
Classroom management Teachers address learner diverse needs by using learner centred strategies and managing individual, group and class access to ICT resources.	1	2	3	4
Acceptable & appropriate uses Teachers advocate, model and teach procedures and policies for safe, ethical and responsible use of technology and the Internet.	1	2	3	4
Teacher Development	**Beginning**	**Applying**	**Proficient**	**Transformative**
Planning Teachers evaluate current research and practice to make effective use of ICT in support of their own professional development and student learning.	1	2	3	4

Competency Statements	Development Level			
	Emergent Level	Technology Literacy Level	Knowledge Deepening Level	Knowledge Creation
Teacher awareness Teachers participate in local and global learning communities to explore creative applications of technology and share and discuss good practices.	1	2	3	4
Informal learning Teachers contribute to the effective use of technology to enhance the teaching profession and the school community.	1	2	3	4

Appendix 7: Curriculum Review

Curriculum Review

Curriculum review will be used to situate learning with and learning through ICTs in the larger curriculum landscape of teacher development in STEM subjects for secondary schools in Kenya and Tanzania. The purpose is to identify connections across subjects and the overall learning outcome for a richer learning experience.

Workshop Group Task

The table below lists the domains to be examined and mapped to arrive at a better informed picture of the purpose, place and role of ICTs to support content and pedagogy in the Teacher Development Curriculum in general and across the STEM (Science, Technology, English and Mathematics) subjects in particular. The table draws from the *TPACK* and the prioritized ICT Competency Frameworks to assist you in examining the technology tools and teacher competencies needs & gaps.

Teacher Professional Development Curriculum Guide

Curriculum Guide	Reference to ICT Domains: Policy, Curriculum,Pedagogy, ICT, Organisation & Administration, Professional Development	ICT Gaps How can ICT be improved/ strengthened?
Overall TPD curriculum goals & objectives		
Overall TPD curriculum priorities		
Overall TPD learning outcomes		
General TPD Pedagogy/ Methodology strategies		
Curriculum Guide	**Reference to ICT** (Policy, curriculum, pedagogy, ICT, org & management, TPD domains)	**ICT Gaps** How can ICT be improved/ strengthened?
Assessment practices, procedures & tasks		
Teacher preparation requirements		

STEM Subject Syllabuses

Subject syllabus	Reference to ICT (Policy, curriculum, pedagogy, ICT, org & management, TPD domains)	ICT Gaps How can ICT be improved/ strengthened?
TPD subject syllabus objectives		
TPD subject syllabus priorities		
TPD subject syllabus learning outcomes		
TPD Pedagogy/ Methodology strategies		
Assessment practices, procedures & tasks		
Teacher preparation requirements		

Appendix 8: Overview of the SIPSE Modules

Five modules covering Technology Literacy (3 modules) and Knowledge Deepening (2 modules) ICT Teacher Competency levels

Technology Literacy Modules 1, 2 and 3

Module 1.1 ICT Use in Didactic Teaching

ICT Teacher Competencies

- Teachers describe how **didactic teaching** with ICT can be used to support students' acquisition of STEM subject matter knowledge **(TL.3.a.),**
- Teachers **i**ncorporate appropriate ICT activities into lesson plans so as to support students' acquisition of STEM subject matter knowledge**. (TL.3.b.)**

In this unit you will learn about	To meet the learning intentions and objectives you will	The ICT components you will focus on are
• How didactic teaching with ICT can be used to support students' acquisition of STEM subject matter knowledge • Improving your skills in basic software of word processor or presentation or spreadsheet • Exploring ICT tools for 'practice and drill' in your planning activities for your subject teaching • Activity templates for introducing technology in your practice and how these can be used alongside your lesson teaching in STEM	• Explore the use of ICT practice and drill activities to support content and pedagogy strategies in a STEM didactic lesson (introduction/ main activities/ assessment) • Complete an activity template for a practice and drill that has a clear link to a STEM topic objective that you are teaching • Do this activity in the classroom • Share the activity with your subject teachers in your school and with your subject teacher group in the SIPSE group workspace	• ICT basic – familiarization with basic uses of word or presentation or excel software; Internet use • ICT exploration – Practice and drill exercises with word or presentation or excel or specialized software

Module 2.1 ICT and STEM Curriculum Standards

ICT Teacher Competencies

- Teachers should be able to match specific Curriculum Standards to particular software packages and computer applications and describe how these Standards are supported by these applications. (**TL.2.a**)
- Teachers help students acquire ICT skills within the context of their subjects or courses. **(TL.2.b.)**

In this unit you will learn about	To meet the learning intentions and objectives you will	The ICT components you will focus on are
• Finding, evaluating, organizing and adapting the right ICT resources (e-content) to meet your teaching and learning requirements in your subject teaching • Using ICT resources in the didactic lessons to promote interactive learning and engage students in using the resources • Using different questioning techniques to promote interactive learning with ICT in your didactic lessons • Identifying ICT resources appropriate to the different characteristics and needs of your learners • Exploring the use of presentation software to promote interactive activates and student learning	• Practice using presentation, evaluating and using e-resources and using effective questioning techniques • Plan activities using presentation, e-resources and questioning techniques to increase student participation and interaction in your subject teaching. You can plan your activities for any part of the didactic lesson – teacher exposition, students' activities or student and teacher review. • Complete an activity template for your presentation & questioning activity that has a clear STEM subject learning objective • Do this activity in the classroom • Reflection on your activity using your journal (and revise if necessary)	• ICT exploration – presentation software - basic & advanced • Internet – search, retrieve and evaluate e-resources

Module 3.1 ICT in the Classroom and Computer Lab

ICT Teacher Competencies

Teachers integrate the use of a computer laboratory into on-going teaching activities. **(TL.5. a)**

In this unit you will learn about	To meet the learning intentions and objectives you will	The ICT components you will focus on are
• How problem-based learning & teaching with ICT can be used to support students' acquisition of STEM subject matter knowledge • Posing real and productive questions to get the most form problem-based learning • Managing and creating a positive classroom environment for ICT use • Using Concept Mapping software to promote problem-based learning	• Plan a problem-based learning activity with questioning techniques and concept mapping to engage students in observations, discussions and questions in order to solve a problem • Complete an activity template for a problem-based learning and simulation activity that has a clear STEM subject learning objective • Do this activity in the classroom • Reflect on this activity (and revise if necessary) to ensure maximum interaction by the students on problem solving and discussions • Share the activity with STEM teachers in your school and with the subject teachers in your SIPSE community online	• ICT basic –Developing simulations on presentation and spread sheet simulation software • ICT exploration – Exploring the use of simulation software in STEM teaching and learning

Module 3.2 National Policies and their Impact on Education

ICT Teacher Competencies

Teachers are able to identify key characteristics of classroom practices and specify how these characteristics serve to implement national policies (**TL.1.a**.)

In this unit you will learn about	To meet the learning intentions and objectives you will	The ICT components you will focus on are

• How to link national and school vision and objectives for ICT in Education and classroom practices
• How to support national, school and SIPSE objectives in school planning and classroom practices
• How to use the SIPSE school criteria framework to do an ICT SWOT analysis of your school
• Activities with ICT tools for navigating and downloading national documents & resources for ICT policy
	• Conduct an ICT Review & SWOT analysis of school to share with staff and management
	• Brainstorm ideas on school and classroom practices to support national, school and SIPSE objectives
	• Share your ideas with your subject teachers in your school and your subject group online
	• Develop your portfolio with examples of:
	  • your activity & reflection on using presentation software or other ICT tools in your classroom activities
	  • your presentation of school ICT Review SWOT analysis
		• ICT basic – familiarization with basic uses of word or presentation or excel software
		• ICT advanced – use of presentation software – charts and videos/ audio etc –
		• Think about how to use presentation software to present your school ICT SWOT analysis

Knowledge Deepening Modules 4 and 5

Module 4.1 Problem-Based Learning and ICT in the Classroom

ICT Teacher Competencies

- Teachers **identify or design complex, real-world problems** and structure them in a way that incorporates key subject matter concepts and serves as the basis of student projects. **(KD.3.b.)**
- Teachers place and organize computers and other digital resources within the classroom so as to support and reinforce learning activities and social interactions. **(KD.5.a)**

In this unit you will learn about
- How problem-based learning & teaching with ICT can be used to support students' acquisition of STEM subject matter knowledge
- Exploring brainstorming and group work organisation strategies to get the most from problem-based learning
- Managing and creating a positive classroom environment for ICT use
- Using Concept Mapping software to promote problem-based learning

To meet the learning intentions and objectives you will
- Plan a problem-based learning activity with brainstorming, group organisation and concept mapping strategies to engage students in observations, discussions and questions in order to solve a problem
- Complete an activity template for a problem-based learning and simulation activity that has a clear STEM subject learning objective
- Do this activity in the classroom
- Reflect on this activity (and revise if necessary) to ensure maximum interaction by the students on problem solving and discussions
- Share the activity with STEM teachers in your school and with the subject teachers in your SIPSE community online

The ICT components you will focus on are
- ICT exploration – Exploring productivity tools to create concept maps and mind maps
- ICT resource development – Developing concept maps and / or mind maps for us in classroom practice

Module 5.1 Project-Based Learning

ICT Teacher Competencies

- ***Teachers describe how collaborative, project-based learning and ICT tools can support student thinking and social interaction, as students come to a deeper understand key concepts, processes, and skills in the subject matter and their application and use to solve real world problems. (KD.3.a.)***

In this unit you will learn about
- How project-based learning & teaching with ICT can be used to support students' acquisition of STEM subject matter knowledge
- Guidelines for setting up project and cooperative learning opportunities in the classroom
- Introduction to web quests planning preparation, organizing of groups and resources and assessment
- Using Webquest software to stimulate and scaffold project development and exploration

To meet the learning intentions and objectives you will
- Plan a project with cooperative learning opportunities and Webquest software to engage students in observations, discussions and questions in order to engage in a structured inquiry
- Complete an planning template for a project process activity that has a clear STEM subject learning objective – where the project process involves teaching and learning for
  - posing productive questions
  - finding resources/ organizing groups
  - interpreting information
  - reporting findings
- Do this activity in the classroom
- Reflect on this activity (and revise if necessary) to ensure maximum interaction by the students on project process
- Share the activity with STEM teachers in your school and with the subject teachers in your SIPSE community online

The ICT components you will focus on are
- ICT exploration – exploration tools to create Webquest resource for project-based learning
- ICT resource development –developing Webquest resources for project development in your subject teaching

Module 5.2 STEM Subject Specific ICT Tools & Software

ICT Teacher Competencies

- Teachers identify key concepts and processes in the subject area, describe the function and purpose of subject-specific tools and how they support students' understanding of these key concepts and processes, and their application to the world outside the classroom **(KD.2.a).**
- Teachers operate various open-ended software packages appropriate to their subject matter area, such as visualization, data analysis, role-play simulations and online references **(KD.4.a)**.

In this unit you will learn about	To meet the learning intentions and objectives you will	The ICT components you will focus on are
• Finding and evaluation open education software using the GeSCI criteria for software evaluation • Developing student writing skills to promote sharing and communication of ideas • Exploring and reviewing Mathematics, Science, and Language software education software packages suitable for promoting problem-based and interactive learning in your subject teaching	• Plan a learning activity that includes the use of shared writing software and resources that you have evaluated and selected and student writing for knowledge sharing and building • Complete an activity template for the learning activity that has a clear STEM subject learning objective • Do this activity in the classroom • Reflect on this activity (and revise if necessary) to ensure maximum interaction by the students on problem solving and discussions • Share the activity with STEM teachers in your school and with the subject teachers in your SIPSE community online	• ICT exploration– experiencing & reviewing educational software • ICT resource development – Using 'shared writing' to produce an educational resource

Module 5.3 STEM Lesson Activities to Support Policy

ICT Teacher Competencies

Teachers explain and analyze the principles of using ICT in Education. Describe how these principles can be put into practice in their own teaching. Analyse what issues arise in implementing these principles and how those issues can be addressed. **(KD.1.a.)**

In this unit you will learn about	To meet the learning intentions and objectives you will	The ICT components you will focus on are

• How to link your classroom activities to national Information and Communication Technology for Development (ICT4D) objectives
• How to use the priority area from the SIPSE school criteria framework to develop an ICT School Plan overview and Action Plan
• Activities with shared writing for team production of the school ICT plan
	• Brainstorm ideas on classroom activities to support national ICT4D objectives
	• Share your ideas about 'connecting classroom to ICT4D' in the discussion forum
	• Work in teams to develop your school plan overview and action plan
	• Develop your portfolio with examples of:
	  • shared document of team contributions on school action plan
	  • shared presentation file of action plan presented to school staff, with inputs form school community
		• ICT exploration and practice – continue exploration and practice with shared writing tools
		• Use these tools to jointly develop school plan overview and action plan

Appendix 9: Module Structure

Course Module Structure – 4 activities leading to *TPACK* & *ICT-CFT*-in-Practice

Building capacity for innovative use of ICT in STEM - 4 activities in each module		
Introductory Activity	**Content Knowledge** Case Study Activities	**Exemplary Curriculum Materials** ..... **Participants see & review ICT enhanced STEM Lesson Plans**
Teaching & Learning Strategies Activity	**Pedagogy Knowledge** Building teaching and learning strategies	**Pedagogical Discussion & Exploration** ..... **Participants discuss & explore traditional & new pedagogical strategies to support STEM**
ICT Practice Activity	**Technology Knowledge** Building ICT basic and advanced skills	**ICT Tool Demonstration & Practice** ..... **With examples of instructional use**
Classroom Practice Activity	***TPACK*-in-Practice** Applying and infusing technology to support pedagogy and content in classroom practice	**Classroom Application** ..... **Teachers create activities & lessons that demonstrate ICT use in STEM teaching and learning**

Appendix 10: Assessment and Evaluation

1. SIPSE Classroom Observation Protocol

Pre-Lesson Review: Background information

1. Name of Observer: .....

2. Observation Date: (DD/MM/YYYY) ...../...../.....

3. Time of the Lesson Observation: .....

4. Name of School: .....

5. Country:..... ; District/ County:.....

6. Name of Teacher: .....

7. Which class or form are you visiting? .....

8. How many students are in the class? .....

9. How many boys and girls are in the class? .....

   Number of Boys .....

   Number of Girls.....

10. What is the subject being taught? (tick)

    ..... Chemistry

    ..... Physics

    ..... Biology

    ..... Technology

    ..... English

    ..... Mathematics

11. What are the teacher's objectives in the lesson? : (*If possible, speak with the teacher before the observation begins and complete this section with the following information: What is the teacher planning to do? How does the lesson/activity fit in with the unit that the class has been doing before? Are there are particular outcomes the teacher is hoping for?)*

12. What are the teacher's classroom arrangements for the lesson? *(Draw or describe the physical arrangement of the classroom. Also what happens as the lesson progresses – what methodology does the teacher adopt throughout the lesson – peer-to-peer learning, group work – same task and different task group work)*

13. What technology resources are present in the classroom? (*Describe the technology resources present in the classroom and include the number of each. Fixed technology resources, like desktop computers and projectors, should be included in the diagram of the classroom above.)*

Part 1: Lesson Observation Rubric

Use the rubric below to observe the lesson.

Tick as appropriate the level of the teacher's Technology, Pedagogical and Content Knowledge (*TPACK*) observed in the lesson – where 3= Observed; 2 = Partly Observed; and 1 = Not Observed.

Provide examples of observed teacher practice where appropriate.

1= Not Observed; 2=Partly Observed; 3 = Observed;

Teacher Knowledge & Practices	1	2	3	Examples of observed or partly observed practices
14. **Content Knowledge (CK)** of STEM subjects				
• Teacher presents some kind of a 'hook' or story to engage the students attention or interest in the main topic concepts. (CK)				
• He/ she clearly introduces the topic and learning objectives and shows how they fit into the lesson plan (didactic or problem-based or project-based lesson). (CK)				
• He/ she provides appropriate information, skills, procedures in relation to the lesson concepts being taught. (CK)				
15. Add a comment on the teacher's CK application in the lesson (based on observed practices)				

Teacher Knowledge & Practices	1	2	3	Examples of observed or partly observed practices
16. **Pedagogical Knowledge (PK)**				
• The teacher engages the students in different levels of questioning to promote higher order thinking (remembering, understanding, analyzing, applying, evaluating & creating type questions). (PK)				
• He/ she addresses the diverse needs of all students by using different group work strategies (same task group work/ different task group work). (Group strategies) (PK)				
• He/ she uses Problem-based or project-based learning approaches to engage students in exploring real-world issues and solving authentic problems. (PK)				
17. Add a comment on the teacher's PK application in the lesson (based on observed practices)				
18. **Technology Knowledge (TK)**				
• Teacher demonstrates developed knowledge in basic ICT skills (in the use of spreadsheet or presentation or word or the Internet). (TK)				
• The teacher demonstrates ability in the transfer of ICT skills and knowledge to new situations in classroom practice. (TK)				
• He/ She demonstrate knowledge on effective combinations of technology to support learning such as laptop, projector with spreadsheet or presentation or simulation use. (TK)				
19. Add a comment on the teacher's TK application in the lesson (based on observed practices)				
20. Pedagogical Content Knowledge (PCK)				
• The teacher has ability to integrate teaching approaches or techniques (questioning, discussion or group work) that arouse students' thinking and creativity in the STEM subjects. (PCK)				

Teacher Knowledge & Practices	1	2	3	Examples of observed or partly observed practices
21. **Technological Pedagogical Knowledge (TPK)**				
• The teacher engages students in technology enhanced learning activities (that use spreadsheets or word processing or simulation or concept mapping or practice & drill etc.). (TPK)				
22. **Technological Content Knowledge (TCK)**				
• The teacher has planned relevant activities that integrate technology tools (spreadsheets or word processing or simulation or concept mapping or practice & drill etc) to promote student STEM concept learning. (TCK)				
23. Add a comment on the teacher's PCK, TPK, and TCK application in the lesson (based on observed practices)				
24. **Technology, Pedagogy, and Content Knowledge (TPACK)**				
• The teachers clearly integrates the component of technology (ICT tools), pedagogy (didactic or problem-based/ project-based approaches/ questioning or group work strategies) to promote creative thinking and innovation of lesson topic concepts. (*TPACK*)				
• He / she chooses technology tools (drill & practice, simulation, or Webquest etc.) that 'fit' together strongly to support pedagogy and content (*TPACK*)				
25. Add a comment on the teacher's *TPACK* application in the lesson (based on observed practices)				

Part 2: Teaching and Learning Activity Observation

26. Which are the teacher pedagogical approaches that were used in the delivery of the lesson? Tick all that apply.

- Leading (includes lecturing, directing class activities) .....
- Facilitating/ assisting students .....
- Class control (includes discipline & management) .....
- Other approaches .....

27. Specify the other approaches that were employed

28. How did the teacher use the technology in the lesson? Tick all that apply.

- Technology was not evident .....
- To present information .....
- For visualisation or modelling of a concept .....
- To demonstrate a student task .....
- For grading, attendance or material preparation .....
- Other .....

29. Specify how else technology was used in the lesson today

Post Lesson – review of teaching and learning

Main questions	Probe Questions (optional - can be used to probe deeper reflection from the teacher)
30. How do you think the lesson went?	What do you think your pupils learned about the topic? How can you tell?
	Do you think the students "conceptual understanding" of the topic of the lesson was improved with the integration of technology (spreadsheets or presentation or simulation etc.)? Explain
31. What went well? What went less well?	What were the positive aspects of the teaching experience?
	What did you (as the teacher) get out of it? Did you find it difficult?
32. How would you have done the lesson differently?	After teaching this lesson, what preparation do you think you need to do for another lesson that integrates technology as tools for learning? What would you do differently next time?
	What general comment can you make about using technology in the STEM classes?

33. **How would you rate this lesson:** Lesson Criteria Rubric

Name of the teacher	Poor (0-5)	Below average (6 – 10)	Satisfactory (11 – 15)	Good (16 – 20)	Excellent (21 – 25)	Tutor Mark	Tutor Comments
	The lesson was not well thought out. There was no planning to integrate the concepts of ICT use to support Didactic or PrBL or PjBL pedagogy and content learnt in the SIPSE project.	There were some efforts in parts of the lesson to integrate the concepts of ICT use to support Didactic, or PrBL or PjBL pedagogy and content taught in the SIPSE project.	The lesson was well thought out and there were good efforts to include *TPACK*, didactic, PrBL or PjBL elements in the lesson.	The Lesson was well planned out with good use of ICT to support pedagogical strategies (questioning/ discussion / group work techniques and didactic or PrBL or PjBL approaches) and STEM concepts.	The lesson stood out exceptionally well will a good combination of all the elements and beyond of application of technology (presentation/ word processing/ spreadsheets/ concept mapping etc.) pedagogy (discussion/ questioning/ group work) and content (STEM subjects) knowledge application.		

34 Based on your ratings, what is the final mark that you will give for the teachers lesson performance? .....

35 Master Trainers Concluding Remarks (Confidential)

SIPSE General Review - Lesson Plan or Lesson Activity Plan

Tutor's general comments
Content: Does the lesson plan identify the lesson topic with clear curriculum learning objectives? **Tutor's comments:**
Technology: Does the lesson plan integrate 'drill and practice' or 'simulation' or 'student worksheet' or 'content presentation' exercises in word or presentation or spreadsheets or software like 'hot potatoes' to support the curriculum learning objectives? **Tutor's comments:**
Pedagogy: Does the lesson plan integrate strategies for 'questioning' or 'promoting discussion' or 'group work' to support the curriculum learning objectives? **Tutor's comments:**
Technology pedagogy and content knowledge: Does the content, pedagogy and technology 'fit' together to support the curriculum learning objectives? **Tutor's comments:**

2. SIPSE Assessment Rubric - Lesson Plan or Lesson Activity Plan

Circle as appropriate

TPACK Assessment Criteria	Excellent 16 - 20	Good 11 - 15	Satisfactory 6 - 10	Fair 1 - 5	Marks
Technologies & Curriculum Knowledge (TCK) (Curriculum-based technology use)	Technologies selected for use in the lesson plan or lesson plan activity are **strongly aligned** with one or more Science or Technology or English or Mathematics (STEM) curriculum learning objectives.	Technologies selected for use in the lesson plan or lesson plan activity are **aligned** with one or more STEM curriculum learning objectives.	Technologies selected for use in the lesson plan or lesson plan activity are **partially aligned** with one or more STEM curriculum learning objectives.	Technologies selected for use in the lesson plan or lesson plan activity are **not aligned** with any STEM curriculum learning objectives.	
Technology & Pedagogical Strategies (TPK) (Using technology in teaching/ learning)	Technology use **strongly supports** pedagogical strategies (questioning, groups work, discussion etc.).	Technology use **supports** pedagogical strategies (questioning, groups work, discussion etc.).	Technology use **minimally supports** pedagogical strategies (questioning, groups work, discussion etc.).	Technology use **does not support** pedagogical strategies (questioning, groups work, discussion etc.).	
Technology Selection(s) (TK) (Appropriate technology selection for curriculum goals & pedagogical strategies)	Technology selection(s) (presentation, word docs, spreadsheets, simulations, you tube etc.) are **exemplary**, given STEM curriculum goal(s) and pedagogical strategies.	Technology selection(s) (presentation, word docs, spreadsheets, simulations, you tube etc.) are **appropriate, but not exemplary**, given STEM curriculum goal(s) and pedagogical strategies.	Technology selection(s) (presentation, word docs, spreadsheets, simulations, you tube etc.) are **just appropriate**, given STEM curriculum goal(s) and pedagogical strategies.	Technology selection(s) (presentation, word docs, spreadsheets, simulations, you tube etc.) are **inappropriate,** given STEM curriculum goal(s) and pedagogical strategies.	
Technology, Pedagogy and Content ***TPACK*** **- "Fit"** (Content, pedagogy and technology fit together)	Content, pedagogical strategies and technology **fit together strongly** within the lesson or lesson activity plan.	Content, pedagogical strategies and technology **fit together** within the lesson or lesson activity plan.	Content, pedagogical strategies and technology **fit together a little** within the lesson or lesson activity plan.	Content, pedagogical strategies and technology **do not fit together** within the lesson or lesson activity plan.	
				Total Marks	

Source: Adapted from Harris, J et al. (2010).

3. SIPSE indicators for ICT school excellence

The criteria for five domains of excellence are shown below. The criteria act as indicators showing how effectively the school meets SIPSE targets for excellence. There are essential criteria indicated by a star symbol (★) in each domain. These essential criteria must be met by all SIPSE Schools of Excellence.

Leadership & Vision

Vision

A SIPSE school can show evidence of:

A whole-school ICT policy (developed or in progress) that outlines a vision and strategy and conveys a positive attitude to the use of ICT. The policy addresses ICT use in the STEM curriculum, planning for structured ICT access for all and Internet safety.

Leadership & Vision – Key Excellence Indicators

On ICT school policy and planning:

- The ICT vision is integrated into the whole-school plan ★
- There is a dedicated ICT coordinating teacher with clearly defined roles and responsibilities
- There is provision in the school ICT policy to collaboratively regularly review and update policy
- The policy plans for present and future development and improvement of ICT use in the school subjects
- The policy supports Continued Professional Development of staff in relation to ICT

On school policy for ICT in teaching and Learning: ★

- Outlines the rationale for ICT and recognises its distinctive contribution to learning and teaching in the school
- Addresses content use of ICT in curricular areas
- The policy addresses specific ICT activities that will support teaching and learning in STEM subjects

On school policy for ICT and Special Education Needs ★

- Supports the inclusion of pupils with special educational needs in relation to ICT use in teaching and learning

On school policy for ICT access, Internet use and safety: ★

- Plans for progression in learning with and through ICT from Technology Literacy levels of traditional didactic teaching to Knowledge Deepening levels of problem-based and project-based learning
- Accounts for regular and structured access for all pupils to ICT
    - If a computer room is available, classes/groups have timetabled slots
    - A rota or turn-taking system helps ensure that all pupils receive regular access to ICT laptop and projector in a classroom situation
- Outlines how the Internet is best used as a resource for learning and teaching
- Includes a policy on acceptable and safe uses of ICT that is implemented throughout the school

ICT in the STEM curriculum

Vision

A SIPSE school can show evidence of:

ICT integration across the STEM curriculum in learning and teaching and teachers in the SIPSE project will demonstrate a clear understanding how ICT can be used in the STEM curriculum to improve student learning.

ICT in the STEM curriculum – Key Excellence Indicators

On ICT in learning and teaching:
ICT supports the key principles of the National Curriculum objectives for ICT integration ★

Key Principals ICT Use in the Curriculum – Tanzania and Kenya

- **ICT integration across a wide range of curricular areas** ★
  - ICT is integrated into the curriculum in secondary schools., and that the curriculum is revised accordingly
  - Subject-specific pedagogy includes the integration of ICT in the teaching and learning process
- **ICT in teaching and learning** ★
  - ICT is used in the teaching and learning process to support the mastery of STEM subject matter while addressing individual learner's differences, critical thinking skills, and language, through interactive and participatory teaching
  - Efforts are made to use ICT for learners with disabilities and other special needs
  - Opportunities are provided to foster the creative and interactive capacity of learners and teachers through the use of ICT and multimedia
- **Use and development of appropriate e-content** ★
  - High quality e-content and local content is promoted and developed in accordance with national mechanisms for evaluation
  - Schools use content developed and disseminated by national curriculum institutions that addresses the preservation and promotion of Tanzania's and Kenya's history and cultural identity and diversity, within the education sector
  - Schools select, evaluate, manage and utilize relevant software packages and e-resources in accordance with national guidelines
  - Schools make use of free and easily accessible teaching and learning materials, as well as free and open source software
- **Professional collaboration and ICT safety** ★
  - Schools optimize the use of available ICT resources available (computer labs, laptops, mobile phones) for the development of an exchange of resources as well as networking and collaborative exchanges between teachers and learners within and outside the country
  - Schools develop rules governing the safe and ethical use of the Internet

Sources: Kenya Ministry of Education. Science and Technology (2006).

Tanzania Ministry of Education and Vocational Training (2007).

School ICT Culture

Vision

A SIPSE school can demonstrate:

An awareness and understanding of the importance of ICT impact on the quality of learning and teaching among staff, students and the wider school community

School ICT Culture – Key Excellence Indicators

Culture of ICT use in the school ★

- There is evidence of a strong ICT presence in the school
- Pupils can be observed using ICT in the lab and/ or the classroom
- Work produced through ICT is in evidence around the school

The computer lab and classroom laptops and projectors are used regularly by pupils and teachers ★

- ICT has been used to prepare newsletters, notes or other material for communication between parents, pupils and staff
- STEM teachers use ICT in their own classroom planning and administration

The school recognises that ICT can extend pupils' learning beyond the classroom★

- Pupils are encouraged to relate the use of ICT at school (such the ICT enhanced activities in STEM) to problem solving and project activities in the local and home environment
- Parents are encouraged and continuously educated on the advantages of using ICT to improve education outcomes through parents meetings, newsletters, AGM, school strategies and all communication from the school
- The school has prepared digital resources such as activity sheets / learning objects for use after school by students
- The school has used ICT in STEM curricular project work or has been involved in ICT projects, either local or in the SIPSE school cross- country network of Kenya and Tanzania or international.
- The role of ICT to improve education outcomes is recognised in the schools' Strategy or development plan

Continuing Professional Development

Vision

A SIPSE school can demonstrate:

A commitment to supporting SIPSE training with school-based teacher development activities for ICT use in STEM and other subjects, providing opportunities for staff meetings, school seminars, teacher–to–teacher observations of ICT use in classroom practice, online presence through a website, blog, Facebook etc.

Resources and Infrastructure

Vision

A SIPSE school can demonstrate:

The required school lab and SIPSE laptop resources to support learning environments for Science, Technology, English and Mathematics (STEM) subject teaching and it has organized appropriate ICT resources that reflect a plan for development and improvement of ICT as part of whole-school policy and strategy plan.

ICT in the STEM curriculum – Key Excellence Indicators

Hardware

- The school shows evidence of sufficient and adequate access to computers/laptops that reflects the SIPSE minimum requirements for a lab and classroom set up for ICT use in STEM teaching and learning★
- The school ICT resources are utilized in the most appropriate manner to maximize opportunities for effective learning and teaching across all curriculum subjects
- ICT is located in the following areas where appropriate:
- Mainstream classrooms
- A computer lab or room
- Library
- Other teaching/learning areas
- A combination of the above
- Heads of Department Offices
- Staff room
- There is an appropriate selection of digital devices available for use that reflects the context of the particular school. For example laptops, projectors, digital cameras etc are available for teacher use.

Infrastructure

- There is a computer network LAN? Available for educational purposes ★
- Internet access is available

Software

- There is a variety of content-rich and content-free software available for use covering curricular areas in STEM teaching ★
- Visit the SIPSE Module Resource Sheet on **Educational Software.**
- Visit the SIPSE platform for **Software Evaluation** by teachers of a range of open educational software
- Teachers use a variety of age and ability appropriate software applications as a learning and teaching resource in STEM subjects ★
- The school has online presence (website, blog, Facebook, etc)

Source: Adapted from Digital Schools of Distinction (n.d.).

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Glossary and Abbreviations

Glossary

Action Learning	A process by which individuals, teams, or organisations work on solving real problems by formulating strategies and taking actions
Assistive Technologies	Technology used by learners with disabilities in order to perform functions that might otherwise be difficult or impossible
Authoring Environment	Allows the user to create multimedia artefacts like websites, simulations, DVDs, virtual worlds for integration into presentations, lectures, lessons and assessments
Case-based learning	An active learning strategy where students investigate and analyse complex, real-life scenarios using a structured inquiry-based approach
Career Stages	Represents a continuum of a teacher's developing expertise from undergraduate preparation through to being an exemplary classroom practitioner and a leader in the profession. (e.g. AITSL has defined four career stages for teachers: Graduate, Proficient, Highly Accomplished and Lead)
Collaborative Learning	An instructional approach in which students of varying abilities and interests work together in small groups to solve a problem, complete a project, or achieve a common goal
Communication and Collaboration Technology	Allows users to interact and work in groups and facilitates the sharing and distributing of knowledge and expertise among community members (e.g. email, text messaging, video conferencing, and social media)
Complex Cognitive Skills	Information management, problem solving, collaboration and critical thinking
Continuous Learning	Regularly upgrading skills and knowledge to improve competence
Critical Thinking	Logical thinking that draws conclusions from facts and evidence
Didactic Teaching	Teaching by telling, talking, explaining, demonstrating, lecturing, posing and answering questions and conducting discussions
Domains of Teaching	The 'Domains of teaching' are the top level organiser adopted by the Australian Institute of Teaching and School Leadership (AITSL) to describe the Australian Professional Standards for Teachers. They are: Professional Knowledge, Professional Practice and Professional Engagement. Together, they broadly describe the professional work of teachers. (see also Focus Areas, Standards)
Drill and Practice Software	Software which promotes the acquisition of knowledge or skill through repetitive practice
Focus Areas	A programme's major areas of concern that need to be addressed through relevant activities or tasks It also refers to a level of organisation of the Australian Professional Standards for Teachers. The top level is Domain (see Domains of Teaching) while the second level is where the Standards (See Standards) reside. A Focus Area is the third level and allows contextualising and finer description of the standard. For example, Focus Area 2.6 (Information and Communication Technology) rests within Standard 2 (Know the content and how to teach it) which in turn rests with the Domain of Professional Knowledge.
Formative Assessment	Assessment given as part of the instructional process to provide the information needed to adjust teaching and learning while they are happening
Graphic Software	Computer programs like Photoshop which create and manipulate images, pictures, photographs, diagrams and drawings
Illustrations of Practice	Visualization or a depiction of practice. It also represents short annotated videos of teachers in Australian classrooms that are authentic and are intended to model how the Australian Professional Standards for Teachers can be demonstrated (both by Standard and by Career stage (Graduate, Proficient, Highly accomplished and Lead).

Lesson Plan	A teacher's detailed description of the course of instruction for an individual lesson or module.
Multimedia Authoring Tools	Multimedia recording and production equipment.
Online Professional Community	A group of people with the same or related occupation who regularly communicate with each other through a website. Members of the community exchange ideas, share experiences and resources, collaborate on projects and support each other. This is also referred to as a community of practice.
Open-ended Software	Software programs that allow students to demonstrate their learning across various learning areas, according to their level of development and preferred learning style (e.g. word processing, multimedia presentation, web authoring, concept mapping and spreadsheets).
Performance Indicators	A particular characteristic or dimension used to measure intended changes defined by an organisational unit's results framework. Performance indicators are used to observe progress and to measure actual results compared to expected results. Performance indicators are usually expressed in quantifiable terms, and should be objective and measurable. (*Source:* UNDP Evaluation Office. 2002. *Handbook on Monitoring and Evaluating Results*. http://web.undp.org/evaluation/documents/HandBook/ME-Handbook.pdf) A metric of performance which provides predetermined descriptions of levels of achievement or indicators of success. A performance indicator or key performance indicator (KPI) is a type of performance measurement. KPIs evaluate the success of an organisation or of a particular activity in which it engages.
Problem-Based Learning	A pedagogical approach where students collaboratively solve problems and reflect on their experiences. Problems are used to engage students' curiosity and initiate learning the subject matter, thus preparing students to think critically and analytically, and encouraging them to find and use appropriate learning resources.
Productivity Tools	Productivity tools refer to any type of software associated with computers and related technologies that can be used as tools for personal, professional, or classroom productivity (e.g. Microsoft Office, Apple Works - word processing, grade and record keeping, web page production, presentations).
Project-Based Learning	Use of classroom projects where students use technology and inquiry to engage with issues and questions that are relevant to their lives.
Reflective Thinking	The learner considers their own learning and reflects on what worked, didn't work and what needs improvement.
Rubric	Specific criteria or guidelines used to evaluate student work.
Scootle	The name given to the online repository of resources for Australian teachers and to its community of practice, managed by Educational Services Australia (ESA).
Simulation	A computer program that simulates an authentic system (e.g. human body, building, organism) and responds to choices made by users.
Social Media	Websites and services that are built around participation and user-generated content (e.g. Facebook, YouTube).
Special Education Needs	Children who have learning difficulties or disabilities that make it harder for them to learn or access education than most children of the same age.

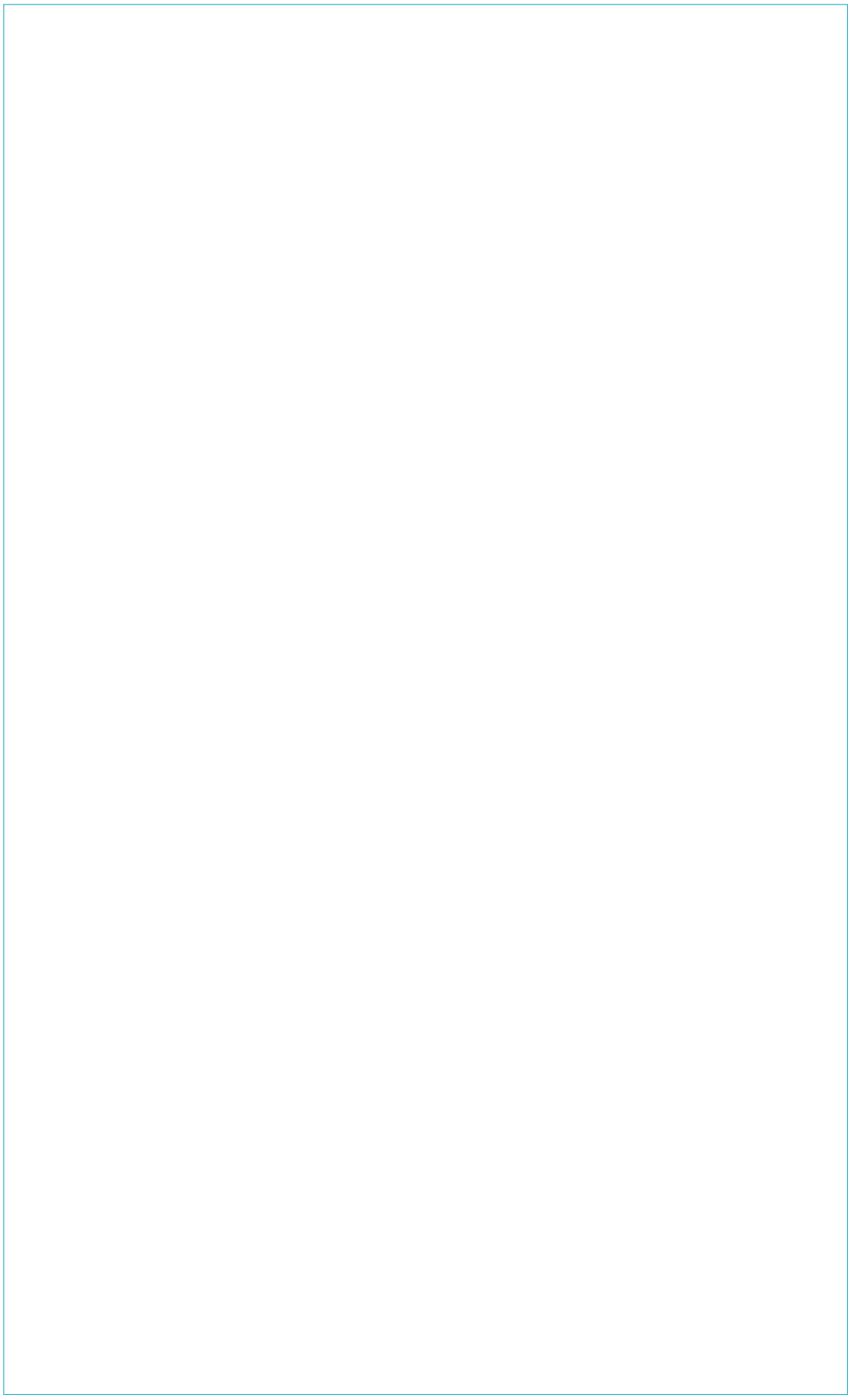
Standards	Common and repeated use of rules, conditions, guidelines or characteristics for products or related processes and production methods, and related management systems practices. According to the *UNESCO ICT-CFT* Syllabus, curriculum standards are the level and extent of the skills, knowledge, and understanding which the student is expected to achieve, and curriculum is a list of the topics to be learnt in a course of study. The terms 'curriculum' and 'syllabus' are used slightly differently in different countries, but essentially they both refer to a list of what is to be learnt. A standard is a formal statement of requirement. The Australian Professional Standards for Teachers (APST) outline the requirements for entry into teaching and to providing evidence of proficiency. Standards are also described for higher levels of performance in terms of increasing leadership within the profession. More specifically, the APST sit within domains of teaching (see Domains of Teaching) and are illustrated through fine-grained Focus Areas (see Focus Areas).
STEM	For the Tanzania and Kenya case, STEM stands for Science, Technology, English and Mathematics subject teaching STEM more commonly refers to Science, Technology, Engineering and Mathematics, an approach to combine these discipline areas into meaningful problem-based learning activities.
Summative Assessment	Assessment given at a particular point in time to determine what students know and do not know.
Technology Integration	Use of technology to support instruction in various subject areas (e.g. languages, social studies, science, maths). When teachers integrate technology into their classroom practice, learners are empowered to be actively engaged in their learning.
Virtual Learning Environment	(VLE) A web-based system designed to facilitate teachers in the management of educational courses for their students. The system presents course content and tracks the learners' progress. While often thought of as primarily tools for distance education, they are most often used to supplement the face-to-face classroom.

Abbreviations

ABS	Australian Bureau of Statistics
ACARA	Australian Curriculum, Assessment and Reporting Authority
ACCE	Australian Council for Computers in Education
ACDE	Australian Council of Deans of Education
AECT	Association for Educational Communications and Technology
AEI	Australian Education International
AITSL	Australian Institute for Teaching and School Leadership
APST	Australian Professional Standards for Teachers
ATEA	Australian Teacher Education Association
ATRA	Australasian Teacher Regulatory Authorities
BEI	Behavioural Event Interviews
BETF	Bright Education Trust Fund
CEMESTEA	Centre for Mathematics, Science and Technology Education in Africa
COBET	Complementary Basic Education in Tanzania
CPD	Continuing professional development
DETE	Department of Education, Training and Employment (Queensland State Government)
ECCD	Early Childhood Care and Development
ECIT	Educational Communications and Instructional Technologies
EDUNET	Educational information service, which is the largest education portal in Korea and administered by governmental support
ESA	Education Services Australia
F2F	Face-to-face
FGD	Focus Group Discussion
FPE	Free Primary Education
FSE	Free Secondary Education
FTE	Full-time equivalent, the means of measuring employment
GER	Gross Enrolment Ratio
GeSCI	Global E-Schools and Communities Initiative
ICBAE	Integrated Community-based Adult Education
ICDL	International Computer Driving License
ICDTA	Institute for Capacity Development of Teachers in Africa
ICST	ICT Competency Standards for Teachers
ICT	Information and Communication Technology
ICTE / ICT4E	ICT for Education
ICTT	ICT Competency Framework for Teachers in Tanzania
ICTIF	ICT Innovation Fund
IICP	International Institute for Communication and Development
INGO	International Non-Governmental Organisation
INSET	In-Service Education and Training
ISTE	International Society of Technology in Education
ITE	Initial Teacher Education
ITU	International Telecommunication Union
KCPE	Kenya Certificate of Primary Education

KCSE	Kenya Certificate of Secondary Education
KD	Knowledge Deepening
KEMI	Kenya Education Management Institute
KESSP	Kenya Education Sector Support Programme
KERIS	Korea Education and Research Information Service
KFIT	Korean Funds In Trust
KICD	Kenya Institute of Curriculum and Development
KICT-CFT	Kenya ICT Competency Framework for Teachers
KOSIS	Korean Statistical Information Service
KSA	Knowledge, skills, and attitudes
LCR	Learner to Computer Ratio
LMS	Learning Management System
MCEECDYA	Ministerial Council for Education, Early Childhood Development and Youth Affairs
MCEETYA	Ministerial Council for Education, Employment, Training and Youth Affairs
MCF	Master Card Foundation
MoE	Ministry of Education
MoEST	Ministry of Education, Science and Technology - Kenya
MoEVT	Ministry of Education and Vocational Training - Tanzania
N/A	Not Applicable
NCTC	National Certified Training Centre
NEEA	National Education Examinations Authority
NEPAD	New Partnership for Africa's Development
NER	Nett Enrolment Ratio
NETS-A	National Educational Technology Standards for Administrators (by ISTE)
NETS-S	National Educational Technology Standards for Students (by ISTE)
NETS-T	National Educational Technology Standards for Teachers (by ISTE)
NFE	Non-Formal Education
NSWIT	New South Wales Institute of Teachers
NTEIEC	National Teachers' Experts for ICT in Education Committee
NTENA	National Teacher Education Network Alliance
OECD	Organisation for Economic Co-operation and Development
OER	Open Educational Resources
OUT	The Open University of Tanzania
PEDP	Primary Education Development Plan
PRESET	Pre-Service Education and Training
QR	Quick Response
SCSEEC	Standing Council on School Education and Early Childhood
SEDP	Secondary Education Development Plan
Sida	Swedish International Development Agency
SiMERR	Science, ICT and Mathematics Education for Rural and Regional Australia, University of New England
SIPSE	Strengthening Innovation and Practice in Secondary Schools
SMART	Self-directed, Motivated, Adaptive, Resources, and Technology- Embedded
SMASSE	Strengthening of Teaching Mathematics and Science Education
STEM	Science, Technology, Engineering, Mathematics
SWOT	Strengths, Weaknesses, Opportunities and Threats
TC	Teacher College

TEI	Teacher Education Institution
TIE	Tanzania Institute of Education
TED	Teacher Education Department
TEQSA	Tertiary Education Quality Standards Agency
TFA	Teach for Australia
TL	Technology Literacy
TIVET	Technical, Industrial, Vocational and Entrepreneurship Training
TPACK	Technological Pedagogical Content Knowledge
TPD	Teacher Professional Development
TQAC	Teacher Quality Advisory Committee
TRCs	Teacher Resource Centres
TSC	Teacher Service Commission
TTC	Teacher Training College
TTF	The Teaching Teachers for the Future project
TVE	Technical and Vocational Education institute
TVET	Technical Vocational Education and Training
UDSM	The University of Dar-es-Salaam
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNESCO ICT-CFT	UNESCO ICT Competency Framework for Teachers
UPE	Universal Primary Education
USAID	United States Agency for International Development



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