



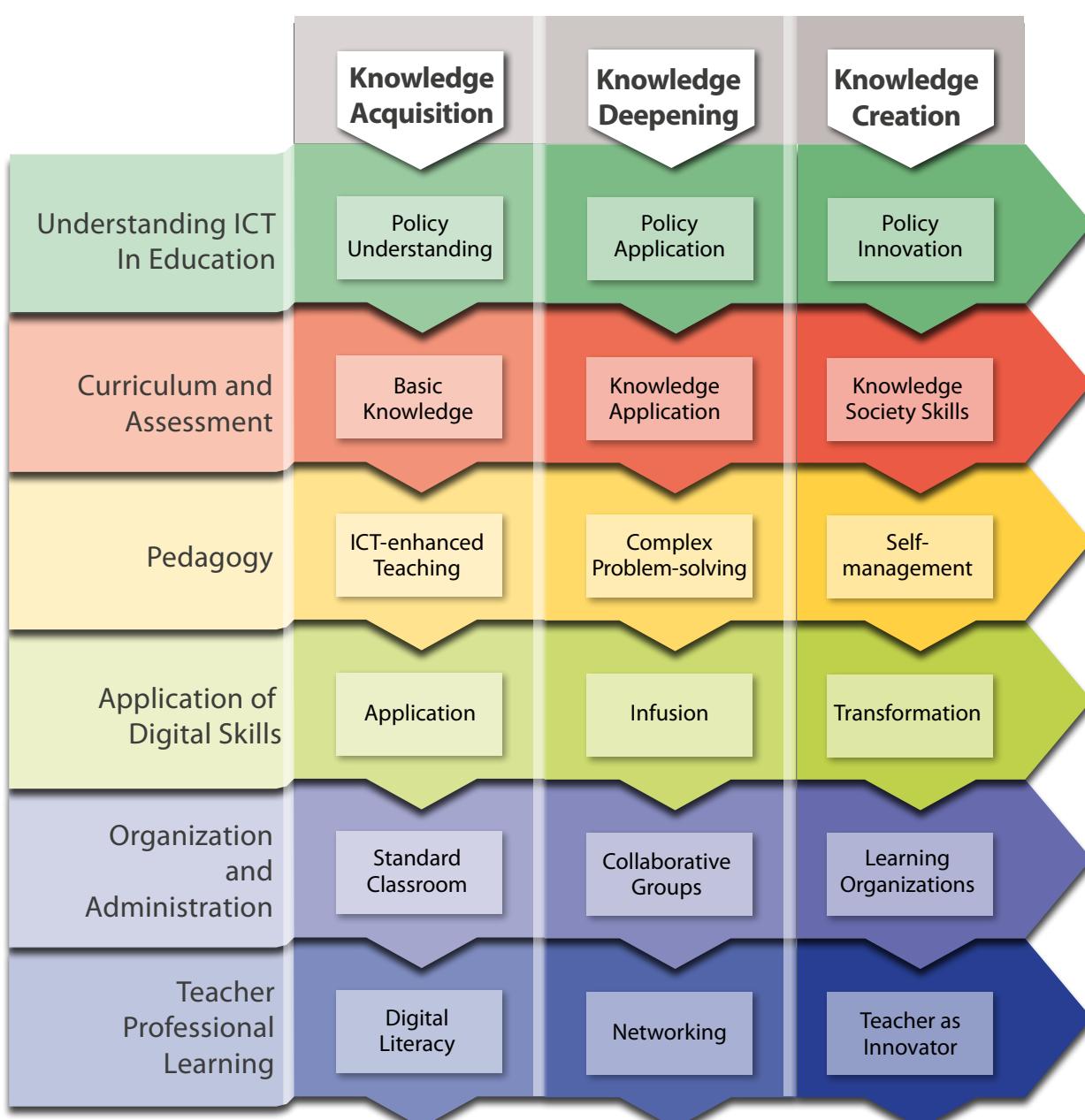
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UNESCO ICT Competency Framework for Teachers

VERSION 3



UNESCO ICT Competency Framework for Teachers



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Foreword

The 2030 Agenda for Sustainable Development recognizes that the prevalence of Information and Communication Technologies (ICTs) have a significant potential to accelerate progress, to bridge the digital divide and support the development of inclusive Knowledge Societies based on human rights, the achievement of gender equality and empowerment. For UNESCO, the development of inclusive Knowledge Societies is based on four pillars: freedom of expression and freedom of information; universal access to information and knowledge; quality learning for all; and respect for linguistic and cultural diversity. From this perspective, ICTs are critical for progress towards the achievement of all 17 Sustainable Development Goals (SDGs). Namely, ICT related targets are addressed in: Quality education (Goal 4), Gender equality (Goal 5), Infrastructure (Goal 9), Reduced inequalities within and across countries (Goal 10), Peace, justice and strong institutions (Goal 16) and Partnerships for the goals (Goal 17).

In the attainment of these goals, technology has the potential to provide innovative solutions to enable learners to take part in quality lifelong learning opportunities, to access information and knowledge and fully participate in society. Digital citizenship - the ability and ethical values to participate in society online – is an increasingly vital element in the 21st Century.

The effective integration of ICT in the schools and classrooms can transform pedagogy and empower students. In this context, it is essential that teachers have the competencies to integrate ICT in their professional practice to ensure the equity and quality of learning. Teachers also need to be able to harness ICT to guide learners in developing Knowledge Society skills such as critical and innovative thinking, complex problem solving, the ability to collaborate, and socio-emotional skills. Teacher training and continued on-going, relevant professional development for teachers are essential if benefits from investments in ICTs are to be realized. Training and on-going support must enable teachers to develop the necessary ICT competencies so they can, in turn, ensure their students develop the relevant skills, including digital competencies for life and work.

In response, UNESCO has developed the ICT Competency Framework for Teachers (ICT CFT) as a tool to guide pre- and in-service teacher training on the use of ICTs across the education system. The ICT CFT is intended to be adapted to support national and institutional goals by providing an up-to-date framework for policy development and capacity building in this dynamic area.

The ICT Competency Framework for Teachers (ICT CFT) Version 3 is a response to recent technological and pedagogical developments in the field of ICT and Education, and incorporates in its structure inclusive principles of non-discrimination, open and equitable information accessibility and gender equality in the delivery of education supported by technology. It addresses the impacts of recent technological advances on education and learning, such as Artificial Intelligence (AI), Mobile Technologies, the Internet of Things and Open Educational Resources, to support the creation of inclusive Knowledge Societies.

The ICT CFT provides a comprehensive set of competencies teachers need to integrate ICT into their professional practice in order to facilitate students' achievement of curricular objectives. Strong political commitments and sustained investment in teacher education, and concerted actions between pre- and in-service teacher trainings form the foundation of the successful implementation of this Framework as it is contextualized to national and institutional goals. For this reason, this document underlines the importance of steadfast commitment to supporting teachers' continuous professional development including through ICT, and includes examples to illustrate how ICT CFT could be used to facilitate teachers' development in diverse contexts. We look forward to strengthening our collaboration with all stakeholders everywhere to leverage ICT to develop the skills required to thrive within the fast-changing inclusive Knowledge Societies.



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Executive Summary

Contemporary societies are increasingly based on information and knowledge, and the ubiquity of technologies. Consequently, societies need to put in place mechanisms to:

- build workforces that have information and communications technology (ICT) skills and are reflective, creative and adept at problem-solving in order to generate knowledge;
- enable people to be knowledgeable and resourceful so they are able to make informed choices, manage their lives effectively and realize their potential;
- encourage all members of society – irrespective of gender, language, age, background, location and differing abilities – to participate fully in society and influence the decisions that affect their lives; and
- foster cross-cultural understanding, tolerance and the peaceful resolution of conflict.

The attainment of these social and economic goals is a key focus of education systems worldwide. Teachers need to be equipped to guide the next generation to embrace and be able to achieve these goals.

The 2030 Agenda for Sustainable Development, adopted by the UN General Assembly, underscores a prevalent global shift towards the building of inclusive Knowledge Societies based on human rights, the achievement of gender equality and empowerment. ICTs are critical for progress towards the achievement of all 17 Sustainable Development Goals (SDGs). Namely, ICT related targets are addressed in: Quality education (Goal 4), Gender equality (Goal 5), Infrastructure (Goal 9), Reduced inequalities within and across countries (Goal 10), Peace, justice and strong institutions (Goal 16) and Partnerships for the goals (Goal 17).

Technology has a significant role to play in the achievement of the SDGs. UNESCO, in partnership with industry leaders and global subject experts, has created an international Framework that sets out the competencies required to teach effectively with ICT: the UNESCO ICT Competency Framework for Teachers (ICT CFT).

There have been three ICT CFT versions: 2008, 2011 and 2018. Each version has reflected the prevailing thinking on the relationship between technology and education, with suggestions on how to achieve competencies using popular technologies of the time. From the outset, it was envisaged that the ICT CFT would be dynamic and revisited regularly to ensure relevance.

The ICT CFT Version 3 takes into account the Agenda 2030 for Sustainable Development, and is designed to preserve those competencies that remain relevant and to frame them within the current advances in technologies and the changing demands of life and work. For example, open educational resources (OER) are now numerous and beneficial and have therefore been included; furthermore, inclusive education is also addressed in the ICT CFT Version 3, in line with the key SDG principle of “leaving no one behind”.

The ICT CFT Version 3 is intended to inform teacher-training policies and programmes to strengthen the use of ICT in Education. Its target audience is teacher-training personnel, educational experts, policy-makers, teacher support personnel and other professional development providers. The ICT CFT assumes a working knowledge of the benefits of ICT in Education, and encourages contextualization and adaptation of teacher professional development as relevant.

This version of the ICT CFT emphasizes that teachers, in addition to having ICT competencies and the ability to develop these in their students, must be able to use ICT to help students become collaborative, problem-solving, creative learners and innovative and engaged members of society.

For this purpose, teachers' professional development should be understood as a lifelong learning process, rather than a one-off event. It is advised that the ICT CFT be integrated into the three phases of teacher professional development:

- pre-service - focusing on initial preparation on pedagogy, subject matter knowledge, management skills and use of various teaching tools including digital tools and resources;
- in-service - including structured face-to-face and distance training opportunities building upon pre-service programmes and directly relevant to teaching needs in classrooms and beyond; and
- On-going formal and informal pedagogical and technical support, enabled by ICTs, for teachers' innovative use of ICT to address daily needs and to facilitate students' higher-order learning.

The ICT CFT Version 3

The ICT CFT consists of 18 competencies organized according to the six aspects of teachers' professional practice, over three levels of teachers' pedagogical use of ICT. The underlying idea is that teachers who have competencies to use ICT in their professional practice will deliver quality education and ultimately be able to effectively guide the development of students' ICT competencies.

The six aspects of a teacher's professional practice addressed are:

1. Understanding ICT in Education Policy;
2. Curriculum and Assessment;
3. Pedagogy;
4. Application of Digital Skills;
5. Organization and Administration; and
6. Teacher Professional Learning.

The ICT CFT is organized over three successive stages or levels of a teacher's development in making pedagogical use of ICT.

The first level is **Knowledge Acquisition**,¹ where teachers acquire knowledge about using technology and basic ICT competencies. The Knowledge Acquisition level demands that teachers be aware of the potential benefits of ICT in the classroom and within national policies and priorities be able to manage and organize the school's ICT investments and use technology to embark on lifelong learning and further professional development.

Teachers who have mastered the competencies in the Knowledge Acquisition level can:

1. articulate how their classroom practices correspond to and support institutional and/or national policy;
2. analyse curriculum standards and identify how ICT can be used pedagogically to support attainment of the standards;
3. make appropriate ICT choices to support specific teaching and learning methodologies;
4. identify the functions of hardware components and common productivity software applications, and be able to use them;

¹ In the 2011 ICT CFT, this level was termed 'Technology Literacy'.

5. organize the physical environment to ensure technology supports different learning methodologies in an inclusive manner; and
6. use ICT to support their own professional development.

The second level is **Knowledge Deepening**, where teachers acquire ICT competencies that enable them to facilitate learning environments that are student-centred, collaborative and cooperative in nature. Teachers are also able to link policy directives with real action in the classroom, have the capacity to build technology plans to maintain the school ICT assets, and forecast future needs. In addition, teachers can study further by linking to national and global teacher networks.

Teachers who have mastered the competencies in the Knowledge Deepening level can:

1. design, modify and implement classroom practices that support institutional and/or national policies, international commitments (e.g. UN Conventions), and social priorities;
2. integrate ICT across subject content, teaching and assessment processes, and grade levels, and create a conducive ICT-enhanced learning environment where students, supported by ICT, demonstrate mastery of curriculum standards;
3. design ICT-supported project-based learning activities and use ICT to facilitate students to create, implement and monitor project plans, and solve complex problems;
4. blend varied digital tools and resources to create an integrated digital learning environment to support students' higher-order thinking and problem-solving skills;
5. use digital tools flexibly to facilitate collaborative learning, manage students and other learning partners, and administer the learning process; and
6. use technology to interact with professional networks to support their own professional development.

The third level is **Knowledge Creation**, where teachers acquire competencies that encourage them to model good practice, and set up learning environments that encourage students to create the kind of new knowledge required for more harmonious, fulfilling and prosperous societies.

Teachers who have mastered the competencies in the Knowledge Creation level can:

1. critique institutional and national education policies alike, suggest revisions, design improvements and speculate on the impact of these changes;
2. determine how best to incorporate student-centred and collaborative learning to ensure mastery of multidisciplinary curriculum standards;
3. while determining learning parameters, encourage student self-management in student-centred and collaborative learning;
4. design knowledge communities and use digital tools to support pervasive learning;
5. play a leadership role in devising a technology strategy for their school to turn it into a learning organization; and
6. continually develop, experiment, coach, innovate, and share best practice to determine how the school can best be served by technology.

Figure 1 and the detailed ICT CFT tables in the current document show how the three levels – Knowledge Acquisition, Knowledge Deepening and Knowledge Creation – and the six educational aspects interact and support one another. At the intersection of each level and aspect is one of the 18 teacher ICT competencies.

Navigating this Document

Chapter 1 introduces the ICT CFT Version 3, explaining its purpose and providing background information, including tracing the evolution of the Framework..

Chapter 2 outlines the international principles underlying the ICT CFT, focusing on the links between the ICT CFT and Sustainable Development Goals. The chapter also addresses the cross-cutting principles expanded on in the ICT CFT Version 3 – Knowledge Societies, Universal Design for Learning, and inclusive education – and outlines the ICT innovations introduced in this version – open educational resources, social networks, mobile technologies, the Internet of Things, artificial intelligence, virtual reality and augmented reality, big data, and coding.

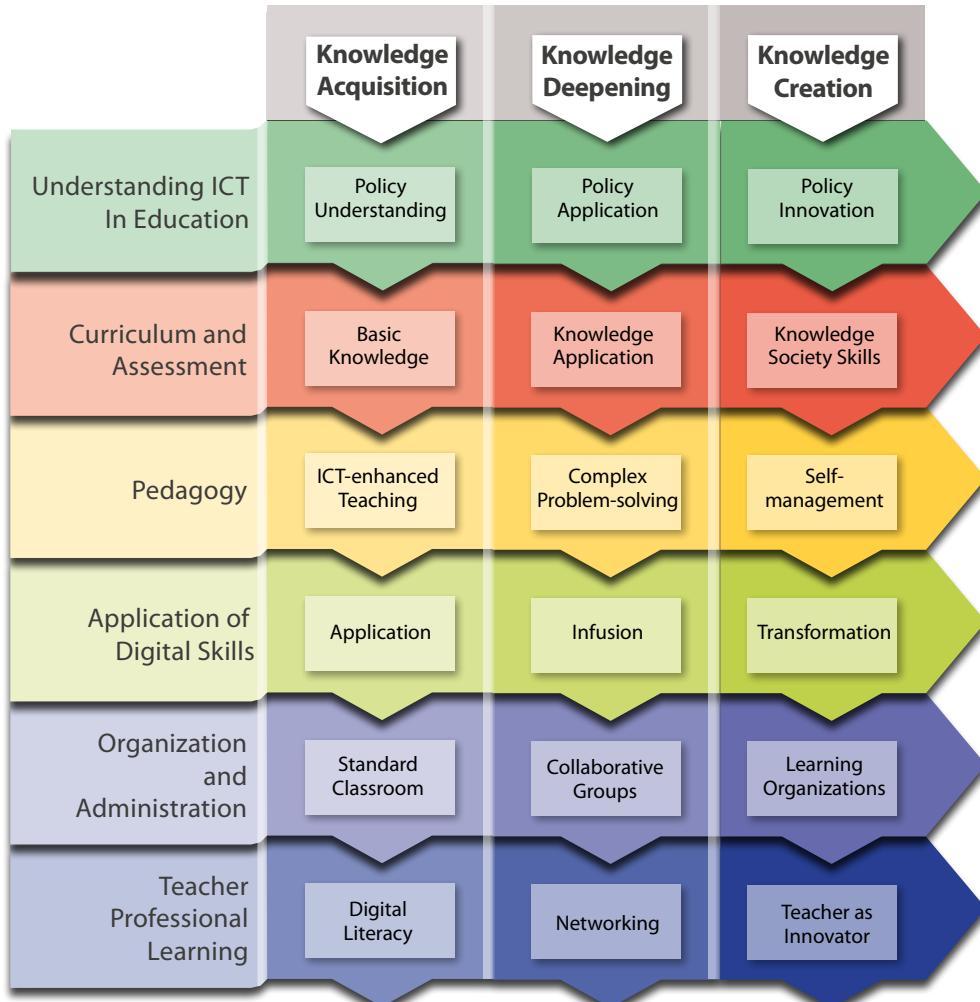
Chapter 3 is an overview of the ICT CFT, providing a synopsis of the three levels and six aspects that together constitute the 18 competencies of the ICT CFT.

Chapter 4 presents the ICT CFT in the form of detailed tables, showing related curriculum goals, teacher competencies, objectives and examples of teacher training activities.

Chapter 5 provides examples of how the ICT CFT has been implemented worldwide since 2011, including in the development of ICT in education policy, teacher standards, assessment criteria, curriculum design, and courseware development. The chapter also gives information on open CFT resources available on OER Commons.

Chapter 6 concludes the document with brief final notes followed by a glossary of the technical terms used.

Figure 1: The UNESCO ICT Competency Framework for Teachers



The ICT CFT Version 3 competencies provide a guide for the development of effective ICT in Education teacher training programmes intended for contextualization to local and national needs.

Chapter I

Introduction

Purpose

The ICT CFT is intended for teacher training on the use of information and communications technology (ICT) in Education. Its target audience is teacher-training personnel, educational experts, policy-makers, teacher support personnel and other professional development providers. The ICT CFT assumes a working knowledge of the benefits of ICT in Education, and encourages contextualization and adaptation for teacher professional development.

The ICT CFT argues that teachers need to use teaching methods that are appropriate for evolving Knowledge Societies. Students need to be enabled not only to acquire thorough knowledge of their school subjects but also to understand how, using ICT as a tool, they can generate new knowledge. For some – perhaps many – teachers, these will be novel and challenging ideas. Implementing the ICT CFT will require strong leadership from government, from those responsible for teacher education and professional development of in-service teachers, and from head teachers and school principals.

Background

There have been three versions of the ICT CFT: 2008, 2011 and 2018. Each version has reflected the prevailing thinking on the relationship between technology and education, with suggestions on how to achieve competencies using popular technologies of the time. From the outset, it was envisaged that the ICT CFT would be dynamic and revisited regularly to ensure relevance.

Given the importance of ICT for education, in developing the ICT CFT, UNESCO – working closely with its partners CISCO, Intel, ISTE and Microsoft, as well as with world-renowned subject matter experts – conducted an extensive consultation to identify the competencies that teachers should develop in order to be able to use technology effectively in the classroom. This work resulted in the UNESCO ICT Competency Framework for Teachers (ICT CFT) first published in 2008 in the form of three booklets, including a policy framework that explained the rationale, structure and approach of the ICT CFT; a set of ICT CFT modules; and a set of implementation guidelines.

The 2011 version consolidated these different components and published the ICT CFT as a single document that included an introduction on the relevance of ICT in Education skills and knowledge, the principles underlying the Framework, the competencies and objectives, and sample syllabi and examination specifications. English, French, Russian Arabic and Chinese versions were made available on the UNESCO website.

In 2016, a review of the ICT CFT was conducted to ascertain how it had been used globally. The review found evidence that between 2008 and 2016 the ICT CFT had influenced the:

- development of national ICT in Education policy;
- creation of national teacher standards related to the integration of ICT in Education;

- development of criteria for assessing national levels of teacher ICT competency and analysing training initiatives;
- shaping of ICT in Education curricula; and
- development of teacher professional development courses.

It was reported that while many initiatives used the ICT CFT as a starting point to create something quite different, many also reported that their derivative documents explicitly linked back to the UNESCO ICT CFT, identifying specific competencies and objectives.

The review elicited feedback from users regarding the user-friendliness of the ICT CFT, as well as how relevant and appropriate the 18 competencies were to inform the uses identified above. The results of the review have been used to shape this current version of the ICT CFT. Given that much work had already been linked to the previous versions of the ICT CFT, it was agreed the latest version should maintain these links. The phrasing of the competencies and objectives was simplified but the intent of each remains the same. Additional objectives were created to incorporate new developments in the field.

Chapter II

The Principles

1. Global Education Priorities

In September 2015, the United Nations (UN) General Assembly adopted the 2030 Agenda for Sustainable Development known as the 'Sustainable Development Goals' (SDGs). These SDGs represent a framework for action that is universal, ambitious and, most importantly, 'of the people, by the people and for the people'. The SDGs underscore a prevalent shift globally towards the building of sustainable, knowledge-based societies. With access, equity and inclusion as its key pillars, SDG 4, Education, calls for the international community to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'. Furthermore, SDG Target 16.10 pledges to '*ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements*'. SDG 10 calls to '*reduce inequality within and among countries*'.

The importance of ICT in Education teacher training was asserted at the 2015 World Education Forum (held in Incheon), which declared that 'ICT must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more effective service provision'.²

The 2015 Qingdao Declaration, at the International Conference on ICT and Post-2015 Education, further reiterated the importance of the professional development of teachers to effectively integrate ICT into their work, stating:

Successful integration of ICT into teaching and learning requires rethinking the role of teachers and reforming their preparation and professional development. It calls for promoting a culture of quality in all its aspects: staff support, student support, curricula design, course design, course delivery, strategic planning and development. We will therefore ensure that teacher-training institutions are equipped and prepared to use ICT adequately to expand the benefits of training and professional development programmes to all teachers, and to act as the vanguard for technology-supported innovations in education. We also commit to providing teachers with system-wide support for the pedagogical use of ICT, to incentivize teacher innovation, and to develop networks and platforms that allow teachers to share experiences and approaches that may be of use to peers and other stakeholders.³

The ICT CFT Version 3 focuses on implementing the realization of these international commitments by providing a guide for the development of effective ICT in Education teacher training programmes that are intended for contextualization to local and national needs.

2 See UNESCO. (2015). Education 2030. Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4, page 8, at: <https://en.unesco.org/education2030-sdg4>

3 See UNESCO. (2015). Qingdao Declaration, page 2, at: http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/pdf/Qingdao_Declaration.pdf

2. Cross-cutting Principles

To contribute to the realization of the above-mentioned international commitments, the ICT CFT Version 3 incorporates in its structure a number of cross-cutting principles or overarching considerations: Knowledge Societies, Universal Design for Learning, and inclusive education. These cross-cutting principles are recommended when using the ICT CFT, including for the development of ICT in Education policy, teacher standards, assessment criteria, curriculum design, and courseware for teacher training.

2a. Knowledge Societies

Knowledge Societies nurture diversity and take advantage of their many knowledge forms, from indigenous, local wisdom to techno-scientific knowledge. Knowledge Societies are societies in which people have the capabilities not just to acquire information but also to transform it into knowledge and understanding, which empowers them to enhance their lives and livelihoods and contribute to the social and economic development of their societies. The sharing of knowledge and information, particularly through ICT, has the power to transform economies and societies. UNESCO works to create inclusive Knowledge Societies and empower local communities by increasing access to, and preservation and sharing of information and knowledge.⁴

2b. Universal Design for Learning (UDL)

Universal Design means the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. Universal Design for Learning (UDL) is a process in which curricula (goals, methods, materials and assessments) are intentionally designed to offer flexible and inclusive approaches that can be customized and adjusted for individual needs. UDL offers a framework for guiding educational practice that aims to achieve flexibility and accessibility in the ways information is presented, the ways students respond or demonstrate knowledge and skills, and the ways they are engaged in the learning process (e.g. with the course content, and interactions with peers and instructors), while reducing barriers in instruction.⁵ UDL incorporates flexible design of learning situations with customizable options, which allows all students to progress from their own, individual starting points.

2c. Inclusive education

Inclusiveness will only be made possible by respecting UDL and principles of non-discrimination, information accessibility, and gender equality in the delivery of education. It is also important that actions be based on fundamental human rights and freedoms.

Language and culture

The emergence of English as the *lingua franca* of globalization leaves little room for other languages in cyberspace and can be a major obstacle to the participation of all in Knowledge Societies; globalization can lead to the

4 See UNESCO. (n.d.). Building Knowledge Societies, at: <https://en.unesco.org/themes/building-knowledge-societies>

5 National Center on Universal Design for Learning. (2013). *How has UDL been Defined?*, at <http://www.udlcentre.org/aboutudl/udldefined>

devaluing and loss of language and culture. If harnessed correctly, though, ICT and the Internet can be powerful tools in preserving and promoting culture and championing languages other than English.

Persons with disabilities

The World Health Organisation reported in 2011 that over one billion people – approximately 15 per cent of the world's population⁶ – live with some form of disability, and the figure is accelerating in line with population increase, growing poverty, natural disasters, ongoing conflicts, and in some countries an ageing population. Many persons with disabilities face a wide range of barriers to accessing education. While technology may provide more information to students in a greater variety of ways, it does not necessarily allow all users to access learning environments and information equally.

Current technology can erect a range of barriers; by the same token, it can provide innovative solutions for persons with disabilities. Curriculum designers and teachers need to be aware that students with disabilities must have access to all components of the learning process (including registration, administrative matters, course work and others) that would be available to students without a disability, and teachers should have positive attitudes and use appropriate pedagogy.⁷ Assistive technologies when harnessed effectively provide an opportunity for persons with disabilities in educational settings to access information and participate fully.

Gender equality

Gender equality means that women and men have equal conditions for realizing their full human rights and for contributing to, and benefiting from, economic, social, cultural and political development. The Education 2030 agenda recognizes that gender equality requires an approach that 'ensures that girls and boys, women and men not only gain access to and complete education cycles, but are empowered equally in and through education'.⁸

Large gender gaps exist in access, learning achievement and continuation in education in many settings, most often at the expense of girls, although in some regions boys are at a disadvantage. Gender differences in access to ICT exist for teachers and students. Furthermore, teachers play an important role in promoting gender equality in the classroom through the use of ICT for teaching and learning. It is important that the principle of gender equality be an integral part of the implementation of the ICT CFT to ensure that technological advances benefit men and women alike.

Ability

ICT has the potential to provide remedial and extension work to students of different abilities. It lends itself to teachers developing multiple progress tracks for a particular learning outcome, which allows students to follow individualized learning pathways.

Consequently, when 'students' is used in the ICT CFT, the term does not refer to a homogeneous group but rather to students with unique strengths and individual needs. Teachers need to use ICT to develop appropriate learning environments that support different learning preferences and styles.

6 See WHO. (2011). World Disability Report, at http://www.who.int/disabilities/world_report/2011/en/

7 See UNESCO. (2016). Learning for All: Guidelines on the Inclusion of Learners with Disabilities in Open and Distance Learning, at: <http://unesdoc.unesco.org/images/0024/002443/244355e.pdf>

8 See UNESCO. (2015). Education 2030. Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4, page 28, at: <https://en.unesco.org/education2030-sdg4>

3. The Potential and Challenges of ICT Innovations

While the ICT CFT makes brief reference to particular technology innovations, opportunities to deploy these are not exhaustive. Based on the context of the country or classroom, and the availability of such innovations, additional opportunities might emerge through flexible curriculum design. The ICT CFT Version 3 also introduces references to the current innovations in relevant aspects, and throughout the three levels.

3a. Open Educational Resources (OER)

Open educational resources (OER) are any educational resources (including curriculum maps, course materials, textbooks, streaming videos, multimedia applications, podcasts, and any other materials that have been designed for use in teaching and learning) that are openly available for use by teachers and students, without an accompanying need to pay royalties or licence fees. An OER is an educational resource that incorporates a licence that facilitates reuse, and potentially adaptation, without requiring that permission first be requested from the copyright holder.

OER has emerged as a concept with the potential to support educational transformation. While the educational value of OER lies in the idea of using resources as an integral method of communication of curriculum in educational courses (i.e. resource-based learning), its transformative power lies in the ease with which such resources, when digitized, can be shared via the Internet.

3b. Social networks

Social networks are websites or applications that provide online connections with people in networks surrounding a common interest or activity. Social network activity includes people publishing profiles that provide information about themselves. Facebook, Twitter, Instagram and LinkedIn are all examples of social networking applications (apps) that can provide classroom, school and global networking opportunities for teachers and students.

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Social networks can be used to enhance pedagogical communication, facilitate interactive learning organization, and strengthen communities of learners and teachers. However, teachers need the skills to address and mitigate issues such as the negative impact of the excessive use of social media on mental and physical health, online bullying and harassment, as well as the deliberate or unintentional promotion of violence, racism, and discriminatory speech.

3c. Mobile technologies

Mobile device ownership is growing globally. Mobile devices include smartphones and tablets, and students are increasingly using these technologies to access information for learning on the Internet. Creative uses for these devices can advance equity of education, improve efficiency and productivity in the classroom, and facilitate personalized learning. Mobile technologies offer teachers and students a more flexible approach to learning by enabling anytime, anywhere learning as well as bridging formal and informal learning. In this regard, strategies and mechanisms are needed to integrate mobile technologies to be a seamless component of the array of technology to be used by teachers and learners.

3d. The Internet of Things

The Internet of Things is the network of computing devices embedded in everyday objects, other than just computers and smartphones, enabling them to send and receive data via the Internet. The Internet of Things is disrupting and transforming numerous areas of everyday life. In education, it is changing the way students learn and teachers teach. The possible future applications of the Internet of Things in education are myriad, and the implications of such disruption are tremendous.

3e. Artificial Intelligence (AI)

There is no universally accepted definition of AI. Generally, the term “artificial intelligence” is applied when a machine, particularly computers, simulate human thinking or behaviour that people associate with human intelligence, such as learning, speech and problem solving.. These processes include learning (acquiring information and the rules for the use of the information), reasoning (using the rules to reach conclusions), and self-correction. Applications of AI include expert systems, speech recognition and natural language processing, machine vision and imagery technology. The latest developments have been made possible by advances in “machine learning” and “deep learning” algorithms, combined with the availability of tremendous computing power and access to big data,

AI is currently used in education in the form of customizable content through adaptive learning programmes and software, tracking and monitoring diagnostics, automation of grading and even AI tutors. It will continue to bring new opportunities for enhanced learning, new forms of learning and offer more flexible lifelong learning pathways. Nevertheless, there are rising concerns over the issues of ethics, data security and human rights alongside the penetration of AI in education.

3f. Virtual Reality (VR) and Augmented Reality (AR)

Virtual reality (VR) is a computer-generated simulation of an environment that a person can interact with. The person is immersed in this simulated environment and able to manipulate objects or perform a series of actions. Augmented reality (AR) is a view of a real-world environment whose elements are expanded by computer-generated images; these overlay the physical environment in real time. AR alters a person’s current perception of a real-world environment, while VR replaces the real-world environment with a simulated one.

VR can enable experiential learning by simulating real-world environments. For visual learners and individuals with learning challenges, VR provides an alternative medium. The benefits of incorporating VR/AR technology into educational experiences include that students are able to participate in life-like engagement, resulting in easier application and retention of the subject matter.

3g. Big Data

As people and devices are increasingly connected online, society is generating digital data traces at an extraordinary rate, unprecedented in human history. Social computing, networked appliances, e-business transactions, mobile computing, wearable sensors, and environmental scanners generate billions of events per second, many of which are stored for later analysis or can be analysed as a real-time data stream. The term ‘big data’ is used to reflect that a quantitative shift of this magnitude is in fact a qualitative shift demanding new

ways of thinking, and new kinds of human and technical infrastructure. This raises a host of opportunities and challenges for society, and for institutions seeking to make sense of this data. Critical debates are developing around what is required to ensure that society can convert big data into a public good by fostering new kinds of literacies and ethics, and combining commercial services with open data and services.⁹

3h. Coding

Coding is what makes it possible to create computer software, apps and websites. Code is a set of instructions that computers can understand. People write code, code powers computers, and computers power everyday objects. Almost anything powered by electricity uses code. Computers run on binary code, and programming languages translate our instructions into binary. A computer programme is a sequence of instructions that a computer can interpret and execute, and is effectively a means of automating processes. Underlying all computer programmes are algorithms, which specify how a task is to be done. Algorithmic thinking – also called computational thinking – underlies computer science, and there has been a growing movement on algorithmic thinking in schools.

Coding is taught so that students are exposed to the skills needed to develop computer applications. Just as students learn to write to be able to organize, express and share ideas, learning to code teaches students how to organize, express and share ideas in new ways, in a new medium.

3i. Ethics and privacy protection

While the pace of technological breakthrough has accelerated, reflection on the ethical and human rights implications, as well as on human capacities, need to be kept up. If ICT innovations are to be developed and used in the service of education and humanity, there needs to be a reaffirmation on the human values-centered approach on the use of ICT for education.

The growing power of ICT in tracking and sharing individual data poses significant data privacy and security risks. It underlines the importance of providing individuals with control over their personal data, protecting personally identifiable private data, and regulating the commercial use of data. There has a need to provide training to teachers and students to develop awareness of data protection as well as skills to ensure that they maintain greater control over their personal data. The innovations in ICT are raising concerns for human rights as well. The use of machine in content moderation on the Internet without human judgement or an auditable framework can have a negative impact on the right to impart, seek and receive information, as well as on information transparency. AI, big data and social networks have also been shown to replicate racial, gender, cultural and other biases that lead to hard to detect discrimination, usually through bias embedded in the data and/or the algorithm.

In this regard, intergovernmental organizations, governments, and all other stakeholders need to urgently adopt ethical principles to guide the development, deployment and use frontier technology particularly in education. This also raises the need for training on ethics for individuals and institutions, especially among teachers and education system managers to create human resources with a holistic view of its impact.

This version of the ICT CFT avoids making explicit references to specific technologies and innovations in the phrasing of the teacher competencies. The ICT CFT, however, does occasionally reference specific technologies as part of the framework's objectives. There are also numerous mentions of specific technologies and innovations when describing example activities.

9 Simon Buckingham Shum. (2012). UNESCO IITE Policy Brief: Learning Analytics, at: <http://iite.unesco.org/pics/publications/en/files/3214711.pdf>

4. The Lifelong Process of Teacher Professional Development

The ICT CFT advocates for the conception of teacher development as a lifelong learning process. To this end, teachers' learning and application of digital skills are recognized as an integral part of the capacity development of teachers from pre-service to their continuous professional growth throughout their careers.

At the pre-service training stage, the preparation of future teachers in subject specific or inter-disciplinary knowledge and pedagogical approaches aims at building their understanding of the relevance of ICT for teaching and learning, often summarized as '*Technological Pedagogical Content Knowledge (TPCK)*'. As in some systems, practicing teachers may not have benefitted from exposure to technology in their pre-service training, it would be important that the introduction of ICT skills training not be limited only to the aspect 'application of digital skills' but also cover other aspects of the ICT CFT. Theoretical components of the training and practical experiences offered to future teachers should be constructed to enable them to acquire, deepen and creatively use ICT in his/her professional practice.

When conditions do not provide these opportunities, in-service training could reinforce the roles of building teachers' ICT competencies. Institutional strategies to streamline the pre- and in-service teacher education programmes to ensure training and support for in-service teachers building on the knowledge acquired in pre-service institutions would be beneficial. Furthermore, teachers' continuous professional development should be supported to enhance teachers' hands-on skills of applying ICT-based pedagogy for classroom management, curriculum implementation, student assessment and collaborative work with peers.

Chapter III

The ICT CFT Structure

The use of new technologies encourages the adoption of new teacher roles that embrace new pedagogies and approaches to teacher education. The successful integration of ICT into the learning environment will depend on teachers' ability to structure learning in new ways, merge technology appropriately with a pedagogy, develop socially active classrooms, and encourage cooperative interaction and collaborative learning and group work. For many, this will require a different set of skills from those they currently possess. The teaching skills of the future will include the ability to develop innovative ways of using technology to enhance the learning environment and to encourage knowledge acquisition, knowledge deepening and knowledge creation. Teacher professional learning will be a crucial component of this educational improvement.

To support this transformation, the ICT CFT organizes the 18 ICT in Education-related competencies into three levels, each with six aspects. Each level is aligned to how teachers typically adopt technology. The first level is where teachers tend to use technology to supplement what they already do in class; the second is where they begin to exploit the true power of the technology and change the way they teach and students learn; and the third is transformative, where teachers and students create knowledge and devise innovative strategies to function at the highest level of Bloom's taxonomy. Each level, however, shares the same six educational aspects while demanding ever-increasing sophistication and proficiency in using technology to achieve educational goals.

By crossing the three levels – Knowledge Acquisition, Knowledge Deepening and Knowledge Creation – with the six aspects of a teacher's work – Understanding ICT in Education Policy; Curriculum and Assessment; Pedagogy; Application of Application of Digital Skills; Organization and Administration; and Teacher Professional Learning – the ICT CFT creates 18 competencies.

The levels represent different stages in the use of ICT in Education. The approach that a country, district or school adopts will depend on the extent to which ICT is already integrated into its community, and contextual parameters.

1. Levels

As a teacher works up through the levels from Knowledge Acquisition to Knowledge Creation, the ICT competencies become more sophisticated but, it can be argued, less technology focused. While some specific basic technical skills need to be mastered early on, at the higher levels technology selection is ideally made by the teams involved in knowledge creation. When selecting technology, these individuals will have a specific need in mind. Technology will be seen as a means to an end rather than a focus in its own right. While ICT will be significant to the end result, it will act as an enabling mechanism.

It is also important to point out that most teachers will not be positioned perfectly within only one level but will have competencies spread across all three levels. Each level is divided into six aspects and a teacher might be stronger at some of these aspects than others. Ideally, any diagnostic tools designed to map individual teachers' proficiencies should account for their strengths and weaknesses in each of the six aspects.

Teachers should be regularly assessed to determine their profile across the levels and aspects and encouraged to develop and advance.

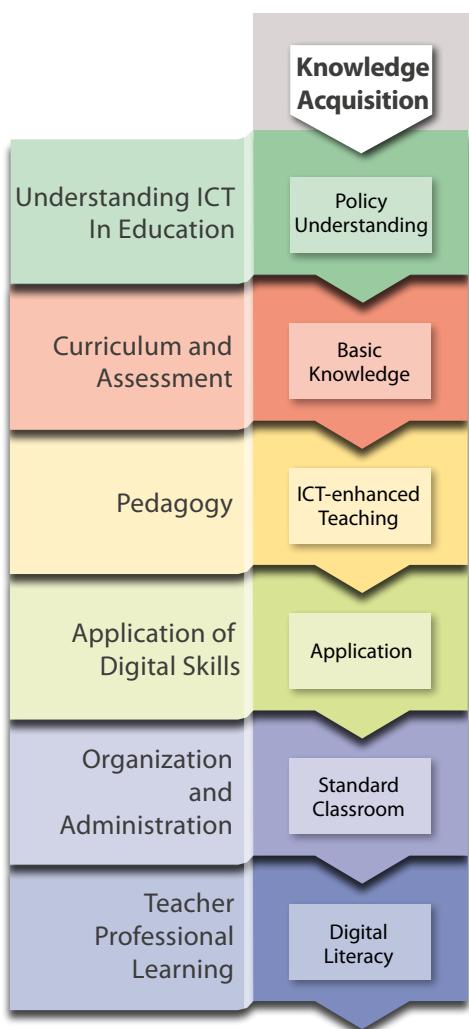
I - Level: Knowledge Acquisition

In the Knowledge Acquisition level,¹⁰ the goal is to enable teachers to support students of different abilities, ages, gender, and socio-cultural and linguistic backgrounds, to use ICT to be effective learners and productive members of society. Teachers should be aware of national development goals and how these correspond to education, and their role in achieving these ends.

Ideally, teachers should acquire basic digital literacy skills and knowledge to support relevant curriculum contexts. This will entail setting aside time within the traditional curricula for the incorporation of a range of relevant productivity tools and technology resources. Changes in pedagogical practice involve the use of various digital tools and digital content as part of whole-class, group and individual student activities.

Changes in teacher practice involve knowing where and when (as well as when not) to use technology for classroom activities and presentations, for management tasks, and for acquisition of additional subject matter and pedagogical knowledge in support of teachers' own professional learning.

Figure 2: The goals of Knowledge Acquisition



Little change in social structure of the classroom or learning environment occurs in this level, other than perhaps the placement and integration of technology resources in the classroom or in computer or ICT labs to ensure equitable access. In the early stages of development, teacher competencies related to the Knowledge Acquisition level include basic digital literacy skills and digital citizenship, along with the ability to select and use appropriate off-the-shelf educational tutorials, games, drill-and-practice software, and web content in labs or with limited classroom facilities in order to complement standard curriculum objectives, assessment approaches, unit plans and traditional teaching methods. Teachers should also be able to use ICT to manage classroom data and support their own professional learning.

II - Level: Knowledge Deepening

In the Knowledge Deepening level, the goal is to increase the ability of teachers to support students of different abilities, ages, genders, and socio-cultural and linguistic backgrounds, to apply knowledge to solve complex, high-priority problems encountered in real-world situations of work, society and everyday life.

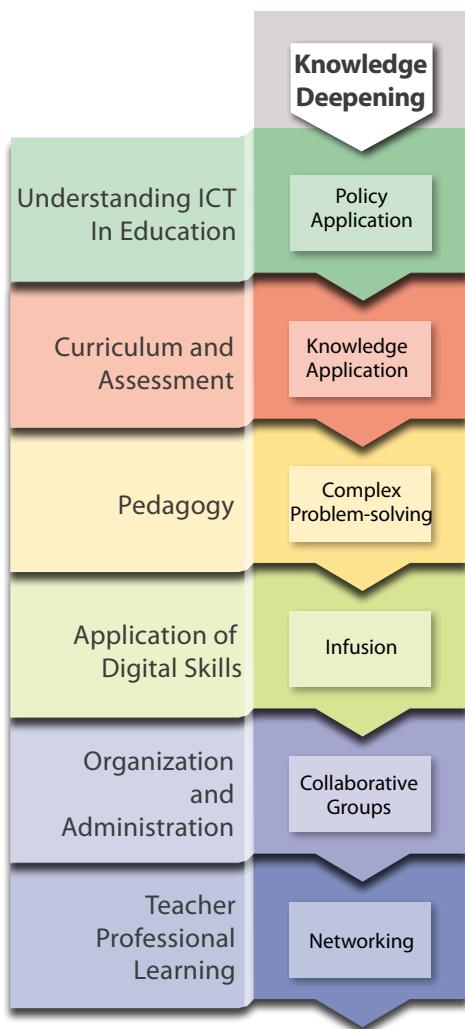
In this level, teachers identify how best to use ICT to support authentic learning and might tie real-world issues relating to the environment, food security, health, and conflict resolution to the requirements of the curriculum. Teachers should not only understand

¹⁰ This level was referred to in earlier versions of the ICT CFT as 'Technology Literacy' (TL). The term 'Knowledge Acquisition' has been adopted to align it with the other two levels: Knowledge Deepening and Knowledge Creation.

policy goals and social priorities but also be able to identify, design and use specific classroom activities that address these goals and priorities. This level often requires an interpretation of the curriculum that pays attention to the depth of understanding and the use of appropriate and contextually relevant assessment strategies.

The pedagogy associated with this level includes collaborative problem-solving and project-based learning, in which students explore a subject deeply and bring their knowledge to bear on complex, everyday questions, issues and problems.

Figure 3: The goals of Knowledge Deepening



In this level, teaching is student-centred and the teacher's role is to structure tasks, guide student understanding, and support students as they tackle collaborative projects. Teachers help students create, implement and monitor project plans and solutions. Lessons and classroom structure are more dynamic than in a conventional classroom setup or in the Knowledge Acquisition level, with students working in groups for extended periods. In guiding students' understanding of key concepts, teachers employ open-ended digital tools that are specific to their subject area, such as visualizations in science, data analysis tools in mathematics, and role-play simulations in social studies. Teachers are also able to access experts and collaborate with other teachers to support their own professional learning.

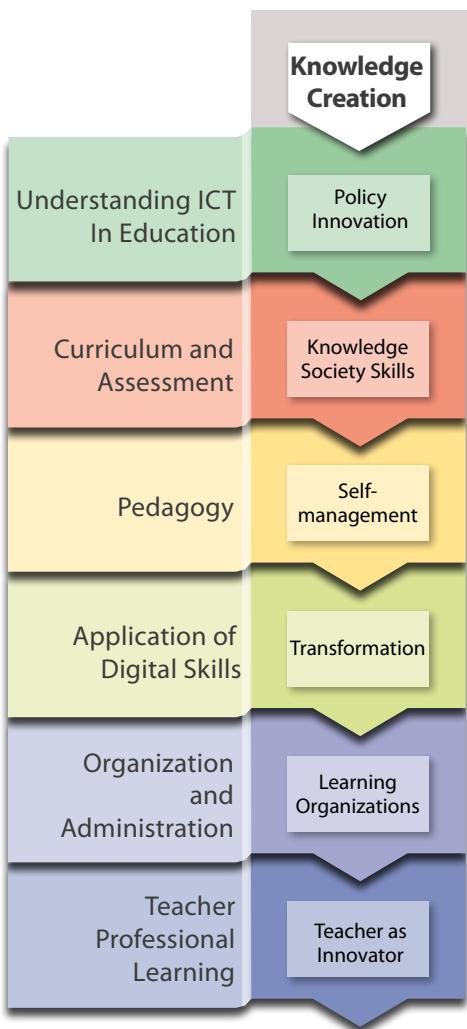
III - Level: Knowledge Creation

In the Knowledge Creation level, the goal is to enable teachers to engage in, and benefit from, knowledge creation, innovation and lifelong learning. Teachers should be able not only to design classroom activities that advance these goals but also to develop programmes to support them throughout the school environment and beyond.

In this level, the curriculum goes beyond a focus on school subjects to explicitly include Knowledge Society skills needed to create new knowledge, namely skills for: problem-solving, communication, collaboration, experimentation, critical thinking and creative expression. These skills become educational goals in themselves and often require new assessment methods.

Perhaps the most significant aim is for teachers to be able to create their own learning goals and plans – to establish what they already know, assess their strengths and weaknesses, design a learning pathway, stay on task, track their own progress, build on successes and adjust to failures, and be part of a peer-learning community. These are skills that can be used throughout a lifetime to participate in a learning society.

Figure 4: The goals of Knowledge Creation



The role for teachers is to overtly model these processes to students of different abilities, ages, genders, and socio-cultural and linguistic backgrounds, to structure situations in which students apply these skills, and to assist students in their own knowledge creation. Teachers build a learning community in the classroom in which students are continuously engaged in developing their own and one another's learning skills. Indeed, schools are transformed into learning organizations in which all the members are involved in learning. Teachers can then be seen as master students and knowledge facilitators and producers, who are constantly engaged in educational experimentation and innovation in collaboration with their colleagues and outside experts to produce new knowledge about learning and teaching practice. A variety of networked devices, digital resources and electronic environments are used to create and support this community in its production of knowledge and in its anytime-anywhere collaborative learning.

Teachers who are competent in the Knowledge Creation level will be able to design ICT-based learning resources and environments; use ICT to create knowledge and encourage students to think critically; support students' continuous, reflective learning; and create knowledge communities for students and colleagues. Teachers will also be able to play a leading role in creating and implementing a vision of their school as a community based on innovation and continuous learning, enriched by ICT.

2. Aspects

Each level shares six aspects that reflect the typical duties of a practising teacher, namely: Understanding ICT in Education Policy; Curriculum and Assessment; Pedagogy; Application of Digital Skills; Organization and Administration; and Teacher Professional Learning. Each level builds on skills and knowledge acquired in the previous level to allow teachers continual growth and development.

I - Aspect: Understanding ICT in Education Policy

This aspect encourages teachers to be aware of how ICT might be aligned to national education priorities as expressed within the policy environment. Teachers are encouraged to understand their significant role in preparing the next generation to be effective and productive members of society. At the Knowledge Acquisition level, teachers are made aware of ICT in Education policies. They are later encouraged to understand and apply policy directives within the Knowledge Deepening level, and then critique national education reform policies and suggest enhancements in the Knowledge Creation level.

II - Aspect: Curriculum and Assessment

This aspect explores how ICT might support the specific objectives as identified in the curriculum, and play a role in supporting assessment. This aspect initially demonstrates how ICT might offer benefits to teaching the curriculum and conducting assessment in the Knowledge Acquisition level, then encourages application of these tools in the Knowledge Deepening level and, ultimately, in the Knowledge Creation level, calls on teachers to reinterpret the curriculum to function effectively within a Knowledge Society and devise authentic assessment strategies to monitor development.

III - Aspect: Pedagogy

This aspect encourages teachers to acquire ICT skills to support effective teaching and learning methods. In the Knowledge Acquisition level, ICT is integrated into traditional teaching methods. While in the Knowledge Acquisition level teaching methods are often didactic in character, subsequent levels encourage teachers to take up alternative student-centred pedagogies – ideally project and problem-based methodologies that incorporate collaboration and cooperation.

IV - Aspect: Application of Digital Skills

This aspect is sizeable in the Knowledge Acquisition level because basic ICT skills are a prerequisite for integrating technology into a teacher's duties. The digital tools identified in the level are commonplace and popular, such as word processors, presentation packages, e-mail clients and social networking apps. However, the other levels tend to be less specific about which tools teachers deploy, allowing for the learning community to determine tools appropriate to the task at hand. In these subsequent levels, the *function of the digital tools – rather than the tools themselves – might be identified, to reinforce and enhance learning.*

V - Aspect: Organization and Administration

This aspect suggests ways to manage the school's digital assets as well as safeguard the people who use them. In the Knowledge Acquisition level, the emphasis is on organizing the physical environment, such as computer labs and classrooms, to support effective use of ICT for learning. In the subsequent levels, the emphasis moves to creating an environment to facilitate collaborative learning, turning the school into a learning organization, supporting learning outside the classroom and even building virtual learning environments that support flipped classrooms and pervasive education. This aspect also encompasses how teachers can support the development of ICT plans to actualize the school's technology strategy.

VI - Aspect: Teacher Professional Learning

The final aspect is designed to suggest ways that ICT can empower teachers to embark on lifelong professional development. Initially it looks at how teachers can develop their digital literacy and use ICT for their professional improvement. Subsequently, the emphasis is on how teachers can engage with educator networks and access resources. In the final level, the emphasis shifts to how teachers – as master students and knowledge producers – can innovate and model best practice, even acting as coach and mentor to their school colleagues.



Chapter IV

The UNESCO ICT CFT Version 3

Knowledge Acquisition

The goal of the Knowledge Acquisition level is to enable teachers to be effective and productive members of the school community and in turn support students to become engaged and productive members of society.

There are six teacher ICT competencies in this level. Teachers who have mastered the competencies in the Knowledge Acquisition level can:

1. articulate how their classroom practices correspond to and support institutional and/or national policy;
2. analyse curriculum standards and identify how ICT can be used pedagogically to support attainment of the standards;
3. make appropriate ICT choices to support specific teaching and learning methodologies;
4. identify the function of hardware components and common productivity software applications, and be able to use them;
5. organize the physical environment to ensure technology supports different learning methodologies in an inclusive manner; and
6. use ICT to support their professional development.

The following goals, objectives and example activities provide clarity as to what is entailed with each competency. The aim of this level is to provide a basic introduction to how ICT can be used to positively impact on all six aspects of a teacher's work.

Knowledge Acquisition

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 1 <i>Understanding ICT in Education Policy</i>	Policy Understanding. Teachers make connections between policy and classroom practices.	Articulate how their classroom practices correspond to and support institutional and/or national policy.	KA.1.a. Identify how policy implementation is shaping classroom practice.	Discuss institutional and/or national policies and common classroom practices. Identify those practices that support policy. Teachers identify and analyse their own classroom practices in terms of how their teaching practices contribute to policy implementation.
			KA.1.b. Identify the principles of using ICT in education in a safe and accessible manner.	Investigate the benefits, and also drawbacks, of using ICT in education. Identify appropriate ICT use to support and enhance their productivity, teaching methods, class administration and continuing professional development.
ASPECT 2 <i>Curriculum and Assessment</i>	Basic Knowledge. Teachers have a basic knowledge of the potential benefits of incorporating a range of relevant ICT resources and productivity tools into any subjects to support both teaching and learning and assessment.	Analyse curriculum standards and identify how ICT can be used pedagogically to support attainment of the standards.	KA.2.a. Match specific curriculum standards to particular software packages and computer applications and describe how these standards are supported by these applications.	Identify specific curriculum standards and identify software packages, digital tools and resources that support the attainment of these standards.
			KA.2.b. Search for and identify OER to support curriculum standards.	Search for OER, using both specialized and common search engines, and select open resources to teach specific curriculum standards.
			KA.2.c. Select ICT to support assessment strategies.	Identify how ICT can support different ways to assess students, such as portfolios, peer assessment, formative assessment and journal reflections. Teachers are introduced to dedicated e-assessment tools.

Knowledge Acquisition

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 3 <i>Pedagogy</i>	ICT-enhanced Teaching. Teachers integrate technologies, tools and digital content to support teaching.	Make appropriate ICT choices to support specific teaching and learning methodologies.	KA.3.a. Choose appropriate ICT solutions in teaching to support students' acquisition of subject knowledge.	Describe how the use of ICT can support and supplement existing classroom teaching. Teachers investigate how ICT can ensure the engagement of students of different abilities, ages, genders, and socio-cultural and linguistic backgrounds, offer higher levels of productivity, and provide greater professionalism to their teaching.
			KA.3.b. Devise lesson plans that incorporate ICT-supported activities to support students' acquisition of subject knowledge.	Author, share and comment on lesson plans that incorporate different roles for ICT. Lesson plans might foresee ICT providing tutorials and drill-and-practice exercises or providing access to a collection of accessible, multilingual digital resources to be manipulated and reinterpreted.
			KA.3.c. Use presentation software and digital resources to support instruction.	Demonstrate the use of presentation software and incorporate additional inclusive and accessible digital media such as audio, video, animations, and virtual and/or augmented reality to supplement subject content in an interesting and engaging way.
ASPECT 4 <i>Application of Digital Skills</i>	Application. Teachers use computers, mobile devices, accessible software, and networks for both teaching and learning and management purposes within a framework of 'safe use'.	Identify the function of hardware components and common productivity software applications, and be able to use them.	KA.4.a. Describe and demonstrate the use of common hardware.	Discuss and demonstrate the basic operation, and appropriate accessibility features, of various types of hardware, such as desktop computers, laptops, printers, scanners and mobile devices and appropriate accessibility features.
			KA.4.b. Create simple text documents using word processor software.	Demonstrate the basic function of a word processor and demonstrate how this software can be used in a lesson for different abilities of students.

Knowledge Acquisition

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 4	Application. Teachers use computers, mobile devices, accessible software, and networks for both teaching and learning and management purposes within a framework of 'safe use'.	Identify the function of hardware components and common productivity software applications, and be able to use them.	KA.4.c. Create simple presentations.	Discuss the purpose of presentation software for education, and demonstrate general features and functions. Create a presentation on a topic of choice.
			KA.4.d. Create simple graphics.	Demonstrate proficiency by creating a graphic that can be used as a teaching aid.
			KA.4.e. Navigate the Internet.	Discuss the purpose and structure of the Internet and the World Wide Web. Use a browser to access popular websites using URLs to navigate the web.
			KA.4.f. Understand the basic principles of cyber safety/security and media and information literacy.	Demonstrate knowledge of good practices of cyber security and media and information literacy. Ensure safe use of social media and mobile devices.
			KA.4.g. Use a search engine to find curriculum resources.	Demonstrate the use of a search engine using simple keyword searches to find subject-related resources. Discuss and consider which keyword strategies elicit the best search results.
			KA.4.h. Create an e-mail account and use it in their daily activities.	Create and use an e-mail account to send and reply to e-mail. Attach digital documents to e-mail messages. Demonstrate e-mail functionality on mobile devices.
			KA.4.i. Identify and use drill-and-practice software to support learning.	Analyse the effectiveness of tutorial and drill-and-practice packages, in supporting the acquisition of specific subject matter knowledge. Online software can monitor student usage. Big data can be harnessed to give insights into how students learn.

Knowledge Acquisition

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
			KA.4.j. Identify and evaluate educational software and web resources, and match them to curriculum standards and students' needs.	Search the Internet to identify appropriate digital resources and tools for specified learning objectives or standards, and analyse these packages for accuracy and curriculum alignment. Discuss the criteria used for analysing and evaluating the digital tools and resources, and their suitability for different learning styles and abilities. Discuss assistive technologies enabled by AI for persons with disabilities.
			KA.4.k. Use record-keeping software to keep student records.	Discuss the purposes and advantages of a digital record-keeping system, and demonstrate the use of such a system to record, for example, marks, attendance, and merit points. Algorithms in software using AI can assist with schedules and marking of simple tests.
			KA.4.l. Use communication and collaboration technologies, including mobile technologies.	Discuss the purposes and advantages of various communication and collaboration technologies. Use these technologies to communicate and collaborate with other teachers.
			KA.4.m. Use social networks to communicate with the wider learning community.	Strategize and use social networking apps to incorporate teachers, students, parents and other interested parties into a wide support group.
			KA.4.n. Troubleshoot ICT problems when technology fails, to ensure minimal disruption to lessons.	Diagnose common ICT problems – such as lack of power, dropped connectivity, and failed logins – and perform minor maintenance, such as setting up anti-virus utilities.

Knowledge Acquisition

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 5 <i>Organization and Administration</i>	Standard Classroom. Where helpful and appropriate, teachers adjust the spatial placement of the classroom or lab to integrate ICT into the lesson, promoting an inclusive learning environment.	Organize the physical environment to ensure technology supports different learning methodologies in an inclusive manner.	KA.5.a. Organize students and ICT in a learning environment to support teaching and learning. KA.5.b. Support small groups and individuals – including those of different abilities, ages, genders, and socio-cultural and linguistic backgrounds – to use digital devices in the classroom. KA.5.c. Identify appropriate technologies, including mobile devices, and pair with corresponding social arrangements to support learning goals. Identify why challenges to ensuring access to technology are affected by factors such as gender and ability. KA.5.d. Monitor and protect hardware and software in the school environment.	Coordinate student learning where each student has access to a computer or device and in contexts where students must share computers. Keep in mind any individualized technology needs to ensure all can engage with the learning. Coordinate student group work where not all students have access to a digital device but work collaboratively to achieve learning objectives. Coordinate students and technology to support learning outside of the classroom or school, such as in the community, homework activities or online learning environments. Install and update anti-virus software and accessibility features, audit and track computer equipment, and monitor the security of classrooms, laboratories and other places where computer equipment is stored. Investigate how the Internet of Things might allow tracking and monitoring of devices and entry access.

Knowledge Acquisition

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 6 <i>Teacher Professional Learning</i>	Digital Literacy. Teachers develop digital literacy and use ICT for professional improvement.	Use ICT to support their professional development.	<p>KA.6.a. Develop professionally by acquiring ICT skills to improve productivity.</p> <p>KA.6.b. Develop professionally within subject areas by using ICT to acquire subject resources and discover new teaching strategies.</p> <p>KA.6.c. Identify and manage Internet conduct and safety issues.</p> <p>KA.6.d. Model the principles of digital citizenship.</p> <p>KA.6.e. Analyse and evaluate digital teaching resources.</p>	<p>Use digital tools to save time and ease administrative tasks such as reporting, record-keeping and timetabling. Software can assist in streamlining these processes. Also use digital channels to enhance communication with management, colleagues, parents, students and other stakeholders.</p> <p>Use ICT to identify up-to-date teaching and learning resources. Interact with other teachers via online channels and social networks to consider alternative teaching strategies – in particular to ensure inclusion, diversity, participation and openness.</p> <p>Discuss and develop appropriate strategies to deal with cyberbullying. Ensure appropriate behaviour and actions when interacting with others online. Identify the origins and impact of viruses, scams, spam, cookies and pop-up adverts. Manage confidentiality of personal data and know what to do when confronted with inappropriate content. These abilities will be important in both computer and mobile learning environments.</p> <p>Model suitable practice when online, particularly in the areas of communication, etiquette, observing the law, protection of self and students, ensuring health and wellness, and observing rights and responsibilities.</p> <p>Evaluate the suitability of digital teaching and learning resources, particularly in terms of 'authority', 'purpose', 'coverage', 'currency', 'objectiveness' and 'accuracy'. Make use of OER and social networks to find resources.</p>

Knowledge Deepening

The goal of the Knowledge Deepening level is to enable teachers to apply ICT to improve their effectiveness in all aspects of their profession, within their given context. Within teaching and learning they will support students to apply knowledge to solve complex, high-priority problems encountered in real-world situations.

There are six teacher ICT competencies in this level. Teachers who have mastered the competencies in the Knowledge Deepening level can:

1. design, modify and implement classroom practices that support institutional and/or national policies, international commitments (e.g. UN Conventions), and social priorities;
2. integrate ICT across subject content, teaching and assessment processes, and grade levels, and create a conducive ICT-enhanced learning environment where students, supported by ICT, demonstrate mastery of curriculum standards;
3. design ICT-supported project-based learning activities and use ICT to facilitate students to create, implement and monitor project plans, and solve complex problems;
4. blend varied digital tools and resources to create an integrated digital learning environment to support students' higher-order thinking and problem-solving skills;
5. use digital tools flexibly to facilitate collaborative learning, manage students and other learning partners, and administer the learning process; and
6. use technology to interact with professional networks to support their own professional development.

The following goals, objectives and example activities provide clarity as to what is entailed with each competency.

Knowledge Deepening

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 1 <i>Understanding ICT in Education Policy</i>	Policy Application. Teachers apply policies in designing classroom practices that implement national policies and address high-priority problems.	Design, modify and implement classroom practices that support institutional and/or national policies, international commitments (e.g. UN Conventions), and social priorities.	KD.1.a. Apply principles of ICT in Education as expressed in policy in their own teaching. Analyse what issues arise in implementing these principles and how these issues can be addressed.	Consider what issues arise when attempting to implement national ICT in Education policy principles in a school setting. Identify potential solutions to barriers.
ASPECT 2 <i>Curriculum and Assessment</i>	Knowledge Application. Teachers support students to apply curriculum content, create assessments to solve real-world problems and set social priorities.	Integrate ICT across subject content, teaching and assessment processes, and grade levels, and create a conducive ICT-enhanced learning environment where students, supported by ICT, demonstrate mastery of curriculum standards.	KD.2.a. Use ICT appropriately to achieve curriculum standards.	Select and apply appropriate digital tools to support curriculum standards, such as using a word processor's grammar checker to encourage student reflection on language construction, accessibility checkers and translation tools, and using animated or AR simulations in science to encourage student manipulation of variables to appreciate impact.
			KD.2.b. Develop and apply knowledge- and performance-based rubrics to assess students' understanding of subject matter concepts, skills and processes.	Using a word processor, spreadsheet or online rubric tool, design and create a rubric that provides guidance in assessing student responses across at least four levels of sophistication.
			KD.2.c. Harness ICT to support alternative assessment strategies, including portfolios, graphic organizers, review and reflection tools, and peer assessment.	Design and create an assessment strategy that uses alternative assessment methods (in addition to tests and examinations) and exploits digital tools and platforms; for example, e-portfolio storage, and peer assessment platforms and learning styles.
			KD.2.d. Adapt OER to support local contexts and curriculum standards.	Search on the Internet for OER, analyse the suitability of the resources for new contexts by applying quality criteria, and adapt them to support learning.

Knowledge Deepening

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 3 <i>Pedagogy</i>	<p>Complex Problem-solving.</p> <p>In collaborative, project-based learning, students explore a subject deeply and bring their knowledge to bear on complex, everyday questions, issues and problems.</p>	<p>Design ICT-supported project-based learning activities and use ICT to facilitate students to create, implement and monitor project plans, and solve complex problems.</p>	<p>KD.3.a. Describe how ICT can support project-based learning.</p>	<p>Describe how different technologies – appropriate for different grades and subjects – can support project-based learning tasks, such as student research, group communication, and presentation of findings.</p>
			<p>KD.3.b. Identify a real-world problem to support project-based learning.</p>	<p>Discuss characteristics of authentic problems that incorporate key concepts; examine examples of such problems; and have students generate examples, such as the need to improve crop productivity, to market a product, or to ensure gender equality in programmes.</p>
			<p>KD.3.c. Identify and evaluate resources that support project-based learning.</p>	<p>Analyse online materials to identify key features of the materials that support deep understanding. For example, do the resources offer alternative perspectives for the students to debate and research? Might the collection by students and analysis of big data be appropriate to solve their particular problem?</p>
			<p>KD.3.d. Design learning activities to engage students in reasoning with, collaborating on, and solving real-world problems.</p>	<p>Design student activities that allow students to collaborate to identify solutions to a real-world problem. Identify technology that can support these activities, such as the use of mobile technologies and social networking groups to encourage discussion and access to outside expertise. Use public spaces such as libraries and museums. Alternatively, encourage students to work together to write code to provide a solution to a specific community challenge, for example the need for more efficient traffic lights.</p>

Knowledge Deepening

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
			KD.3.e. Structure lesson plans and learning activities that describe project-based learning.	Synthesize project-based learning ideas into a lesson plan. Identify how the lesson will be launched, how students will initially be confronted with the problem, how they will access resources, how they will engage with activities, what the final output will be, and how students will be assessed.
			KD.3.f. Implement collaborative, project-based lesson plans, and provide guidance to students towards the successful completion of their projects.	Implement and facilitate a problem-based learning initiative where the teacher supports and guides student-centred learning, taking into account considerations of different abilities, ages, genders, and socio-cultural and linguistic backgrounds.
ASPECT 4 <i>Application of Digital Skills</i>	Infusion. Teachers employ open-ended technology tools to understand and teach key concepts.	Blend varied digital tools and resources to create an integrated digital learning environment to support students' higher-order thinking and problem-solving skills.	KD.4.a. Operate software packages that are appropriate to subject areas to encourage higher-order thinking in students.	Use specialized packages that are appropriate to the subject matter and that support visualization, data analysis, role-play and simulations. Use virtual and augmented reality (VR and AR) to support simulations.
			KD.4.b. Evaluate the accuracy and usefulness of web resources and web-based tools in support of subject areas.	Evaluate the suitability of digital teaching and learning resources. Consider if the resources and digital tools are really useful in supporting the curriculum standards, or are acting as a distraction.
			KD.4.c. Use authoring tools to design curriculum materials.	Author teaching and learning resources using software ranging from popular productivity suite programmes to specialized web applications.
			KD.4.d. Use school management software.	Capture marks, generate reports and keep attendance records using school or project management software.

Knowledge Deepening

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
			<p>KD.4.e. Use digital communication tools to support student collaboration within and beyond the classroom.</p> <p>KD.4.f. Use interlinked digital devices to establish a network comprising students and the teacher, allowing them to share digital resources and work collaboratively on lesson activities.</p> <p>KD.4.g. Source and evaluate digital tools to support students with disabilities and sociolinguistic minorities, and ensure gender equality in the delivery of education.</p>	<p>Use technology to interact with students when not in the classroom. Tools such as social networking groups, the school intranet and bulk texting can be used to support learning after school hours by sharing resources, alerting students to assignment deadlines, and responding to requests for help on homework.</p> <p>Use interactive white boards that share their content and resources with student devices and allow students to volunteer information back to the white board. This can be achieved using 'clickers' and/or the board's built-in sharing functionality linking student mobile phones and tablets.</p> <p>Identify and use technology tools that can support students with disabilities. This includes assistive technologies such as text-to-speech utilities, open-source accessibility options and vibrating and flashing alerts. AI facilitates a growing variety of accessibility tools for students with disabilities.</p>
ASPECT 5 <i>Organization and Administration</i>	Collaborative Groups. Class periods and classroom structure are more dynamic, with teachers facilitating collaboration and use of digital resources.	Use digital tools flexibly to facilitate collaborative learning, manage students and other learning partners, and administer the learning process.	KD.5.a. Access, evaluate and disseminate digital resources to support student-centred learning activities and social interactions.	Organize technology so that it can best support student needs – including those with different abilities, ages, genders, and socio-cultural and linguistic backgrounds – when they are working on activities that require them to research, debate, collaborate and create. Consider whether all the students in a group need access to technology or if one or two devices would suffice. Also consider if students will need technology when they are on the move.

Knowledge Deepening

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
			KD.5.b. Manage student project-based learning activities in a technology-enhanced environment.	Organize technology to support collaborative student activities that also provide evidence of engagement. Use technology, such as a learning management system (LMS), social media or blogging, to provide students with a platform for interaction.
			KD.5.c. Access, evaluate, organize and disseminate digital resources to support students with disabilities.	Determine how to organize assistive technologies and tools in different learning environments so that students with disabilities will have access to them. Consider how speech-to-text utilities might be reconfigured to work on mobile devices to support students. AI enables new technology and accessibility tools for persons with disabilities.
			KD.5.d. Devise an ICT integration strategy for their subject/department.	Reflect and create a vision of and strategy for how technology might be better used for the subject/department/grade. Consider how technology can be organized to better support teaching, learning and administration. What are the technology gaps that are barriers to achieving the vision? What staff skills need to improve to achieve this?
			KD.5.e. Set up digital communication mechanisms so that the school can disseminate information to the wider school community.	Canvass the wider school community to determine which digital tools are popular. Communication tools could include bulk texting, group e-mails and the use of social media. Create and maintain such a channel.

Knowledge Deepening

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 6 <i>Teacher Professional Learning</i>	Networking. Teachers use ICT to access resources and develop professional networks.	Use technology to interact with professional networks to support their own professional development.	KD.6.a. Use ICT networks to access and share resources that support professional development goals.	Search for and engage with dedicated national, regional and global teacher professional development networks that connect teachers and encourage sharing of expertise and resources.
			KD.6.b. Use ICT networks to access external experts and learning communities to support professional development goals.	Develop a personal learning network that includes following education experts on popular social networks, as well as organizing a network of local teachers who share interests.
			KD.6.c. Use professional networks to access, analyse and evaluate professional learning opportunities.	Search for and participate in online training courses and communities that offer professional development opportunities. Consider podcasts, webinars, portals, blogs, and massive open online courses (MOOCs) that offer teacher education courses, and accredited courses offered by local higher education institutions.

Knowledge Creation

The goal of the Knowledge Creation level is to capacitate teachers to create Knowledge Societies for students, school colleagues and the community. These teachers model good practice and encourage others.

1. There are six teacher ICT competencies in this level. Teachers who have mastered the competencies in the Knowledge Creation level can:
 2. critique institutional and national education policies alike, suggest revisions, design improvements and speculate on the impact of these changes;
 3. determine how best to incorporate student-centred and collaborative learning to ensure mastery of multidisciplinary curriculum standards;
 4. while determining learning parameters, encourage student self-management in student-centred and collaborative learning;
 5. design knowledge communities and use digital tools to support pervasive learning;
 6. play a leadership role in devising a technology strategy for their school to turn it into a learning organization; and
 7. continually develop, experiment, coach, innovate, and share best practice to determine how the school can best be served by technology.

The following goals, objectives and example activities provide clarity as to what is entailed with each competency

Knowledge Creation

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 1 <i>Understanding ICT in Education Policy</i>	Policy Innovation. Teachers and school staff are active participants in the evolution of education reform policy.	Critique institutional and national education policies alike, suggest revisions, design improvements and speculate on the impact of these changes.	KC.1.a. Design, implement and modify school-level education reform programmes.	In collaboration with other staff members, design and implement a series of initiatives designed to bring the school in line with the national vision as articulated in ICT and education policies.
			KC.1.b. Reflect on implications of reform policies and the potential impact of these.	Reflect and articulate in writing what needs to change in order for ICT and education policy directives to be carried out. What needs to happen to ensure compliance? What are the implications of doing this at school and national levels?
			KC.1.c. Suggest improvements to existing national education reform policies.	Critique national ICT and education policies and draft recommendations on how components of these might be updated and improved to fully exploit new developments in the area of ICT and education.

Knowledge Creation

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 2 <i>Curriculum and Assessment</i>	Knowledge Society Skills. The curriculum goes beyond a focus on knowledge of school subjects to explicitly include Knowledge Society skills such as problem-solving, communication, collaboration, and critical thinking. Teachers support students to determine their own learning goals and plans. Assessment is itself a part of this process; students are able to assess the quality of their own and one another's products.	Determine how best to incorporate student-centred and collaborative learning to ensure mastery of multidisciplinary curriculum standards.	KC.2.a. Analyse the curriculum standards to identify opportunities where students can master Knowledge Society skills and complex cognitive skills, taking into account learning styles, abilities and sociolinguistic skills.	Analyse the curriculum of allied subjects and determine which standards best support student problem-solving, critical thinking, collaboration, information management and creativity, and how they could be combined across subjects. If students are learning to write code, identify where coding projects would link the complex cognitive skills with Knowledge Society skills.
			KC.2.b. Guide students to make sound ICT choices and acquire the appropriate skills to search for, manage, analyse, evaluate and use information relevant to the curriculum.	Ensure students have media and information literacy skills and appropriate digital tools to process information to support study across subjects. Students need to be able to synthesize their findings across disciplines. Consider a research project that encourages student teams to research different elements of a topic and then develop a graphic display, an app or a web page showing the intersection of their findings.
			KC.2.c. Guide students to make appropriate ICT choices to achieve curriculum standards that support reasoning, planning, reflection and knowledge building.	Analyse the curriculum of allied subjects and determine which standards best support student reasoning, planning, reflection and knowledge building. Consider webquests or opportunities for students to research and build mini tutorials aimed at teaching their peers.
			KC.2.d. Guide students to use ICT to achieve curriculum statements that support the development of communication and collaboration skills.	Analyse the curriculum of allied subjects and determine which standards best support student communication and collaboration. Consider encouraging student groups to script and create videos on topics that cut across subjects.
			KC.2.e. Help students develop assessment strategies to test their own understanding of key subject matter and ICT skills, including peer assessment.	Devise a strategy to encourage students to see the benefits of formative assessment. Introduce the journal or blog as such a reflective device, and encourage students to probe and comment on one another's entries.

Knowledge Creation

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 3 <i>Pedagogy</i>	Self-management. Students work in a learning community in which they are continually engaged in creating knowledge products and building upon their own and one another's knowledge and skills.	While determining learning parameters, encourage student self-management in student-centred and collaborative learning.	KC.3.a. Explicitly model their own reasoning, problem-solving and knowledge creation while teaching students.	Model – and ask students to emulate thoughtfulness, curiosity, creativity, good interpersonal skills and self-regulation – when coordinating students involved in collaborative group work.
			KC.3.b. Design online materials and activities that engage students in collaborative, problem-solving research.	Devise a set of activities that task students to work together to produce a digital product or artefact or develop a virtual environment. Support teams of student research and curate a web-based, VR or AR exhibition. Alternatively, students can be required to create a series of infographics on curriculum topics.
			KC.3.c. Help students design project plans and activities that engage them in collaborative, problem-solving research or artistic creation.	Plan a lesson, prior to a big project, to provide students with organizational skills. Encourage students to develop project plans with activities, timelines, milestones and allocation of responsibilities for each project team member.
			KC.3.d. Help students create digital media resources that support their learning and interaction with other audiences.	Identify and alert students to media tools that might prove useful for their projects. Consider mobile apps to edit photographs and video, graphics packages that support the design of infographics, website builders, and alternative publishing options to reach a wide audience.
			KC.3.e. Help students reflect on their own learning.	Devise a set of milestone activities within a project that encourage students to reflect on their learning processes. Consider student blogs or video diaries for recording and sharing reflective experiences.

Knowledge Creation

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 4 <i>Application of Digital Skills</i>	Transformation. Teachers and students use various networked devices, digital resources and electronic environments to produce knowledge and collaborative learning.	Design knowledge communities and use digital tools to support pervasive learning.	KC.4.a. Create an online learning environment to support pervasive learning.	Assemble and integrate a set of technologies to support student learning that can function outside the classroom. Consider using an LMS to create a basis for online activities, or identify social networks to perform this function.
			KC.4.b. Use digital tools to support online collaboration between students and members of the knowledge community.	Identify and set up digital tools that encourage collaboration. Consider incorporating online word processors, interactive boards and live video feeds, and presentation packages and spreadsheets that allow multiple developers to work on the same document, or find a free wiki platform that allows multiple users to create websites. Mobile technologies could be especially useful to achieve this objective.
			KC.4.c. Use digital tools to track and evaluate student contributions to learning in the knowledge community.	Identify and use online tools to monitor student contributions to learning. Consider using platforms that offer AI-enabled diagnostic tools, such as an LMS, to provide statistics measuring student engagement. Big data can enable insight into student interactions.
			KC.4.d. Encourage students to develop their own digital tools to support learning.	Encourage student-developers to create their own hardware and software. Consider using available hardware and software programmes to encourage students to code new software.

Knowledge Creation

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 5	Learning Organizations. Schools are learning organizations in which all actors are involved in the learning process.	Play a leadership role in devising a technology strategy for their school to turn it into a learning organization.	KC.5.a. Organize digital knowledge-building environments to enhance teaching and learning.	Experiment with and evaluate different knowledge-building technology options and determine the implications for the school in adopting each. Evaluate tools and platforms such as an LMS, social networking groups and collaborative writing platforms.
			KC.5.b. Identify and set up digital planning tools to support organization and administration of schools.	Evaluate school management software. Determine the implications for the school, and thus the suitability, in terms of cost, staff development and infrastructure needs. Can AI-supported software assist with streamlining these processes?
			KC.5.c. Devise a strategy to implement a school-wide technology integration plan.	Lead or advise management in the development of a strategy to manage school ICT. Consider developing an ICT budget, auditing existing ICT equipment, projecting future ICT needs, creating a maintenance strategy, and determining staff training requirements and what support the wider community could provide. Can radio-frequency identification (RFID) or similar technology assist with monitoring hardware and access control?
			KC.5.d. Foster a reciprocal flow of information between all school stakeholders via school communication channels.	Evaluate school communication channels between stakeholders and enhance the mechanism to ensure information flows both to and from the school.

Knowledge Creation

	CURRICULAR GOALS FOR TEACHER TRAINING	TEACHER COMPETENCY (Teachers can ...)	OBJECTIVES (Teachers should be able to ...)	EXAMPLE ACTIVITIES
ASPECT 6 <i>Teacher Professional Learning</i>	Teacher as Innovator. Teachers are themselves master students and knowledge producers who are engaged in innovation to produce new knowledge about learning and teaching practice.	Continually develop, experiment, coach, innovate, and share best practice to determine how the school can best be served by technology.	<p>KC.6.a. Support the process of implementing a vision of what their school might be like when ICT is implemented in the curriculum and classroom practices.</p> <p>KC.6.b. Foster innovation by promoting continuous learning among colleagues.</p> <p>KC.6.c. Continually evaluate and reflect on professional practice to promote innovation and improvement.</p> <p>KC.6.d. Share and discuss best practices in teaching via professional communities.</p> <p>KC.6.e. Licence and distribute their original teaching resources as OER.</p>	Identify and support the implementation of the school ICT strategy. Collect and analyse data to develop an ICT strategy. Showcase to peers and management the benefits of collecting and interpreting data using a school management system or other databases. Devise and offer a series of professional development initiatives aimed at supporting colleagues in the acquisition of skills to exploit technology, with the aim of enhancing teaching and learning. Alternatively, recruit groups of staff members to work together through online professional development courses. Organize staff development initiatives where colleagues present innovative teaching strategies they either intend to implement or have implemented, and encourage discussion and reflection. Showcase innovative school practice to groups outside the school through online professional groups or through national teacher competitions. Share exemplary teaching and learning resources – such as lesson plans, worksheets, lab notes and tests – with the wider education community by releasing these resources with an open licence.



Chapter V

Implementation Examples and Resources

Introduction

General principles for teacher education should be considered when contextualizing and implementing the ICT CFT. Teachers professional development in ICT competencies should be recognized as a process rather than an isolated training event. One-off training workshops or events are less effective than on-going professional development activities. The ICT CFT is a tool that can be integrated into the sustained support for teachers' lifelong development of ICT competencies, and be used to streamline the process of the pre- and in-service teacher education. It follows, therefore, that effective teacher professional development should model effective teaching practices. It is advised that the training settings and professional development practices approximate the classroom environment to the greatest extent possible. Hands-on instruction and examples on pedagogical use of ICT is necessary to demonstrate how ICT could be used as vital tools in teaching and in facilitating learning process. In addition, professional development activities should encourage and support collaboration between teachers.

A review of the 2011 version of the ICT CFT undertaken in 2016 identified the following common uses of the framework:

1. influencing ICT in Education policy creation;
2. influencing national teacher standards;
3. providing assessment criteria to determine levels of teacher ICT competence;
4. shaping teacher curriculum design; and
5. designing teacher professional development courses.

Feedback from users of earlier versions of the ICT CFT identified the absence of examples and a suggested implementation guide as a problem. There is now, however, plenty of evidence of how the ICT CFT has been used across the globe. This chapter provides a number of implementation examples.

UNESCO has always maintained that the ICT CFT should be seen as a 'starting point' – a reference work designed to guide and suggest – rather than as a fixed, set of directives; and has always encouraged others to adapt and expand it as they see fit. This is underscored by publishing the current version of the ICT CFT under an open licence, encouraging repurposing. The examples in this section provide an overview of how the ICT CFT has been used by governments and institutions worldwide.

The chapter concludes with information on the OER Commons searchable repository of open courseware resources that are indexed according to the ICT CFT competencies and objectives.

1. Influencing ICT in Education Policy Creation

The ICT CFT has influenced the development of ICT in Education policy documents. Some national policies even mention the ICT CFT explicitly. For example, this excerpt from the Latin America and the Caribbean (LAC) region published in 2014 states:

The adoption of an established acceptable ICT in Education and Training set of standards or ICT competencies for teachers across all levels and stages. To this end the UNESCO ICT Competency Framework for Teachers (CFT) will be considered to guide the professional development of educators. The Framework encourages training beyond basic ICT skills and addresses issues of policy, curriculum, assessment, pedagogy, organisation and professional development at three levels deepening sophistication.

Professional development of teachers to focus on all teachers of all subjects and all levels to ensure effective ICT use from the early childhood level. The UNESCO ICT CFT to be used as a framework to govern both pre-service training and continuing professional development (CPD), to ensure that there are pathways for ongoing capacity building and refresher courses.

An example drawn from a different national policy (published in 2013), also identifies the ICT CFT explicitly and, like the policy above, advocates use of the ICT CFT to shape development of both in- and pre-service professional development training:

Using the UNESCO ICT CFT, the Ministry of Education, Sports, Youth, and Gender Affairs will seek to align and integrate all relevant current professional development courses in the country into a broader national framework of competence. This will include courses offered by the [local university], the Ministry itself (through the Teacher Education Department and Curriculum Development Unit), and other support agencies such as the Commonwealth of Learning. Where necessary, existing courses will be reviewed to ensure alignment with the UNESCO ICT CFT.

2. Influencing National Teacher Standards

The ICT CFT has, since 2011, impacted on the development of ICT in Education teacher standards created to support the implementation of policy directives. These standards identify ICT skills and competencies for which teacher training institutions, and in-service professional development initiatives, are encouraged to develop programmes. The ICT CFT has been seen as a starting point by those tasked with developing a set of localized standards, as it provides a comprehensive list of ICT in Education competencies that spans more than just teaching and learning, including also school administration, classroom organization and lifelong learning. Examples below show how the ICT CFT has been used in the development of standards.

In 2013, a Ministry of Education from the LAC Region released a report in which the introduction references the role played by the 2011 version of the UNESCO ICT CFT. The influence of the ICT CFT is evident, as the localized standards have a structure reminiscent of the ICT CFT but have been reworked to better suit local teachers. There are three levels of sophistication (Exploration, Integration and Innovation) and five educational aspects (Pedagogy, Communication, Management, Research and Technology), as shown in Table 1.

Table 1: Scope of professional development standards for ICT competencies for teachers using the ICT CFT as a starting point

COMPETENCIES	LEVEL COMPETENCY		
	EXPLORATION	INTEGRATION	INNOVATION
Technology Ability to select and use a variety of technological tools for relevant, responsible and efficient purposes, understanding the principles that govern them, how to combine them and licenses that restrict their use.	Recognizes a wide range of technological tools and some ways of integrating them in educational practice.	Uses various technological tools in education, according to his/her role, curriculum area, level and context in which he/she works.	Uses his/her knowledge of a wide variety of technologies for the design of innovative learning environments and to find solutions for problems identified in the context.
Communicative Ability to communicate, contact and engage in virtual and audio-visual spaces through various means and handling multiple languages, synchronously and asynchronously.	Uses various channels and languages associated to ICT to communicate with the educational community.	Develops collaborative work strategies in the school drawing on his/her experience participating in ICT based networks and communities.	Participates in communities and publishes his/her products in different virtual spaces taking advantage of multiple digital supports, using languages enabled by ICT.
Pedagogical Ability to use ICT to support teaching and learning processes, recognizing the possibilities and limitations of the incorporation of these technologies in students' development process and in his/her own professional development	Identifies new strategies and methods mediated by ICT, as a tool for his/her professional work.	Suggests projects and learning strategies using ICT to foster students' learning.	Leads significant experiences that involve differentiated learning environments according to the students' needs and interests.
Management Ability to use ICT for effective planning, organization, administration and evaluation of educational processes, both in terms of teaching practices and institutional development.	Organizes activities of his/her professional work with the use of ICT.	Incorporates ICT to improve the management, academic, administrative and community related processes of his/her institution.	Suggests and leads actions to improve integrated processes of school management.
Research Ability to use ICT to transform knowledge and generate new knowledge.	Uses ICT to record and track what he/she lives and observes in his/her practice, context and of his/her students.	Leads his/her own research projects and those of his/her students	Develops innovative educational strategies that include collective knowledge generation.

Released in 2011, another example of a contextualized ICT CFT was developed by a Ministry responsible for Education from the Africa Region. It draws inspiration from the earlier (2008) version of the UNESCO ICT CFT. While this framework is closely aligned to the ICT CFT, keeping the structure and most of the competencies, contextualization included adding a further developmental level, called 'Emergent' (for 'Beginning Teachers'), to those offered by the ICT CFT. The other three levels were named 'Technology Literacy' (for 'Applying Teachers'); 'Knowledge Deepening' (for 'Proficient Teachers'); and 'Knowledge Creation' (for 'Transformative Teachers'), and most of the competencies were rephrased (see Table 2).

Table 2: Excerpt from a contextualized ICT CFT

		EMERGENT	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION	
COMPETENCY DOMAINS AND SUBDOMAINS		PERFORMANCE INDICATORS. TEACHERS...	BEGINNING. TEACHERS ...	APPLYING. TEACHERS ...	PROFICIENT. TEACHERS ...	TRANSFORMATIVE. TEACHERS ...
Policy & Vision	Policy Awareness	research, evaluate and support school and national policy and vision for ICT integration across all subject areas	identify and evaluate local, national and global vision 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 and	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	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 (I.A.1.) (national and/ or school policies for ICT integration across all subject areas)	identify key concepts and processes in content areas; describe the function and purpose of simulations, visualizations, data collection tools and data analysis software and how they support student understanding of these key concepts and processes and their application to the world outside the classroom (II.A.1)	design, implement, and modify school/ institutional level education reform programmes that implement key elements of national education reform policies (III.A.1.) (using technology to support reform)

Note: Enumerated statements refer to competencies in the UNESCO ICT CFT.

However, the contextualized ICT CFT maintains its links to the original to ensure the relationship between the two is explicit. This is done by quoting the ICT CFT objective codes. This contextualized ICT CFT was used to shape professional development initiatives in two African countries.

The contextualization and adaptation of the ICT CFT is quite common and has occurred in many countries, according to the 2016 UNESCO ICT CFT review; the development of localized and contextualized ICT in Education standards was a commonly reported usage of the UNESCO ICT CFT. Those tasked with developing local standards reported that the ICT CFT was a good starting point for their own contextualization efforts because it offers an expert opinion backed by a recognizable, respected organization. The ICT CFT also provides concrete examples of competencies and is easily adaptable.

3. Providing Assessment Criteria to Determine Levels of Teacher ICT Competence

The ICT CFT is being used to provide criteria when assessing national levels of teacher ICT competence or undertaking an analysis of training initiatives.

In the Africa Region, researchers used an adapted version of the ICT CFT in a study that measured national levels of teacher ICT competence and professional development training options. The research findings indicated that teacher in-service training initiatives were targeting only the lowest levels of ICT competencies (corresponding to the Knowledge Acquisition level of the ICT CFT). Consequently, any future training plan should aim at the competencies corresponding to the higher levels of the framework. As a result of the research, teacher training initiatives began targeting high-level skills based on the 'Knowledge Deepening' and 'Knowledge Creation' levels.

A 2013 initiative in the Asia and Pacific Region, designed by the country's Ministry of Education, implemented a one-student-one-computer model in twelve selected schools around the country. The ICT CFT competencies were used to prepare an instrument for evaluation of teachers' readiness for the project during its preparatory phase.

A component of an ICT in Education teacher professional development initiative in the Europe and North America Region includes an online self-assessment tool. It allows teachers to assess their levels of ICT competence and ability to innovate. The tool also acts as a mechanism to encourage teachers to move through the different levels of the programme. The ICT CFT was used to identify relevant areas and sub-areas and to suggest 'concrete' competency descriptors, particularly around 'teaching with ICT (pedagogical competence)'.

4. Shaping Teacher Curriculum Design

Going a step further from the development of standards and determining skill levels is the development of a curriculum to support the acquisition of the competencies identified in standards documents. There is evidence that the ICT CFT has had some impact in this area.

In 2012, the ICT CFT was harnessed to develop an ICT in Education curriculum for a bachelor's degree by a university in the Latin America and the Caribbean Region, and an associate's degree offered by local teacher training colleges.

The curriculum document states:

The curriculum draws extensively on the UNESCO ICT Competency Framework for Teachers (CFT), and particularly on two of the stages of teacher development: Technology Literacy (TL) and Knowledge Deepening (KD). The curriculum described below, however, has been developed for the [national] context where much teaching takes place in remote areas served by poor connectivity and minimal access to digital technologies. However, despite some adjustments, the curriculum remains aligned to and faithful in spirit to the UNESCO Framework.

One significant divergence from the ICT CFT is the integration of a Basic ICT Skills component in year 1 of the curriculum. Staff teaching the curriculum requested there be a gentle immersion into ICT, necessary because most of those enrolling for the associate's degree have limited prior access to ICT and are unlikely to be familiar with the software and hardware.

The curriculum document goes further and states the following division of study designed to cover two of the ICT CFT levels: Technology Literacy/Knowledge Acquisition and Knowledge Deepening (see Table 3).

Table 3: Example of an ICT in Education programme for pre-service teachers

UNESCO ICT CFT APPROACH: TECHNOLOGY LITERACY	ASSOCIATE'S DEGREE		
	Year 1	2 Credits	30 Contact hours
	Year 2	2 Credits	30 Contact hours
UNESCO ICT CFT APPROACH: KNOWLEDGE DEEPENING	BACHELOR OF EDUCATION DEGREE		
	Year 3	3 Credits	45 Contact hours
	Year 4	3 Credits	45 Contact hours

Table 4 presents an excerpt from the curriculum statements section of the document. The format used is a convention for all curriculum documents in the country in question but this example has an added section that links directly to one of the ICT CFT objectives.

Table 4: Example of curriculum statements and links to the ICT CFT objectives

YEAR 1: BASIC ICT SKILLS AND TECHNOLOGY LITERACY I								
TOPIC	Objectives				Content	Activities/ Materials	Evaluation	Areas of Integration
	Skills	Knowledge	Understanding	Attitude				
YEAR 1 ASSOCIATE'S DEGREE BASIC ICT SKILLS – UNIT 1								
COMPUTER HARDWARE	Basic operation of computer hardware	Terminology & function of hardware components	Needs to troubleshoot if computer is not working	Overcome any apprehension or fear of using technology	Function of computer components and peripherals e.g. laptops, printers, storage.	See Introductory tutorials at http://www.gclearnfree.org/ComputerBasics	Potential to assess mastery of the skill through the setting of portfolio tasks	
	UNESCO ICT CFT Objective: Describe and demonstrate the use of common hardware (TL.4.a)				Correct terminology	Basic troubleshooting		
YEAR 1 ASSOCIATE'S DEGREE BASIC ICT SKILLS – UNIT 2								
WORD PROCESSING	Basic operation of a Word Processor	Basic knowledge of formatting and layout options and when to deploy them	How a Word Processor is different from a typewriter	To appreciate potential productivity savings and high levels of professionalism when preparing documents	Word Processor software (e.g. MS Word) Basic functions, formatting, grammar and spelling checkers. Printing.	See Introductory tutorials at http://www.gclearnfree.org/word2010 TL Module 1 Unit 3 of ICT in Education for Teachers Course CD ROM. Free digital textbook: Word 2010 Introduction from Bookboon	Potential to assess mastery of the skill through the setting of portfolio tasks	All subjects & learning areas
	UNESCO ICT CFT Objective: Describe and demonstrate the basic tasks and uses of word processors, such as text entry, editing text, formatting text and printing (TL.4.b)							

5. Designing Teacher Professional Development Courses

A review study conducted in 2016 reported the most common use of the ICT CFT was in the creation of teacher professional development courses and units of study. This use is distinct from the curriculum design mentioned above in that it entails development of the teaching and learning activities and materials as part of a structured course, rather than simply developing the curriculum for courses. Whether aimed at pre- or in-service teachers, these courses have been designed to realize the competencies identified in the ICT CFT.

Some of these courses leverage directly from the ICT CFT, while others have adjusted the competencies to suit local needs. Below are some examples of such professional development initiatives. The majority have been developed under the auspices of the local education ministry, but there is also evidence of commercial companies making use of the ICT CFT.

National initiatives

In a Latin America and the Caribbean Region initiative the course materials and activities were designed to develop in teachers a range of competencies and achieve a number of objectives identified from the ICT CFT. The course was developed using OER in order to contain costs and speed up the development process, the rationale being that if the materials did not need to be developed from scratch they could be assembled more quickly.

Initially, the course was paper-based because of concerns that access to computers and connectivity in remote areas was poor. However, as access in schools improved and the focus moved to supporting pre-service teachers where access to digital devices and connectivity was assured, the lessons were adapted for distribution via CD-ROM in a web-based format; and today they are available on the Internet. The course's links to the competencies and objectives of the ICT CFT are clearly stated at the start of each unit of study.

The upside of this course being made with OER and licensed under a Creative Commons Attribution (CC-BY) licence is that other countries have been able to adapt and repurpose the materials. Several countries have adapted, expanded, enhanced and created their own courses using elements drawn from the Latin American materials, and in turn have shared their derivative course with others. The links with the ICT CFT remain intact in all the examples below, as does the open licence.

One Ministry of Education [from the Africa Region] coordinated several government agencies and local universities to fashion an ICT in Education professional development course for in-service teachers. The need arose out of a commitment made by government to provide better access to technology in the nation's primary schools. Advisors pointed out that many teachers would need to be trained to support ICT-integrated lessons to ensure proper use of the technology investment, and the course was developed to respond to this need.

The course provides extension study opportunities for those teachers who have already completed basic ICT courses. Consequently, it is pitched predominantly at the Knowledge Deepening level. It is a blended learning course, with 24 notional hours of study conducted on a face-to-face basis and 66 hours delivered through an LMS. To create units of study, OER were adapted to work in the local context. Some new materials were also developed: local developers added many online activities designed to nurture the desired competencies; a portfolio assessment strategy was designed to collect evidence of teachers' ability to use the competencies in their classrooms; and numerous support tools were added, such as an accessibility guide for students with disabilities. The local developers also produced an online facilitator-training course designed to prepare support staff tasked with taking care of the teachers working on the LMS.

In the same country another courseware development initiative, using OER to create professional development courses for science, technology, English and mathematics (STEM) teachers is being developed. The model being used to develop the course materials balances two frameworks: the UNESCO ICT CFT and the Technology-Pedagogy-Content Knowledge (TPACK) framework¹¹. The ICT CFT is used to provide levels of increasing sophistication and specific ICT in Education competencies, while TPACK provides the lesson focus on digital technology, teaching method and/or STEM subject content. While the links with the UNESCO competencies are clear, a large component of the course is aimed at providing school management staff with skills for managing ICT in schools; thus, this section of the course had to be crafted by adapting different frameworks, as the ICT CFT does not cover these competencies.

In another example in the Africa Region, a Ministry responsible for education took advantage of the open licence of the above-mentioned ICT in Education courses and added value by sourcing additional OER in order to pitch their derivative course predominantly at the 'Technology Literacy' level ('Knowledge Acquisition' level in the ICT CFT Version 3). This course uses a blended learning methodology with 40 notional hours of contact time and 20 hours of online study. The online study component runs for five weeks after the face-to-face component has been completed and is intended to provide participants additional time to use and consolidate skills not normally possible during a five-day workshop. Because it does expect to service teachers with very basic ICT skills, the course has created units of study that are not directly covered by the 2011 ICT CFT. There are sections on learning in a blended learning environment and basic computer troubleshooting.

Following on from the above initiative, a third education ministry in the Africa Region adapted the course further. They required an 'offline' version. The course was downloaded and reworked to reflect the local realities of classroom practice. Their course materials and activities can be accessed from a memory stick and ensure access should connectivity fail. Schools nominate a master trainer, who is tasked with training the school's teachers using the materials and activities provided. Support comes from multiple staff engaging with the content simultaneously, sharing the journey and supporting one another.

Two universities, from different countries in the Africa Region, have developed French ICT CFT-inspired courses. The first used existing English language OER aligned to the ICT CFT to design professional development opportunities for higher education teaching staff. The OER were translated into French and then adapted to respond to the local university environment. The course is accessed through an LMS. The second university adapted this French version to support the training of pre-service teachers.

In 2017, a teacher training college adapted components of the above-mentioned ICT CFT courses and added new materials, particularly for the Knowledge Creation level. The college's vision was to create small units of study, between 30 minutes and two notional hours, spread across all three levels: Technology Literacy, Knowledge Deepening and Knowledge Creation. The course needed to appeal to teachers at all levels of development because the province is characterized by large variations in teacher ICT proficiency. The college developed 54 units of study, amounting to 80 notional hours. Teachers, however, are only required to complete 20–30 hours of training a year. A pre-test was designed for identifying the ideal combination of units for individual teachers according to their current level of ICT proficiency.

Also in 2017, a further distance education institute in the Africa Region began a process of developing its own ICT CFT-inspired course, drawing on the open content from the courses discussed above. This was possible at this juncture because of the establishment of the ICT CFT Hub on OER Commons, which pools ICT CFT open resources and links them to specific ICT CFT competencies (see more on this below). The distance education institute translated the English language OER content into Portuguese.

11 See <http://www.tpack.org/> for an overview of the TPACK framework.

In addition to the OER courses outlined above, there are examples of courses that have connections with the ICT CFT but do not use only open resources. For example, one programme developed in the Arab States Region is the realization of the national strategy of offering ICT in all the nation's schools. The training programme is a set of modules aimed at teachers, inspectors and school directors, and is based on all three levels of the ICT CFT. The programme is now officially part of the national education strategy plan and more than 200,000 teachers and 900 master trainers have been targeted to work through the programme. It is offered face-to-face and online and covers four areas: ICT and professional development; ICT and improving access to information; ICT for opening the school to its surroundings; and ICT for the establishment of a culture of partnership.

Corporate initiatives

Microsoft was an important development partner of the 2011 UNESCO ICT CFT. In 2012, Microsoft developed a course titled 'Teaching with Technology', which was closely aligned to the UNESCO ICT CFT. The course has been deployed in varied contexts, including Egypt, Russia, South Africa and Tunisia. Consequently, it has many manifestations, as it has been adapted to respond to local needs.

'Teaching with Technology' is being promoted as a ready-made course for countries that want to use the ICT CFT. For example, in one country in the Arab States Region in which the UNESCO ICT CFT was contextualized for use, the Ministry of Education established a unit responsible for running programmes that provide the relevant ICT competencies. This unit currently offers, among other courses, a blended version of the 'Teaching with Technology' course, in Arabic (see Figure 5), facilitated by 165 master trainers; and Microsoft issues teachers with Microsoft Certified Educator (MCE) certificates on successful completion. During 2015–2016, 40,000 teachers across the country's 24 governorates received the MCE certificate.

Another example of a corporate training course aligned to the UNESCO ICT CFT is the Intel® 'Transforming Learning' programme. It is designed to inculcate 21st century learning skills in its participants and the course introduction aligns these skills with the UNESCO ICT CFT.

6. Open CFT Resources on OER Commons

In 2016, UNESCO created the OER Commons repository on the Institute for the Study of Knowledge Management in Education (ISKME) website, where open courseware resources could be indexed according to the ICT CFT competencies and objectives. The ICT CFT Hub has a search tool that allows developers to search for, and identify, resources that would support teachers to acquire a specific ICT CFT objective (see Figure 6).

Figure 5 : Interactive search matrix on the UNESCO ICT CFT Hub on OER Commons

	Technology Awareness	Knowledge Deepening	Knowledge Creation
Understanding ICT In Education	Policy Awareness 19 Resources	Policy Application 20 Resources	Policy Innovation 10 Resources
Curriculum and Assessment	Basic knowledge 20 Resources	Knowledge Application 27 Resources	Knowledge Society Skills 20 Resources
Pedagogy	Integrate Technology 23 Resources	Complex Problem Solving 28 Resources	Self management 17 Resources
ICT	Basic Tools 33 Resources	Complex Tools 29 Resources	Pervasive Tools 13 Resources
Organization and Administration	Standard Classroom 18 Resources	Collaborative Groups 16 Resources	Learning Organizations 9 Resources
Teacher Professional Learning	Digital Literacy 24 Resources	Manage and Guide 16 Resources	Teacher as Model Learner 12 Resources

At the time of writing, the repository contains mainly links to units of study associated with one or more of the ICT CFT objectives. These units of study range from 30 minutes to six notional hours and are all openly licensed with various Creative Commons licences.

The open licences allow everyone to use and adapt the units as they see fit, without asking for author's permission and free of charge. These study units have been created by a varied set of developers drawn from UNESCO / Ministry of Education projects run in some 10 countries in the Africa, Asia and the Pacific as well as the Latin America and the Caribbean Regions from 2012–2018¹².

At the 2nd OER World Congress, held in 2017, the Hub also became the online 'home' of the Network of Institutional Champions, a community of practice designed to support and guide new developers who wish to adapt the resources further and create new ICT CFT-inspired resources. The Hub's communication tools help link these international OER/CFT champions and connect them to new practitioners.

12 Visit the ICT CFT Hub on OER Commons at <https://www.oercommons.org/hubs/UNESCO>.



Chapter VI

Conclusion

The ICT CFT is intended to inform educational experts, policy-makers, teacher support personnel and providers of professional learning on the role of ICT in educational reform, as well as to assist UNESCO Member States in developing national ICT competency standards for teachers.

There are indications that to date the ICT CFT has been successful in achieving this vision. There is strong evidence that the ICT CFT has informed the creation of national educator ICT standards and the development of courses aimed at developing ICT competencies in teachers. There is also evidence that the ICT CFT has, in recent years, been used to support ICT in Education policy creation and reform efforts where technology is seen as an enabling agent for education. Not originally envisaged, the ICT CFT has informed curriculum development and the creation of tools to assess teacher levels of ICT competency. It has also attracted an audience wider than originally intended, with some corporate players finding value in the ICT CFT too.

Since 2008, much work has been done in the areas above and there are now many examples of, and approaches to, the ICT CFT's use. UNESCO's 'flexible' approach to sharing the ICT CFT means that in many cases policy-makers and courseware developers have used the ICT CFT as a starting point for an initiative rather than a prescriptive text. This has resulted in multiple interpretations, some of which have been described here. Some of these interpretations are openly licensed, allowing reuse and adaptation of ICT CFT assets and encouraging further interpretations.

The ICT CFT works best when it can influence and shape; therefore users are encouraged to interact with the wider ICT CFT community, and to use the ICT CFT and the associated open resources to shape contextualized ICT CFT-inspired initiatives.



Glossary

Simple definitions of technical terms used in this publication.

- **accessibility** – this describes the degree to which an environment, service or product allows access by as many people as possible, in particular persons with disabilities.
- **accessibility features** – a built-in software feature that increases usability for users with particular impairments.
- **application (app)** – a computer programme (see also programme).
- **artificial intelligence (AI)** – the simulation of human intelligence processes by machines, particularly computers.
- **assessment for learning** – a new name for formative assessment (see formative assessment below).
- **assistive technology (assistive ICT)** – technology that is used to increase, maintain, or improve functional capabilities of persons with disabilities
- **augmented reality (AR)** – a view of a real-world environment whose elements are expanded by computer-generated images. These images overlay the physical environment in real time.
- **authoring environment** – software for creating websites.
- **blog** – a website, usually maintained by one person who can post commentary, descriptions of events, pictures or videos. Other users can leave comments on blog entries but only the owner can edit the actual blog. Blogs are often referred to as ‘online journals’.
- **capacity building** – increasing people’s abilities, usually their ability to carry out their work, by improving their knowledge and skills.
- **collaboration** – two or more people working together towards a common goal. While similar to cooperation (see below) it requires closer alignment of the participants and clear roles and responsibilities of group members.
- **competency** – the skills, knowledge and understanding needed to do something successfully to a professional standard.
- **computer laboratory (lab)** – a classroom full of computers so each student has their own computer to work on.
- **cooperation** – two or more people working together to achieve a specific goal of mutual benefit (as opposed to working in competition).
- **course** – a programme of study.

- **curriculum** – a list of the topics to be learnt in a course of study; a set of courses the content of which is designed to provide a sequential approach to learning. (The terms ‘curriculum’ and ‘syllabus’ are used slightly differently in different countries, but essentially they both mean a list of what is to be learnt.)
- **curriculum framework** – a set of ideas and principles from which a more detailed curriculum or syllabus can be developed.
- **curriculum standards** – the level and extent of the skills, knowledge and understanding that the student is expected to achieve.
- **cyber safety/security** – the safe and responsible use of ICT; practices and precautions to observe when using the Internet, to ensure personal information and devices remain uncompromised.
- **diagnostic tool** – a method for determining if a student needs remedial or extension activities.
- **didactic teaching/didactic instruction** – teaching by telling students about the subject; teaching by talking, explaining, demonstrating, lecturing, posing questions to students, answering students’ questions and conducting discussions with students. This is in contrast to teaching by helping students to learn through experimenting and reflecting, by getting students to do things rather than primarily listening to the teacher.
- **digital (as in digital content, digital devices, digital resources, digital technology)** – essentially, another word for computers and computer technology. (Computers store and process information by converting it all to single-figure numbers: digits.)
- **digital citizenship** – having the ICT equipment and skills to participate in a digital society, for example, to access government information online, to use social networking sites, and to use a mobile phone.
- **digital literacy** – the ability to use digital technology, communication tools or networks to locate, evaluate, use and create information. It also refers to the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers, or to a person’s ability to perform tasks effectively in a digital environment.
- **digital tools** – another name for ICT.
- **disability** – this covers different functional limitations of people, including physical, intellectual or sensory impairment, medical conditions or mental illness.
- **drill-and-practice software** – computer programmes that help the student to learn through repeated practice, for example, to memorize vocabulary in a foreign language or to learn maths procedures.
- **e-portfolio** – also referred to as a digital/online portfolio, an e-portfolio is a collection of electronic evidence created and assembled by a student, and can include text, electronic files, images, multimedia and blog posts.
- **e-safety** – the safe and responsible use of technology, including the use of the Internet and communication using electronic media; also referred to as ‘Internet safety’ (see also cyber safety).
- **flipped classroom** – a blended learning strategy that mixes face-to-face interaction with technology; the traditional learning environment is reversed, with students being introduced to content at home through videos or digital content, and active learning happening in the classroom.
- **formative assessment (also termed ‘assessment for learning’)** – assessment that helps students to learn (that shapes, or forms their learning) by showing what the students have not understood, what they might need to repeat and whether they are ready to move to the next stage (see also summative assessment).

- **gender** – the socially constructed relations between men and women. Societies decide which resources men and women can access jointly or separately, the work they can perform, the clothes they wear, and the knowledge they are allowed to acquire, as well as how they acquire and use it. Gender is about relationships that may change over time and place. While sex tends to be fixed, gender is amenable to change over time depending on circumstances. Gender relations between men and women may vary between classes, races and cultures. Institutions may have cultures that determine the executive, administrative and service positions of men and women.
- **gender equality** – this ensures that women and men enjoy the same status and have an equal opportunity to exercise their human rights and realize their full potential to contribute towards economic, social, cultural and political development and to benefit from the results. It is the equal value attributed by society to both the similarities and the differences between women and men, and the different roles they play. Gender equality can be promoted when resources, opportunities and support are availed to men and women without regard to biological sex.
- **graphic organizer** – a visual display that illustrates information and relationships between facts, concepts or ideas.
- **graphics software** – computer programmes, such as Photoshop, that allow the creation and manipulation of images, pictures, photographs, diagrams and drawings.
- **ICT** – information and communications technology which means computers, mobile phones, digital cameras, satellite navigation systems, electronic instruments and data recorders, radio, television, computer networks, satellite systems or almost anything that handles and communicates information electronically. ICT includes both the hardware (the equipment) and the software (the computer programmes in the equipment).
- **ICT CFT** – the UNESCO ICT Competency Framework for Teachers.
- **inclusive** – accommodating all people, and ensuring that information and the use of ICT is accessible.
- **Internet** – the Internet and the World Wide Web (or web, or websites) are often used interchangeably; but strictly speaking the Internet is the network that connects computers around the world, and the websites are the documents, images and other material on the network.
- **Internet of Things** – the network of computing devices embedded in everyday objects, enabling them to send and receive data via the Internet.
- **Internet safety** – see e-safety and cyber safety.
- **Knowledge Society** – a society that nurtures its diversity, and that takes advantage of its many knowledge forms, from indigenous, local wisdom to high-level techno-scientific knowledge. This concept emphasizes that knowledge is not only produced in a scientific laboratory but is also represented in the accumulated experience of humankind in all nations.
- **Knowledge Society skills** – the skills needed to handle and create information and knowledge, which means skills such as problem-solving, critical thinking, analysis, collaboration, communication, understanding others' points of view, and being able to use ICT, which is a key tool for handling information.
- **learning management system (LMS)** – a software application or web-based technology used to plan, implement and assess a learning process, allowing a teacher to create and deliver content, monitor student participation, and assess student performance.
- **learning organizations** – organizations, such as a school or a company, that embrace the idea that everyone needs to keep learning throughout life. Thus, teachers would continue to learn more about the subjects they teach and learn more about how to teach those subjects.

- **learning society** – a society that embraces the idea that everyone should keep learning throughout life.
- **mobile device** – a hand-held computing device, such as a mobile phone or tablet.
- **module** – a part of something.. A course of study in teacher education or a professional learning programme might be divided into modules. The full course would comprise a set of modules.
- **massive open online course (MOOC)** – a free, web-based distance learning programme aimed at enrolling many people from around the world.
- **media and information literacy** – a pedagogical approach recognizing the changes and developments in ICT, which highlight the need for individuals to competently access, analyse, evaluate, create and use information and communication; the need for individuals to be both authors and consumers of information and media content; the need for individuals to critically analyse information and media content using active inquiry; and the need for them to use information and media for claiming human rights and advancing sustainable development.
- **networks** – linked computers. Computers may be linked together either by wires or wirelessly; a network of linked computers could be just the computers in a classroom or office building (local), or a set of computers across a city (metropolitan) or linking computers from different parts of the world (Internet).
- **off-the-shelf educational software** – educational programmes that are ready to be used with students without the teacher having to do anything to them, for example, a programme to help students learn spelling. This is in contrast to a digital resource that the teacher creates, such as a list of spelling words created by a teacher in a word-processing programme.
- **online** – connected to the Internet, for example, accessing websites and e-mail.
- **open educational resources (OER)** – teaching and educational resources that are openly licensed and available free of charge.
- **open-ended tools** – computer programmes that can be used for many different purposes, for example, word-processing or spreadsheet programmes. This is in contrast to a computer programme that can only be used for a specific purpose, such as a programme that provides a visualization of a particular scientific process.
- **open licence** – specifies what can and cannot be done with a work (text, image, software or multimedia). Open licences usually grant permission to access, reuse and redistribute a work with few restrictions, and requiring attribution.
- **operations (as in hardware and software operations)** – using the hardware and software; for example, pressing buttons, moving levers, clicking on menus, taking photographs with a digital camera, taking measurements with a digital thermometer.
- **package** – computer programme (see also programme).
- **pedagogy** – this usually means teaching methods, styles and techniques, the way in which the teacher teaches. It can also mean simply teaching, or the study of teaching.
- **peer assessment** – an approach where students or peers assess one another's work based on the teacher's benchmark.
- **persons with disabilities** – the term is used to apply to all persons with disabilities, including those who have long-term physical, mental, intellectual or sensory impairments, which hinders their full and effective participation in society on an equal basis with others.

- **pervasive learning** – a social process that enables students to construct relevant and meaningful learning experiences by connecting the students to communities of devices, people and situations.
- **planning and thinking tools** – computer programmes that can be used to create the lists, calendars, schedules, diagrams or other types of documents used in planning and thinking.
- **presentation software** – computer programmes, such as PowerPoint, that are used to create and display a series of slides (text and images), typically to an audience watching a large screen.
- **productivity software (or tools)** – word-processing, spreadsheet and presentation software.
- **professional learning** – the additional skills and knowledge that teachers acquire in their work, beyond what they learnt in order to become qualified teachers. Teachers can gain this additional knowledge and these skill in various ways, through courses, programmes, conferences, seminars, events and workshops, from colleagues, through experience and experimentation, personal research and reflection, and through membership of professional networks and associations; sometimes referred to as ‘professional development’ or ‘CPD’(continuing professional development).
- **programme** – another word for software, application, package, for example, Microsoft Word, or Photoshop; the set of instructions loaded into a computer that enable it to provide specific functions such as word processing, spreadsheets, presentations, databases and image editing.
- **publishing technologies** – any digital method for spreading information to a wide audience; for example, desktop publishing (the software used to produce printed documents), podcasts and websites.
- **resource (as in digital, ICT, web, online resource)** – digital information, and digital hardware and software.
- **rubrics (as in assessment rubrics, knowledge-based-rubrics, performance-based rubrics)** – criteria for assessment, the features to be looked for in evaluating students’work. For example, the assessment criteria in a piece of writing might include correct spelling and punctuation, good use of paragraph divisions, and a clear, logical structure. Rubrics often include the weightings or the number of marks to be awarded to different aspects of a piece of work.
- **school management system** – a database system that can be used for managing schools’ daily work.
- **school technology integration plan** – school-level strategy for the adoption, use and maintenance of ICT systems, and the accompanying capacity and skills requirements.
- **software (software package, etc.)** – computer programme (see also programme).
- **social network** – a website or application used for connecting people and allowing them to communicate by sharing information, images and messages.
- **socio-cultural** – combining social and cultural factors.
- **sociolinguistic** – the interaction of age, gender, social class, background, location and culture with language.
- **speech-to-text software** – a type of software that converts audio content and transcribes it into written words in a word processor. This is a type of assistive technology (see above) that is helpful for persons with disabilities that make it difficult for them to use a keyboard. Speech-to-text software may also be known as ‘voice recognition software’.
- **student-centred, (as in student-centred teaching, or student-centred activities)** – teaching styles or learning activities in which students are active rather than passive, in the sense that they undertake projects or investigate or experiment for themselves rather than listening passively to the teacher.

- **students with disabilities** – see ‘persons with disabilities’
- **summative assessment** – assessment that sums up what the student has achieved, the point they have reached in their learning, to see if they qualify for a certificate or award or a place at university or a particular job. Summative assessment usually takes place at the end of a course of study, and produces information used by third parties such as employers or admissions officers. It is in contrast to formative assessment (see above), which takes place during a course of study, which produces information for the student and teacher and is intended to help the student learn. The difference between the two types of assessment lies in the purpose of the assessment, rather than the form of the test or exam. Thus, for example, a spelling test may be formative or summative depending on the way the results are used.
- **syllabus** – another word for curriculum (see also curriculum).
- **teacher education** – the course of study, usually provided by a university or other higher education institution, which qualifies a person to be a school teacher; sometimes referred to as ‘preservice teacher training’ or ‘initial teacher training’.
- **teacher-centred (as in teacher-centred teaching or teacher-centred activities)** – didactic teaching (see also didactic teaching and student-centred).
- **technology** – often used as another word for ICT, although strictly speaking ‘technology’ can mean almost any type of tool or applied knowledge. For example, pencil and paper, slates, blackboards and whiteboards are all types of writing technology.
- **technology resources** – digital information, hardware and software tools.
- **tutorials (as a type of software)** – usually a video explanation or demonstration.
- **ubiquitous learning** – anywhere, anytime learning and is therefore closely associated with mobile technologies.
- **unit (as in unit plans)** – part of a course of study, a module.
- **Universal Design** – the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.
- **Universal Design for Learning (UDL)** – an approach to addressing the diversity of student needs by suggesting flexible goals, methods, materials and assessment processes that support teachers to meet varied needs. Curricula created using UDL are designed from the outset to meet the needs of all students. A UDL framework incorporates flexible design of learning situations with customizable options, which allow all students to progress from their own, individual starting points.
- **virtual reality (VR)** – a computer-generated simulation of an environment that a person can interact with; the person is immersed in this environment and able to manipulate objects or perform a series of actions.
- **web content** – textual, visual and aural information published on websites.
- **web accessibility** – ensuring websites, tools and technologies are designed and developed so that persons with disabilities can use them, and that all people can perceive, understand, navigate and interact with the Internet, and contribute to the Internet.
- **website** – A website is a collection of related web pages, including multimedia content, typically identified with a common domain name, and published on at least one web server.
- **wiki** – a website or online resource that allows anyone to set up a resource in which content can be created collectively, and allows anyone who views the wiki to add to or edit the existing content.

The ICT Competency Framework for Teachers (ICT CFT)

Version 3 is a tool to guide pre-and in-service teacher training on the use of ICTs across the education system. It is intended to be adapted and contextualized to support national and institutional goals. Its target audience is teacher-training personnel, educational experts, policy-makers, teacher support personnel and other professional development providers. Implementing the ICT CFT will require strong leadership from government, from those responsible for teacher education and professional development of in-service teachers, and also from head teachers and school principals.

The ICT CFT Version 3 responds to the 2030 Agenda for Sustainable Development, adopted by the UN General Assembly, which underscores a prevalent global shift towards the building of inclusive Knowledge Societies.

It addresses recent technological and pedagogical developments in the field of ICT and Education and incorporates inclusive principles of non-discrimination, open and equitable information accessibility and gender equality in the delivery of education supported by technology.



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