ICT STANDARDS AND COMPETENCIES
from the pedagogical dimension:
A perspective from levels of ICT adoption in teachers' education practice

Pontificia Universidad JAVERIANA Cali

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Introduction

The training proposal based on Standards and Competencies in information and communications technologies (ICTs) from the pedagogical dimension presented herein is based on the ongoing dialogue between teacher training and research experiences relating to the reflective use of ICTs. The greatest challenge of this training proposal is to transcend the use of ICTs and focus on teaching practice as the most important process to be transformed.

This proposal's purpose is to provide a vision of the quality training that today's teacher needs to face the challenge of teaching in a knowledge and information society. This aims to be a training benchmark for improving the quality of education in schools at all levels based on levels of adoption of ICTs and their educational uses.

This document describes the contextual elements behind the proposal; presents the model of ICT Standards and Competencies from the pedagogical dimension based on levels of ICT adoption, their meaning and use within the six-phase Con-TIC-Go training route; and outlines the methodological resources that support the training route and the scope and limitations of the proposal.

The relevance of this proposal is as a basic guideline for any teacher or school on adopting ICTs in their educational strategies and practices. In that sense, the school and/or teacher can use this proposal to assess their educational strategies or practices involving ICTs in terms of the planned standards. That identification and recognition process can then lead to a process of training, support and assessment based on their level of ICT adoption in order to develop ICT competencies from the pedagogical dimension.

1

Context elements

ICTs in the Knowledge and Information Society and their impact in educational settings

> *ICTs make it possible to implement communication and education strategies to establish new ways of teaching and learning by using advanced management concepts in an increasingly demanding and competitive world where nothing can be left to chance*
> (Díaz, Pérez & Florido, 2011: 82)

The role of ICTs in education settings has been widely debated in recent decades: teachers and researchers have wondered about the extent to which linking ICTs to education practices truly promotes learning (Hicks, 2011; Kinchin, 2012; Tompsett, 2013). It is now seen as important to move beyond debates on the technical aspects of ICTs (access, coverage and speed) to consider education strategies that facilitate changes in the knowledge of students participating in technology-enabled educational activities. It is therefore vital to know how teachers adopt ICTs in their educational practice.

Integrating ICTs into teaching and learning processes is now an accepted practice among many schools and teachers. However, the longed-for impact of ICTs has not lived up to the expectations of the education sector (hence the importance of understanding that the context of use, framework and purpose of incorporating ICTs all determine their ability to transform teaching and improve learning) (Coll, 2008: 17). The positive expectation around ICTs in the education system and the conditions that would enable the expectations to be met highlight the need to make changes in all areas (technical, pedagogical, administrative and managerial) to produce effective and efficient educational experiences that promote the teaching and learning process. The demand for those changes is focused in particular on the actors within an education setting (teachers and students), who are required to undergo a paradigm shift in the notion of teaching and learning (as well as competencies and skills related to adopting ICTs in the role and function they fulfil in an educational setting).

Against that backdrop, it is essential for institutions and bodies that manage education in various countries to set up or embrace training models that help them to respond to the unstoppable and constant change that characterizes an information and knowledge society. Building and/or selecting such models should involve considering aspects that go beyond technical management of programmes and equipment. They should be based on developing ICT competencies from a pedagogical, didactic, reflective and critical perspective around the role that technologies play in constructing knowledge and social development.

Quality education and ICT adoption

The transition from an education model based on an industrialized society to one shaped by the demands of a digital society is a process under way in most institutions worldwide. The transition brings a new order and a new development (Castells, 1995) that challenges the traditional policies of conventional education models and highlights the need to study and analyse the structure and basis for this development using other reference points. The above does not imply jeopardizing the achievement of education targets in terms of training upstanding professionals committed to sustainable development in their regions, the promotion of equal opportunities and education quality. On the contrary, this transition must help achieve those targets that ensure the ability to compete in an ever-changing market and an increasingly demanding society.

The advent of electronic information processing, digitization of data and the development of social networking undermine the unities of place, time and function that underpin traditional teaching and learning processes. This is because of the opportunity offered by the information revolution in terms of decentralized tasks, asynchronous activities, virtual communication and particularly student protagonism (De Rosnay, 1998).

ICT uses in education may bolster teaching and learning practices that aim to build significant learning experiences. Martí (2003) and Coll (2004, 2008) recognize the potential of ICTs to transcend space and time boundaries of accessing information, training and education, while also facilitating the user's processing of that information. That potential is due to ICT characteristics: *storage* and *transmission* of information to provide access to large volumes of data; *dynamism* and *formalism* make it possible to present changing information in a cohesively structured and logical way; *hypermedia* and *multimedia* enable information to be represented in various formats in a non-linear way; *interactivity* facilitates the manipulation of information in two directions (with the technology feeding back into the user's action, which is then redirected thanks to the feedback) (Martí, 2003); and *connectivity* for networking and the new possibilities for group and collaborative working that provide many ways of improving quality and quality for teachers and learners alike (Coll, 2004). The uses of technological tools and their impact on education are largely dependent on knowing and harnessing those characteristics (Caicedo, Montes & Ochoa-Angrino, 2013; Montes & Ochoa, 2006a).

ICTs have the potential to act as psychological tools that can mediate interpsychic and intrapsychic processes within teaching and learning when their mediating role in the student-teacher-content interactive triangle is recognized.

The benefits of their characteristics fulfil their potential when those incorporating them are clear about their mediating role between: students and content; teacher and content; teacher and students; among students in activities between teachers and students; and in the structure of work and learning spaces or environments in an education setting (Coll, 2008). This shows that making use of ICTs depends on the teacher's level of adoption in terms of being able to devise and implement significant educational spaces (Coll, Mauri & Onrubia, 2008; Montes & Ochoa, 2006a).

These spaces are seen as structured situations that involve concrete learning goals while facilitating interaction between the student and the situation, among students and/or between the educator and the student. Such spaces are set up as problem-solving situations and require the student to have various skills (Colombian Ministry of Education & Colombian Education Faculties Association, 2009). Against this backdrop, many institutions have made inroads in the process of integrating ICTs into their education settings because of the opportunities they offer. Those institutions must have a coherent proposal that guarantees successful results in terms of project quality. That involves setting up technical and pedagogical support in keeping with the institutional guidelines relating to educational mission and vision.

In this sense, the link between Quality Education and the incorporation of ICTs is based on the reality that they are here to stay. It is therefore necessary to leave behind the question about their impact so that a new question can permanently permeate schools around how we use ICTs to increase education quality.

Reflective use of ICTs

As a cornerstone of developing ICT competencies from a pedagogical perspective, teachers' reflective use of those technologies presupposes that the potential of ICTs for representing and transmitting information is not a contribution to teaching and learning processes per se. Rather, it depends on the teacher's adoption of ICTs when integrating them into the system of symbols present in any education setting (spoken, written, audiovisual, graphic, numerical or aesthetic language) in order to create new conditions relating to the educational objectives proposed.

Adoption refers to how teachers incorporate ICTs into their daily classroom activities. Adoption is linked to the knowledge that teachers develop of ICTs, the instrumental use they make of them and the changes they make to adapt them to their educational practices. There are various levels of ICT adoption from the simplest to the most complex form. This gradual process of adoption can be described using an itinerary. These levels range from using ICTs to streamline operational processes in the classroom (by conveying content more

efficiently to students, which does not require the teacher to be aware of ICTs' potential) to advanced levels where teachers deliberately integrate technology to generate educational experiences that would be difficult to implement without the use of ICTs.

Despite the fact that the levels have some hierarchical characteristics (or the ability to move up from basic to advanced levels), they are not mutually exclusive and may not involve linear and gradual progress. The same teacher may have practices that could be classified at different levels of adoption. Such variability can be understood by seeing adoption as a complex phenomenon based on multiple factors. As with many other knowledge construction processes, this depends on factors including prior knowledge, the (implicit or explicit) learning theory of teachers, their representations of ICTs, the ICTs available, the number of students, the teacher's intention and the student's intention. In terms of the ideas of Fischer (2009) and Fischer and Bidell (2006) around the variability of development and learning, it could be said that such variability does not rule out progress in the adoption of technology in education settings. However, progress will be a dynamic and uneven process that ultimately results from the interaction between the above-mentioned factors (student, teacher, sub-area of knowledge involved and the technology itself).

Advances in levels of adoption involve the reflective use of ICTs. Reflective use is deliberate and arises from experiences and ongoing practice as part of a process of ongoing reflection that enables teachers to review their practice and propose better suited and more effective ways of incorporating ICTs into teaching and learning. In other words, the coherence and relevance of content, learning objectives, teaching strategies and the use of ICTs increase in direct proportion to the level of reflective integration of technology within teaching.

Teachers must be well prepared if they are to use ICTs efficiently within their teaching practice. Although some progress may be intuitive, teachers need to deliberately create meaning around the use of ICTs in education. This can outline a learning itinerary in which teachers begin with a model aimed at learning from technology (instrumental use) and move towards a model of learning with technology (using it to promote meaningful learning) (Caicedo, Montes & Ochoa-Angrino, 2013; Martí, 2003; Montes, 2007; Jonassen, Carr & Yueh, 1998).

The aim of the reflective use of ICTs in teaching practice is based on a knowledge and recognition of their benefits, the deliberate usage in line with that knowledge and the opportunity that offers in terms of transforming education practices that are conducive to generating meaningful learning and comprehensive development for students.

Professional teacher training: skills needed for the 21st century

The transformation of our society into an information and knowledge society mediated by ICTs, the demand for quality education and the need for a reflective use of ICTs for the benefit of teaching and learning processes all imply challenges and a restructuring of education (given the impact and demands generated by such changes in terms of how society organizes, works, relates and learns).

One of the challenges of those conditions relates to rethinking the roles of teaching and the professionals delivering it: teachers. How do these changes affect teachers? How do we rethink the role of teachers in the new circumstances? How should new teachers be trained? How can teachers' knowledge and attitudes adapt to respond to and make use of the new opportunities offered by ICTs in an information and knowledge society? And what type of education and school settings are possible? (Marcelo, 2001).

It is vital to rise to the challenge from the perspective of professional teacher training in terms of developing the skills that are expected to be necessary and essential for the challenges of the 21st century (Partnership for 21st Century Skills, 2009). Those skills are directly related to the teaching profession and its pedagogical and didactic dimension that is highlighted by the development of teaching and learning processes. The incorporation of ICTs in education appears to bolster that dimension of teaching, which makes such technologies essential for the profile of a 21st-century teacher (Larrosa, 2010).

Although the skills under consideration are those that all teachers should have (regardless of whether they incorporate ICTs into their teaching practice), they do establish conditions for professional teaching practice, vocation, the profession's scientific and technical competency, an open attitude, dedication and recognition of the duties and ethical rights of their profession vis—à-vis society (Larrosa, 2010) that will determine the success of incorporating any resource into teaching and learning processes.

Psychoeducational skills: the capacity to create education settings, recognize discipline or environmental issues, generate experiences that promote concrete links with problems identified, and to promote reflection, critical thinking and the comprehensive assessment of learning.

Vocational and leadership skills: an ability in terms of training, innovative and creative management of available resources and teaching and assessment methods, as well as knowing how to impact, influence, listen, ask, explain and communicate effectively.

Collaborative and cooperative skills: having a communicative attitude and perspective in relations with peers or colleagues for the purposes of an open sharing of information and knowledge in order to improve learning processes based on the main features of ICTs (Martí, 2003).

In terms of cross-cutting learning skills that apply across the board to any knowledge domain that teachers wish to develop in students, global 21-st century skills include critical thinking, creative thought and communication and collaboration.

Critical thinking: means skills in using different types of reasoning; making judgements; making decisions based on the assessment of evidence and arguments; and problem solving.

Creative thinking: relates to the skill of creating new ideas and the ability to reformulate and refine one's own ideas.

Communication: refers to the skills of communicating clearly and effectively in different formats and settings.

Collaboration: is linked to the skills of working effectively and flexibly in various teams and with different people.

In this sense, the teacher's role is more essential than ever as training and the validation of these skills needs education settings to be designed, implemented and assessed in a way that teaches people how to think, engage in lifelong autonomous learning and apply content to real-life challenges and contexts.

However, strengthening training conditions in terms of these skills must involve research and should also serve to build and implement training programmes that successfully enforce one of the most prized rights of the information and knowledge society: the right to learn.

It is vital for institutions and all educational agencies to recognize that teacher training in the teaching process must be based on data from research and practice that can provide guidelines, critiques and ways of implementing, understanding and researching teacher training in a constantly changing social context (to ensure that the discourse does not become empty and pointless).

2

Guidelines for the model of ICT standards and competencies

Below is the model that describes the extent to which teachers integrate ICTs into their pedagogical practice to promote meaningful construction of knowledge in their students. This approach categorizes teacher competencies for the design, implementation and assessment of ICT-enabled education practices, as well as the different ways of representing knowledge on integrating technology into education (familiarization, utilization and transformation).

Those skills and forms of representation are the basis for levels that flexibly classify ICT-enabled teacher practices from the simplest to the most complex. At the initial level of adoption (integration), teachers use ICTs as a tool for optimizing the presentation of content, communicating and conveying information. In advanced levels of adoption, the internal dynamics of education practices are improved through the inclusion of ICTs. At those levels, ICTs become tools that facilitate knowledge construction (reorientation) or even become powerful mediators generating dynamics that would be impossible without ICTs (evolution). The classification is dynamic and can include variable and differentiated teacher profiles based on particular approaches to technology, subject, education setting and their individual stage on the journey to adoption.

From this viewpoint, ICT adoption processes in education could be seen as coming under the generic definition of competencies (seen as "know how in context") (Ochoa-Angrino, Ordoñez & Charria, 2003). A better adoption and integration of ICTs in teaching requires the development of competencies and the construction of knowledge using reflective teaching. In its most advanced state, that knowledge would be explicit to show teachers the best ways of using ICTs to achieve certain learning objectives (particularly those related to the meaningful construction of knowledge).

ICT competencies from the pedagogical dimension

As a result, the aim of a training plan based on ICT adoption should develop a series of competencies in the educational use of such technologies. In this case, the skills prioritized are the *design*, *implementation* and *assessment* of ICT-enabled educational spaces.

Competencies in the design of ICT-enabled education settings refer to planning and organizational skills around elements that lead to the construction of ICT-enabled education settings for meaningful learning and comprehensive education for students.

Competencies relating to implementing ICT-enabled learning experiences in education settings relate to skills that facilitate the design and planning of an education setting and that are then reflected in a teacher's education practice.

Lastly, *competencies to assess the effectiveness of ICT-enabled education settings* are linked to skills that enable teachers to

evaluate effectiveness to promote meaningful learning in students as a result of ICTs being incorporated into their practice.

It should be pointed that levels of adoption in terms of these competencies are assessed using activities designed by teachers. With that in mind, it is not possible to attribute a single level of competency to each teacher. Levels are based on how technology is used in specific practices.

Levels of ICT adoption: elements

The three levels of ICT adoption assigned to an education practice are based on the idea that teachers' representations determine their decisions relating to their teaching practice (with or without ICT use) and therefore impact their perceptions, opinions and actions in the classroom (Biddle, et al., 2000, cited by Díaz, Martínez, Roa & Sanhueza, 2009). Teachers' representations can depend upon professional training, cultural factors and personal theories relating to the teaching-learning process.

This document uses levels of technology adoption based on an adapted version of the assessment model of Hooper and Rieber (1995). They proposed a phased model of technology adoption. The phases include integration, reorientation and evolution. The model has been enriched by considering: 1) differentiated competencies for designing, implementing and assessing ICT-enabled education settings, and 2) levels of familiarization, utilization and transformation of education practices supported by ICTs. The inclusion of the above two dimensions deepens the analysis of ICT-adoption phases in education settings and facilitates a greater understanding of what happens in real (ecologically valid) educational settings.

Elements of level of adoption

The elements shaping levels of adoption are based on three categories of representation adapted from the model of adoption of cultural practices by Orozco, Ochoa and Sánchez (2002). Technology familiarization refers to what the teacher knows about technology and its uses (declarative knowledge). Utilization refers to the everyday use of education practices that involve ICT adoption (with a procedural bent). Lastly, transformation relates to adaptive changes to practice that involve classroom use of technology. The latter aspect is linked to conditional knowledge (Montes & Ochoa, 2006a: 91). Teachers' knowledge (conceptual, procedural and conditional) of ICTs could be said to determine their use and the adaptations made to their teaching practice.

The following table illustrates the components of the model.

ICT Competency	LEVEL OF ADOPTION								
	Integration			Reorientation			Evolution		
	Familiarize	Utilize	Transform	Familiarize	Utilize	Transform	Familiarize	Utilize	Transform
Design	*Description*	*Description*	*Description*	„	„	„	„	„	„
Implement	„	„	„	„	„	„	„	„	„
Assess	„	„	„	„	„	„	„	„	„

Table 1. Components of the Model of ICT Standards and Competencies. Levels of ICT adoption from the pedagogical dimension based on levels of adoption.

Integration level

This level of adoption involves an idea of ICTs as tools that make it easier to present content, communicate and convey information. Decisions about ICT usage in teaching practice depend on the novelty that the tools provide in terms of saving time, money and versatility.

The design of activities focuses on improving the everyday management of the education setting. ICTs are therefore used to inform about upcoming activities, optimize access channels to content and make for more flexible resource management in time and space. This level may involve practices geared towards the digitization of class content, such as moving from paper to digital copies. Teachers assessing the effectiveness of ICT integration in their practice tend to emphasize limitations and contributions in terms of time saving, resources and access to large volumes of information.

One example of practice that could be categorized at this level is the use of multiple choice tests using a Learning

Management System (LMS). A teacher may choose this method as it is popular with students and they like it more than using pen and paper. This is because they are familiar with the digital environment, marks are given immediately and they can see what they got right and wrong (which makes for faster and more relevant feedback). Furthermore, that feedback can be given individually or as a group.

From the teacher's point of view, this is a very useful form of assessment as it is not hand marked (which saves time and makes results more reliable). In addition, marks go directly to the grade centre (which means that students can track their performance in that subject). The system can save the questions from various tests to form a question bank.

This tool offers the option of various types of question (multiple choice, true or false and so on), which makes it possible to carry out different forms of assessment and make tests less monotonous. In summary, assessment through LMS can be said to be useful for students and teachers alike as it saves time, provides rapid feedback and streamlines exam logistics.

Generally speaking, the use of ICTs is based on transmission and storage characteristics (Martí, 2003). In this form of use, ICTs facilitate communication and access to the information needed to teach. Transformations take the form of improved content presentation, storage, communication, transmission and exchange of information. The resulting changes do not significantly alter the traditional way the class is delivered. ICTs are not requiring the student to interact with the information in new ways. Technology-enabled teaching practices at this level remain at the edge of the specific knowledge construction involved in education activity.

Reorientation level

At this level, in a given educational activity the teacher uses technological tools to organize teaching practice with the active participation of students around specific teaching-learning activities. ICTs are no longer represented as tools that can easily, quickly and cheaply give students access to large volumes of information, but rather are adopted as tools that facilitate knowledge construction thanks to their specific characteristics: interactivity, formalism, dynamism, multimedia and hypermedia (Martí, 2003). These characteristics make it possible to access, utilize and transform information in different formats and to simulate and model problem solving. At this level, teaching could not be carried out without using technological tools. According to Coll, Onrubia and Mauri (2007), optimizing and harnessing those characteristics enable ICTs to be used by students and teachers to plan, regulate and guide intramental and intermental processes involved in knowledge construction.

One example of practice at this level would be collaborative blogging to aid understanding of topics covered in class. The teacher uses this integrated tool in class and asks students to write about their understanding of the content. However, the writing process is enriched by the multimedia and hypermedia characteristics of ICTs. This is achieved when teachers ask students to write blogs based on their own online searches and resources, while also sharing viewpoints and digital resources.

In this case, the teacher uses ICTs to move from being a content specialist to a learning facilitator who monitors the knowledge of students. This involves different tasks, such as designing instructions and learning situations that lead to a reflective use of blogs; offering an initial structure that students can use to draft and interact; encouraging students to work autonomously and search independently for information; and monitoring and actively feeding back into the knowledge construction process.

Evolution level

At this level, the teacher is clear that ICTs create environments that involve known semiotic systems and push the human capacity to represent, process, transmit and share information into a new league (Coll & Martí, 2001, cited by Coll, Onrubia & Mauri, 2007). From this perspective, teachers use that potential to mediate between relationships between students and learning content, as well as the interactions and exchanges between teachers and students and among students, colleagues, institutions and research groups.

At this level, teachers use ICTs in an ongoing attempt to maximize their mediating capacity as psychological instruments.[1] When this happens, ICTs are used so that students develop critical thinking about the content and different forms of meaningful reasoning about what they know. In other words, the teacher flexibly and creatively uses virtual tools to create settings that enable the student to interact meaningfully with the subject of study (Montes & Ochoa, 2006b: 8). This use of ICTs occurs for instance in virtual

[1] This concept originates in Vygotsky's works on the importance of semiotic mediation in the development of higher psychological processes and human learning. According to the definition provided by Kozulin, psychological tools are the symbolic cultural artifacts - signs, symbols, texts and formulae - that enable us to master psychological functions such as memory, perception, and attention; he saw psychological instruments as bridge between individual acts of cognition and the symbolic socio-cultural (Kozulin, 2000: 15). Owing to the semiotic characteristics of ICTs, they can be seen as psychological instruments in the Vygotskyian sense as they are resources that people can use to transform their psychological processes (Coll & Monereo, 2008: 100).

problem solving, modelling of how laws operate and multirepresentational descriptions (Montes & Ochoa, 2006a).

This presupposes that the teacher makes good use of ICTs in a way that shows a coherent relationship between the following: overall course content, teaching-learning objectives and activities, assessment activities and a range of technological tools to mediate (facilitate, boost, promote and develop) the achievement of educational aims. This is combined with a series of suggestions and guidelines about how to use these tools to develop teaching and learning activities. With enough clarity at this level, the teacher can collaborate and share progress with colleagues while helping them embrace some technological tools themselves (Montes & Ochoa, 2006a: 97).

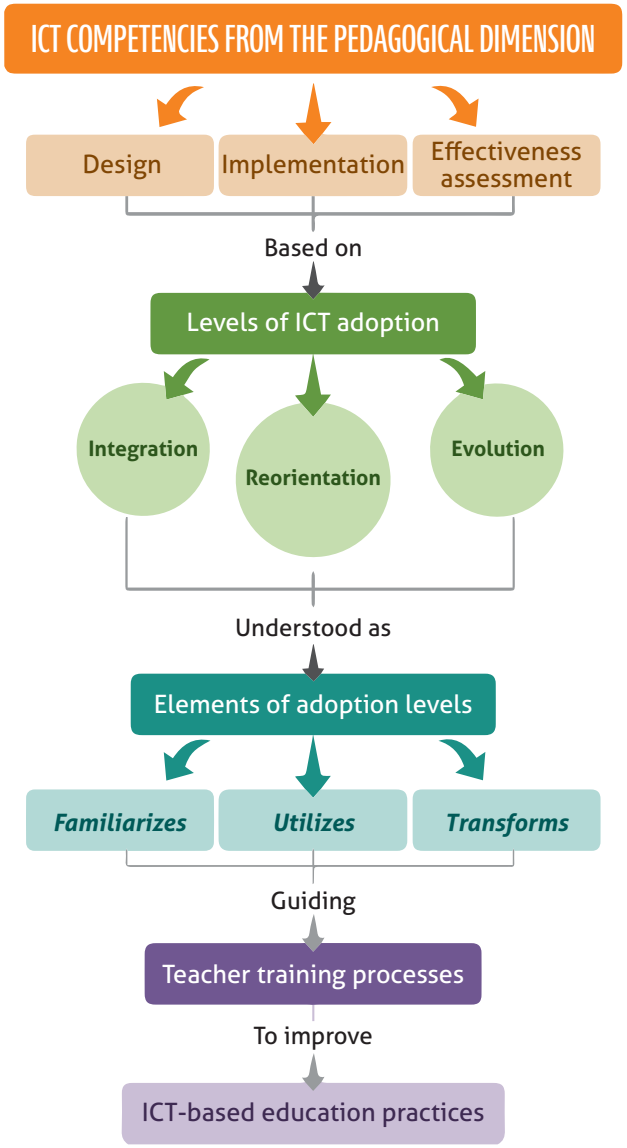

Figure 1. Model of ICT competencies from the pedagogical dimension.

The model guidelines are then used to ensure that teacher training aims to transform practice as part of an upward trend. Although a teacher's practices may be at various levels depending on competency and the level of adoption, training plans and/or routes should lead the teacher to transform practice based on the features of the next level of adoption. Figure 2 represents the training route that provides the standards with meaning and usefulness.

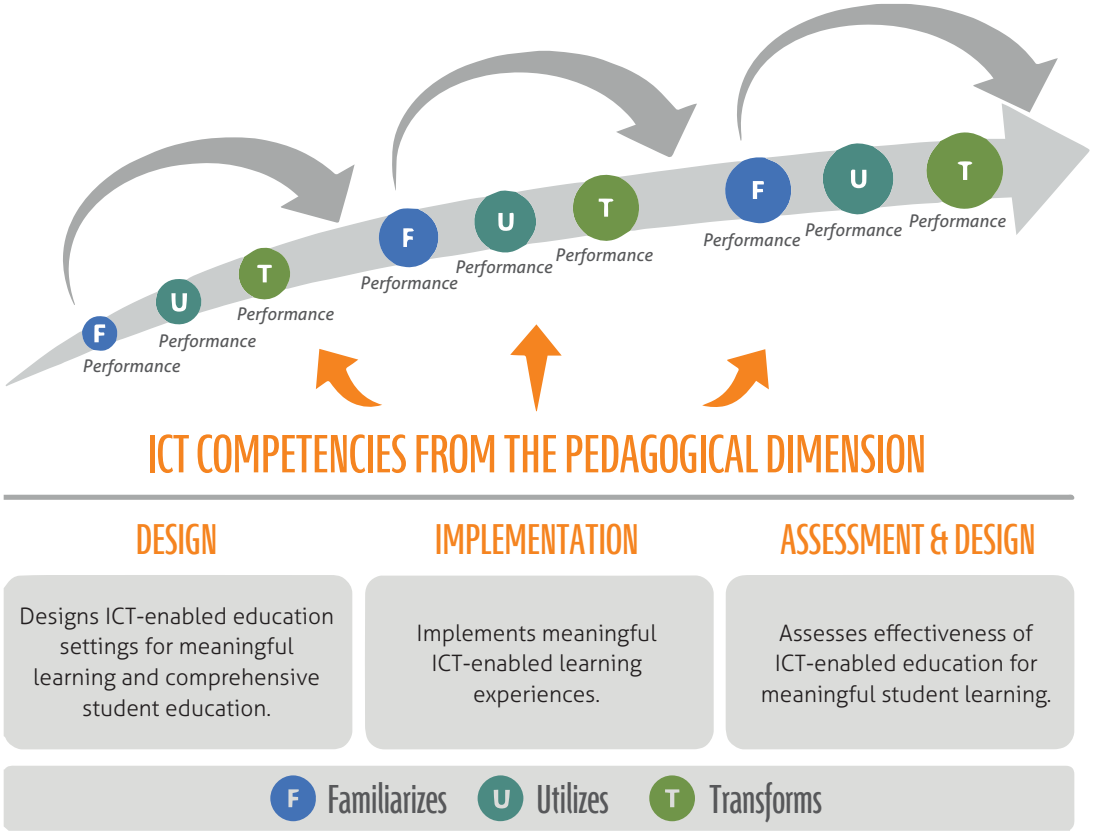

Figure 2. ICT competencies from the pedagogical dimension and levels of ICT adoption.

3

ICT standards and competencies from the pedagogical dimension

This section provides an explanation about the pedagogical dimension and the structure of standards underpinning the training route and the resources offered by the model.

What does the pedagogical dimension mean?

Although the process of ICT integration involves various areas relating to key roles of teachers integrating the technologies into their work, the proposal below is focused on the pedagogical dimension of that work.

This dimension refers to any teaching work relating to the capacity to support meaningful learning and the comprehensive development of students by creating meaningful practices and activities for participants, recognizing discipline-based or environmental issues, generating experiences to form tangible links with the issues identified and promoting reflection, critical thinking and integrated learning assessment. This also involves a vocation for educating people, innovative and creative management of technological resources and teaching/assessment methodologies and the skill to impact, influence, listen, ask, explain and communicate effectively.

What is a standard?

A standard is a structure for identifying the elements of a competency by establishing the guidelines for assessment. A competency is therefore evaluated through each of the relevant standards involved. In other words, if a competency has four criteria then there are four standards (and the assessment of those standards is tantamount to assessment of the competency).

Structure of standard

Table 2 presents the structure of the standard and its components:

- Title of dimension: pedagogical.
- A code composed of the initial for the level of adoption, the initial of the element of the adoption level and the number of the competency, such as Level of Adoption: integrates; level element: transforms; competency 1 = , N.I.C.1).
- The expiry of the competency (or the date for review).
- The criterion for the competency. This is based on the characteristics of implementation and performance of the level of adoption and the element of the level that covers the competency.

- Descriptions for the criterion, which describe the level of adoption of the competency that can be identified and assessed (using lower-case letters).
- The field of application of the competency indicates the situations where it applies. This space should be used to fill in situations in which it is used.

	CODE N.I.T.1	EXPIRY 2016
PEDAGOGICAL DIMENSION	INTEGRATION LEVEL	
COMPETENCY	Level element: TRANSFORMS	
1. Designs ICT-enabled education settings for meaningful learning and comprehensive education of students.	1.3. Adapts the use of ICTs for the storage, communication, transmission and exchange of information.	
Descriptions		
a. During the design of education settings, the teacher adds, removes and/or reorganizes ICTs tools to facilitate content, presentation; the storage, communication, transmission and exchange of information; and access to and searching of quality information (on the basis of suggestions from support groups, colleagues, students and others).		
Fields of application: Lesson planning using education platforms.		

Table 2: Structure of the competency standard

Below are the competency standards for each level of adoption. The first ones are competency standards for the Integration level, then Reorientation level, and finally Evolution level. The Design competency is No. 1; Implement competency is No. 2 and the Assess competency is No. 3 - in that order.

INTEGRATION LEVEL

STANDARDS OF ICT COMPETENCIES FROM THE PEDAGOGICAL DIMENSION:

Competency 1. Design

PEDAGOGICAL DIMENSION	**Code N.I.C.1 Exp.2016 INTEGRATION LEVEL**
COMPETENCY	Level element: FAMILIARIZES
1. Designs ICT-enabled education settings for meaningful learning and comprehensive education of students.	1.1. Knows that ICTs contribute to the storage, communication, transmission and exchange of information in the design of an education setting.

Descriptions

a. Identifies some basic tools to improve effectively the storage, communication, transmission and exchange of information.
b. Recognizes that ICTs provide more flexibility in terms of space, time and resource management.
c. Recognizes the importance of using technology to visualize the structure of content in an education setting.
d. Recognizes the benefits and implications of using ICTs for accessing and searching quality information in an education setting.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.I.U.1 Exp.2016 INTEGRATION LEVEL
COMPETENCY	Level element: UTILIZES
1. Designs ICT-enabled education settings for meaningful learning and comprehensive education of students.	1.2. Strategically organizes the use of ICTs for the storage, communication, transmission and exchange of information in the design of an education setting.

Descriptions

a. Includes the general organization of the education setting using ICTs and prioritizing content presentation.
b. Designs assessments using ICTs tools for greater flexibility in terms of space, time and resource management.
c. Includes instructions for communicating and transmitting information effectively using ICTs.
d. Includes the use of ICTs for accessing and searching quality information in an education setting.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.I.T.1 Exp.2016 INTEGRATION LEVEL
COMPETENCY	Level element: TRANSFORMS
1. Designs ICT-enabled education settings for meaningful learning and comprehensive education of students.	1.3. Adapts the organization of the use of ICTs for the storage, communication, transmission and exchange of information in the design of an education setting.
Descriptions	
a. During the design of education settings, the teacher adds, removes and/or reorganizes ICTs tools to facilitate content, presentation; the storage, communication, transmission and exchange of information; and access to and searching of quality information (on the basis of suggestions from support groups, colleagues, students and others).	
Fields of application:	

INTEGRATION LEVEL

STANDARDS OF ICT COMPETENCIES FROM THE PEDAGOGICAL DIMENSION

Competency 2: Implements

PEDAGOGICAL DIMENSION	**Code N.I.C.2 Exp.2016** **INTEGRATION LEVEL**
COMPETENCY	Level element: FAMILIARIZES
2. Implements meaningful ICT-enabled learning experiences.	2.1. Knows how to implement ICTs for the storage, communication, transmission and exchange of information in an education setting.
Descriptions	
a. Understands the functioning of ICT tools that improve the communication and transmission of information to optimize the management of time, space and resources in an education setting. **b.** Recognizes the functionality of ICT tools for managing access to and searching of quality information.	
Fields of application:	

PEDAGOGICAL DIMENSION	Code N.I.U.2 Exp.2016 INTEGRATION LEVEL
COMPETENCY	Level element: UTILIZES
2. Implements meaningful ICT-enabled learning experiences.	2.2. Uses ICTs to store, communicate, transmit and exchange information in an education setting.

Descriptions

a. Effectively promotes the communication and transmission of content and activities with and among students using ICTs.
b. Uses ICTs to describe, organize and inform about activities to be carried out in the education setting.
c. Carries out ICT-enabled assessment to optimize time and resource management in an education setting.
d. Promotes and uses ICTs to access and search for quality information in an education setting.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.I.T.2 Exp.2016 INTEGRATION LEVEL
COMPETENCY	Level element: TRANSFORMS
2. Implements meaningful ICT-enabled learning experiences.	2.3. Adapts the use of ICTs for the storage, communication, transmission and exchange of information in an education setting.
Descriptions	
a. Adds, removes and reorganizes tools to facilitate content presentation; the storage, communication, transmission and exchange of information; and access to and searching of quality information (on the basis of suggestions from support groups, colleagues, students and others) in ICT-enabled education settings.	
Fields of application:	

INTEGRATION LEVEL

STANDARDS OF ICT COMPETENCIES FROM THE PEDAGOGICAL DIMENSION

Competency 3: Assesses

PEDAGOGICAL DIMENSION	**Code N.I.C.3 Exp.2016** **INTEGRATION LEVEL**
COMPETENCY	Level element: FAMILIARIZES
3. Assesses the effectiveness of ICT-enabled education settings to promote meaningful student learning.	3.1. Knows that ICTs facilitate assessment of effectiveness in terms of the storage, communication, transmission and exchange of information in an education setting.

Descriptions

a. Recognizes the advantage of using ICTs for assessment to streamline marking and the returning of grades.

b. Recognizes the advantage of using ICTs in an education setting for the communication and transmission of information.

c. Recognizes the advantages of using ICTs in an education setting to access and search for quality information.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.I.U.3 Exp.2016 INTEGRATION LEVEL
COMPETENCY	Level element: UTILIZES
3. Assesses the effectiveness of ICT-enabled education settings to promote meaningful student learning.	3.2. Utilizes ICTs to assess effectiveness in terms of the storage, communication, transmission and exchange of information in an education setting.
Descriptions	
a. Monitors the costs and benefits of using ICTs in education settings in terms of time, resources, access to information and transmission and storage of content. **b.** Monitors student participation in terms of time, resources, information access and searches and transmission and storage of content.	
Fields of application:	

PEDAGOGICAL DIMENSION	Code N.I.T.3 Exp.2016 INTEGRATION LEVEL
COMPETENCY	Level element: TRANSFORMS
3. Assesses the effectiveness of ICT-enabled education settings to promote meaningful student learning.	3.3. Adapts the use of ICTs to assess effectiveness in terms of the storage, communication, transmission and exchange of information in an education setting.

Descriptions

a. Uses suggestions (from support groups, colleagues, student and others) to assess the effectiveness of ICT-enabled practices for the transmission of information and content and the access to and searches of quality information.

b. Establishes criteria for assessing the costs and benefits of using ICTs in education settings in terms of time, resources, access to information and transmission and storage of content.

Fields of application:

REORIENTATION LEVEL
STANDARDS OF ICT COMPETENCIES FROM THE PEDAGOGICAL DIMENSION
Competency 1: Designs

PEDAGOGICAL DIMENSION	**Code N.R.C.1 Exp.2016** **REORIENTATION LEVEL**
COMPETENCY	Level element: FAMILIARIZES
1. Designs ICT-enabled education settings for meaningful learning and comprehensive education of students.	1.1. Knows that ICTs have the potential to contribute to students' knowledge construction in an education setting.

Descriptions

a. Recognizes the importance of using ICTs to optimize the education practice that takes place in an education setting (in terms of knowledge construction).
b. Identifies the link between activities, content and ICTs in an education setting.
c. Recognizes that ICTs enable education practices to be replicated in different settings.
d. Knows the possibilities offered by ICTs for student monitoring and assessment.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.R.U.1 Exp.2016 REORIENTATION LEVEL
COMPETENCY	Level element: UTILIZES
1. Designs ICT-enabled education settings for meaningful learning and the comprehensive education of students.	1.2. Strategically organizes the use of ICTs for students to construct knowledge in an education setting.

Descriptions

a. Includes activities for collaborative knowledge construction.
b. Includes the use of ICTs as tools to provide students with multiple representations of content in the form of multimedia and hypermedia.
c. Includes the use of ICT tools that facilitate the semantic organization of knowledge (such as concept maps, schemas and tables) to support presentations and to help students analyse and organize what they know or are learning.
d. Includes the use of ICT tools for the dynamic modelling (simulations, spreadsheet, microworlds and so forth) to establish dynamic links among complex and abstract phenomena.
e. Proposes ICT-enabled assessments to demonstrate students' knowledge construction.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.R.T.1 Exp.2016 REORIENTATION LEVEL
COMPETENCY	Level element: TRANSFORMS
1. Designs ICT-enabled education settings for meaningful learning and comprehensive education of students.	1.3. Adapts the organization and use of ICTs for students' knowledge construction in an education setting.
Descriptions	
a. During the design of ICT-enabled education settings, the teacher adds and/or reorganizes tools not yet used based on previous design experiences. b. Adds, removes and/or reorganizes ICT-enabled content, activities and/or assessments to optimize the demands of the education setting. c. Suggests adjustments to the education setting with change criteria that are innovative, aesthetic, based on accessibility or ICT enabled.	
Fields of application:	

REORIENTATION LEVEL

STANDARDS OF ICT COMPETENCIES FROM THE PEDAGOGICAL DIMENSION

Competency 2: Implements

PEDAGOGICAL DIMENSION	Code N.R.C.2 Exp.2016 REORIENTATION LEVEL
COMPETENCY	Level element: FAMILIARIZES
2. Implements meaningful ICT-enabled learning experiences for comprehensive education of students.	2.1. Knows how to implement ICTs to construct student knowledge in an education setting.

Descriptions

a. Understands the functioning of ICT tools to promote (active, autonomous or collaborative) knowledge construction.

b. Knows how to assess knowledge acquired by the student using ICTs.

c. Recognizes assessment as a process of monitoring and follow-up involving students themselves.

d. Recognizes the contribution of ICTs in monitoring the knowledge construction process: level of student participation, conceptual change and/or final performance.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.R.U.2 Exp.2016 REORIENTATION LEVEL
COMPETENCY	Level element: UTILIZES
2. Implements meaningful ICT-enabled learning experiences for comprehensive education of students.	2.2. Utilizes ICTs to construct student knowledge in an education setting.

Descriptions

a. Utilizes various ICT applications and/or tools to achieve reasoning and/or learning objectives to promote:
   - Multiple representations of a phenomenon.
   - Organization of knowledge.
   - Dynamic relationships among complex and abstract phenomena.
   - Collaborative knowledge construction.

b. Carries out ICT-enabled assessments to demonstrate students' knowledge construction in keeping with learning objectives.

c. Utilizes ICTs to provide student feedback based on assessment processes.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.R.T.2 Exp.2016 REORIENTATION LEVEL
COMPETENCY	Level element: TRANSFORMS
2. Implements meaningful ICT-enabled learning experiences for comprehensive education of students.	2.3. Adapts the use of ICTs for students' knowledge construction in an education setting.

Descriptions

a. In ICT-enabled education settings, removes and/or reorganizes tools based on learning objectives and student performance (with reference to systematically collected information).

b. Proposes changes to the ICT-enabled education setting based on change criteria relating to aesthetics and accessibility.

Fields of application:

REORIENTATION LEVEL

STANDARDS OF ICT COMPETENCIES FROM THE PEDAGOGICAL DIMENSION

Competency 3: Assesses

PEDAGOGICAL DIMENSION	Code N.R.C.3 Exp.2016 REORIENTATION LEVEL
COMPETENCY	**Level element:** FAMILIARIZES
3. Assesses the effectiveness of ICT-enabled education settings to promote meaningful student learning.	3.1. Knows that ICTs facilitate the assessment of effectiveness for students' knowledge construction in an education setting.
Descriptions	
a. Recognizes that ICTs facilitate the monitoring and assessment of student learning. b. Recognizes that the education setting is likely to undergo significant changes as a result of incorporating ICTs. c. Recognizes that the incorporation of ICTs in an education setting promotes knowledge construction.	
Fields of application:	

PEDAGOGICAL DIMENSION	Code N.R.U.3 Exp.2016 REORIENTATION LEVEL
COMPETENCY	Level element: UTILIZES
3. Assesses the effectiveness of ICT-enabled education settings to promote meaningful student learning.	3.2. Utilizes ICTs to assess effectiveness in building student knowledge in an education setting.

Descriptions

a. Utilizes information provided by ICTs to assess effectiveness of ICT-enabled practices in knowledge construction.

b. Monitors the costs and benefits of using ICTs in education settings in terms of collaborative knowledge construction, autonomous learning and active learning.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.R.T.3 Exp.2016 REORIENTATION LEVEL
COMPETENCY	Level element: TRANSFORMS
3. Assesses the effectiveness of ICT-enabled education settings to promote meaningful student learning.	3.3. Adapts the use of ICTs to assess effectiveness in constructing student knowledge in an education setting.
Descriptions	
a. Proposes alterations and changes based on analysis of the effectiveness of integrating ICTs in an education setting. **b.** Establishes strategies to demonstrate the contribution of technology to teaching and student learning.	
Fields of application:	

EVOLUTION LEVEL

STANDARDS OF ICT COMPETENCIES FROM THE PEDAGOGICAL DIMENSION

Competency 1: Designs

PEDAGOGICAL DIMENSION	Code N.E.C.1 Exp.2016 EVOLUTION LEVEL
COMPETENCY	Level element: FAMILIARIZES
1. Designs ICT-enabled education settings for meaningful learning and comprehensive education of students.	1.1. Knows the importance of keeping up to date with ICTs and teaching-learning processes to generate new possibilities of ICT use and to share with colleagues the progress in practice and or/strategies in an education setting.
Descriptions	
a. Recognizes the importance of seeking up-to-date information on current ICT trends in education. b. Recognizes the times demands of planning and developing an ICT-enabled education setting. c. Recognizes the importance of having clear resources and limits for using ICTs before designing an education setting. d. Knows the importance of coherent content, activities and assessment in an ICT-enabled education setting. **e.** Knows that ICT tools can be adapted to multiple education settings, based on the particular demands of each one.	
Fields of application:	

PEDAGOGICAL DIMENSION	Code N.E.U.1 Exp.2016 EVOLUTION LEVEL
COMPETENCY	Level element: UTILIZES
1. Designs ICT-enabled education settings for meaningful learning and comprehensive education of students.	1.2. Strategically organizes ICT use to generate new possibilities for their use and to share with colleagues the progress in practice and or/strategies in an education setting.

Descriptions

a. Structures education settings that demonstrate the link between content, activities and assessment.
b. As a result of incorporating ICTs, proposes significant changes in other education settings to replicate content, activities and/or assessments.
c. Sets up education settings that would be impossible without deliberate use of ICTs.
d. Proposes education situations based on ICTs that promote collaborative learning, real and genuine problem solving and content comprehension and application.
e. Includes technological strategies for presenting content and activities that take account of students' learning styles and pace.
f. Identifies the types of ICT tools and assessments that can evaluate an education setting on the basis of learning objectives.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.E.T.1 Exp.2016 EVOLUTION LEVEL
COMPETENCY	Level element: TRANSFORMS
1. Designs ICT-enabled education settings for meaningful learning and comprehensive education of students.	1.3. Adapts the organization and use of ICTs to generate new possibilities for their use and to share with colleagues the progress in practice and or/strategies in an education setting.

Descriptions

a. Makes changes to the design of ICT-enabled education settings based on student needs and content characteristics.
b. Enriches the structure of an education setting based on the potential of ICT characteristics.
c. Considers new possibilities offered by ICTs for enriching education settings based on their characteristics and potential for learning.
d. Spreads knowledge by supporting peers to design ICT-enabled education settings.

Fields of application:

EVOLUTION LEVEL

STANDARDS OF ICT COMPETENCIES FROM THE PEDAGOGICAL DIMENSION

Competency 2: Implements

PEDAGOGICAL DIMENSION	Code N.E.C.2 Exp.2016 EVOLUTION LEVEL
COMPETENCY	Level element: FAMILIARIZES
2. Implements significant ICT-enabled learning experiences for comprehensive education of students.	2.1. Knows how to implement ICTs to generate new possibilities for their use and to share with colleagues the progress in practice and or/strategies in an education setting.
Descriptions	
a. Understands the scope and limits of ICTs for learning experiences within an education setting. b. Identifies multiple contexts of application for ICTs based on their characteristics and in the light of learning objectives in an education setting. **c.** Understands the potential of ICTs for feedback, monitoring and assessment of students' learning processes.	
Fields of application:	

PEDAGOGICAL DIMENSION	Code N.E.U.2 Exp.2016 EVOLUTION LEVEL
COMPETENCY	Level element: UTILIZES
2. Implements significant ICT-enabled learning experiences for comprehensive education of students.	2.2. Utilizes ICTs to generate new possibilities for their use and to share with colleagues the progress in practice and or/strategies in an education setting.

Descriptions

a. Disseminates and shares knowledge on ICT implementation by formal means (conferences and class materials) and informal means (talking with colleagues).
b. Transfers knowledge on the usefulness of an ICT tool from one education setting to another.
c. Collaborates with colleagues on implementing ICT-enabled education settings.
d. Utilizes ICTs to propose teaching and learning situations that involve real and genuine problem solving.
e. Utilizes ICTs to promote in-depth learning (understanding and application of content).

Fields of application:

PEDAGOGICAL DIMENSION	Code N.E.T.2 Exp.2016 EVOLUTION LEVEL
COMPETENCY	Level element: TRANSFORMS
2. Implements significant ICT-enabled learning experiences for comprehensive education of students.	2.3. Adapts the use of ICTs to generate new possibilities for their use and to share with colleagues the progress in practice and or/strategies in an education setting.
Descriptions	
a. Enriches the education setting by incorporating tools other than those proposed in the original design. b. Makes changes to the initial design of the education setting in keeping with relevant information or characteristics and/or needs of students. c. Adapts and adjusts the education setting based on the systematic analysis of feedback provided by ICT implementation. **d.** Proposes new uses of ICTS to design, implement and assess education settings to promote meaningful student learning.	
Fields of application:	

EVOLUTION LEVEL

STANDARDS OF ICT COMPETENCIES FROM THE PEDAGOGICAL DIMENSION

Competency 3: Assesses

PEDAGOGICAL DIMENSION	Code N.E.C.3 Exp.2016 EVOLUTION LEVEL
COMPETENCY	Level element: FAMILIARIZES
3. Assesses the effectiveness of ICT-enabled education settings to promote meaningful student learning.	3.1. Knows that ICTs facilitate the assessment of effectiveness in an education setting to generate new possibilities for their use and to share with colleagues the progress in practice and or/strategies.

Descriptions

a. Knows how to measure the impact of ICTs on students' learning processes.
b. Recognizes the importance of follow-up and assessment for ensuring improvements to and quality of ICT-enabled teaching and learning processes.
c. Identifies changes that should be made to teaching practice based on information systematically collected on ICT-enabled practices.

Fields of application:

PEDAGOGICAL DIMENSION	Code N.E.U.3 Exp.2016 EVOLUTION LEVEL
COMPETENCY	Level element: UTILIZES
3. Assesses the effectiveness of ICT-enabled education settings to promote meaningful student learning.	3.2. Utilizes ICTs to assess effectiveness in an education setting to generate new possibilities for their use and to share with colleagues the progress in practice and or/strategies.
Descriptions	
a. Systematically monitors the effectiveness of ICT-enabled education settings to promote meaningful student learning. **b.** Measures the impact of the incorporation of ICTs on teaching and learning processes in an education setting.	
Fields of application:	

PEDAGOGICAL DIMENSION	Code N.E.T.3 Exp.2016 EVOLUTION LEVEL
COMPETENCY	Level element: TRANSFORMS
3. Assesses the effectiveness of ICT-enabled education settings to promote meaningful student learning.	3.3. Adapts the use of ICTs to generate new possibilities for their use and to share with colleagues the progress in practice and or/strategies.
Descriptions	
a. Communicates strategies for monitoring and assessing the effectiveness of educational uses of ICTs to promote meaningful student learning.	
Fields of application:	

4

Meaning and use of standards

ICT competencies and their respective standards aim to help educational institutions and teachers with a training process based on their needs and level of ICT adoption (with a special emphasis on education, or the pedagogical dimension).

The proposed training route is expected to enable teachers to:

- Recognize their expectations (as teachers) in terms of the pedagogical dimension and ICT adoption in their teaching practice and professional work.
- Identify their training needs in terms of ICT competencies and their respective standards.
- Use the training route to outline a training itinerary to move up ICT adoption levels and the relevant competencies.

Adoption and training route: *Con-TIC-Go...*

This training route has five phases.

Phase 1: evaluation of the level of ICT adoption in education practices

The aim of the first phase is for institutions and the teaching team to identify the level of ICT adoption of their education practices, using evaluation instruments based on *Standards of ICT competencies from the pedagogical dimension.*

Once the level of adoption, competencies and categories have been established, it is vital to find a specific way to assess teacher performance. Above and beyond classifying teachers at a certain level, the standards make it possible to define ICT adoption profiles based on the use they make of the technologies in specific practices.

Initially, teachers are assessed based on concrete education practices using ICTs. This benchmark is then used as a starting point for exploring with teachers what they know, how they use and transform technology to mediate teaching practice and to achieve educational intent.

Levels of adoption can vary: a) over time (when assessing the history of a particular process of adoption); b) if comparing

performance of colleagues with similar levels of adoption; c) in terms of level, for different categories of representation (familiarization, utilization and transformation) for competencies; and d) depending on the intention when using ICTs for a specific educational practice.

This implies that many levels of functioning can coexist (Siegler, 2006), and these emerge as teachers use ICTs in practice in real time. A teacher can therefore have declarative knowledge of the potential of a certain technological tool, without applying that knowledge. In contrast, another teacher might use an ICT-enabled resources without knowing the pedagogical intent behind his/her actions. Teachers may also make a reflective change to improve the transmission of information when a given activity does not require the use of more complex technological tools.

The following case illustrates the situation where a teacher can be at different levels of adoption of ICT competencies from the pedagogical dimension:

> On a civil engineering course, students learn to assess, identify and intervene in pavement diseases. To support teaching and learning processes, the teacher uses a virtual learning platform. The teacher uses the platform to send students e-mails, show the time line of activities, hand out marks, explain the subject programme, carry out short tests on content using closed questions, assign work and make materials available to students (bibliographies, images, videos and so forth).
>
> On this course, the students are facing a real problem in this discipline: road diagnostics and proposing projects to resolve identified needs. The project requires students to carry out field work for the purposes of photographs, measurements, interviews and surveys to facilitate calculations and simulations in support of the solutions proposed.
>
> The project and some calculations must be carried out using online documents. This is because the teacher is constantly monitoring progress activity by identifying proposal weaknesses and using questions to help students recognize problems and adopt improvements/solutions for themselves.

In that case, the teacher is using ICTs in various ways in the education practices involving students while considering the many factors shaping the learning process: content covered, teaching and learning objectives, the support that students

require in adopting content, ways of approaching content and relevant forms of monitoring and assessment. The teacher uses technological tools for the purposes of communication and storage (integration level) while harnessing the potential of other tools (such as simulation systems and monitoring the learning process) to encourage students to build knowledge meaningfully (evolution level). In the light of the above, figure 3 represents how a teacher demonstrates multiple levels of adoption in practice.

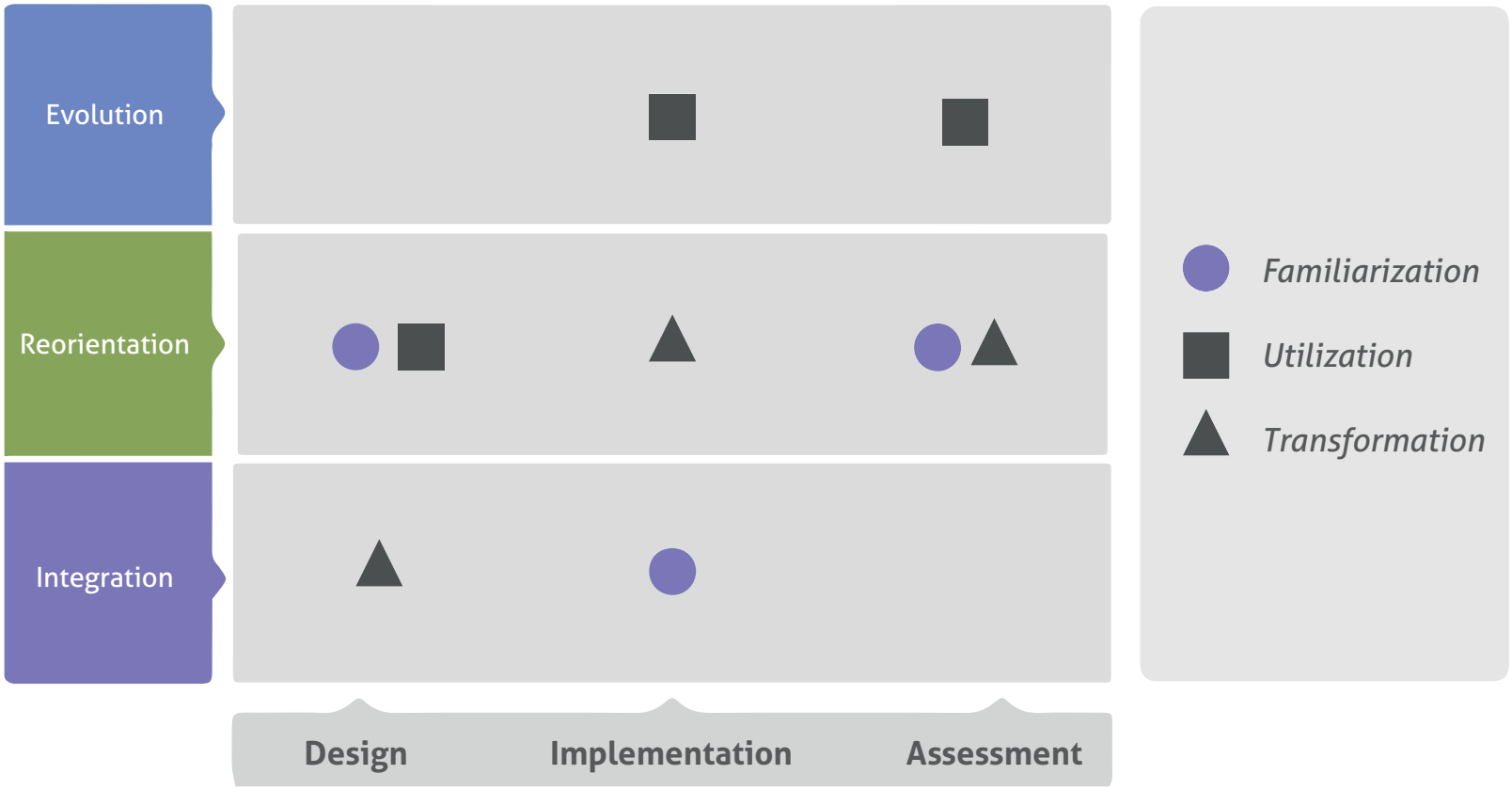

Figure 3. Representation of evaluating an education strategy and/or practice using ICTs, according to the model of ICT standards and competencies from the pedagogical dimension (based on levels of ICT adoption).

Phase 2: reflection and instruction in the use of ICTs to promote meaningful teaching and learning processes

Once the teacher has reflected on his/her particular use of ICTs in teaching practice, a training process can begin (tutorials, videos, massive open online courses (MOOC), webinars, workshops and so forth) on designing teaching practices and strategies based on the guidelines from the *Standards of ICT competencies from the pedagogical dimension* – and in the light of teaching and learning objectives from those strategies and practices (*Training route: learning with others, learning from others, learning together and learning autonomously*).

The meaning of the strategies proposed in this phase of the Training route is based on the training needs identified at the time. This phase facilitates:

- Flexibility and contextualization (in time and space).
- Reflection and a commitment to quality performance in forums for dialogue.
- Knowledge of what peers have done (internal and external).

As the Training route is designed to be an ongoing, flexible and contextualized process, the strategies include various arrangements or options that adapt to the needs and availability of those involved, the demands of their professional context and the options offered by ICTs to link theory and practice by being flexible and contextualized and generating spaces for cooperation, collaboration and dissemination.

Based on the above, training strategies will be based on four approaches: learning from others; learning with others; learning together; and learning autonomously. The various training strategies will have technical and pedagogical support provided by the Pontificia Universidad Javeriana Cali, Colombia. The overall objective in each strategy is to prompt the teacher to design an education strategy and/or practice that uses ICTs along the technical and pedagogical guidelines provided in the various training arenas.

Note: All of the training strategies are in keeping with the development of ICT competencies and their standards, and will be assessed on the basis of performance. Each of the outputs from the activities in the second phase of the route will have a sheet for follow-up and assessment in accordance with the models of ICT standards and competencies from the pedagogical perspective based on levels of ICT adoption.

Learning community

Learning from others: training strategies with an "expert" who uses his/her knowledge and experience to propose training activities. This can take place face to face or remotely.

- General courses
- Workshops
- Diplomas

In order to respond to the needs to:

- Link theory and practice.
- Be flexible and contextualized in time and space.

Learning with others: strategies that facilitate an exchange of ideas, the development of communication and social skills and the achievement of cooperation goals with others.

- Forums
- Hangouts
- Webinars
- Workshops
- Seminars

In order to respond to the needs to:

- Promote reflection and commitment to quality performance in forums for dialogue.
- Know what peers have done (internal and external).

Learning together: strategy based on the principles of networked learning. Its potential lies in the fact that:

- Teachers from various schools and training levels interested in sharing, talking and learning about education and ICTs remain in contact and interact together.
- It provides a shared framework for communicating and sharing information.
- It activates dialogue for exploring new possibilities and shared problems, as well as creating new mutually beneficial opportunities.
- It captures and disseminates existing knowledge to improve practice, identify solutions to shared problems and recognize good practices.
- It introduces intradisciplinary and interdisciplinary collaboration processes around ICT competencies from the pedagogical dimension.
- It contributes to the organization and achievement of purposes and actions that yield tangible results.

- It facilitates new knowledge generation.

Self-management of learning: training strategies in which participants activate, support and process information and affects that are systematically geared towards knowledge construction.

- Educational videos
- Video tutorials
- Learning objects
- MOOCs

Phase 3: guided use of ICT-enabled education practices

The aim of this phase is for teachers to develop strategies and practices designed to be supported by and receive feedback from assessors and/or trained teachers, such that they can use the guidelines to demonstrate the aspects to consider in their teaching practice to increase effectiveness.

As a result of what is learned from the process of technical and pedagogical support and follow-up to demonstrate progress under the *Model of ICT standards and competencies from the pedagogical dimension* based on levels of ICT adoption, the next phase of the training route shall begin with the pilot education practice and/or strategy with the assistance (in person or virtually) of a pedagogical assessor. To begin this phase of the Training route, a work schedule is established and the implementation of the designed practice and/or strategy is launched in a real education setting to identify successes and difficulties.

Phase 4: review of the results of implementing the ICT-enabled education practice

This phase sees the finalization of practice implementation. The impressions gained during the previous phase are collected and reviewed to identify aspects to change during subsequent implementation of a practice and/or strategy using ICTs. This is the time to refine the practice, as well as systematizing and documenting it for potential replication.

Following the third phase of the training route, the pedagogical assessor will assess the phase according to the methodological perspective underpinning the training route based on standards for ICT competencies. Phase 4 comprises two stages: the first happens during phase 3 and the second stage takes place at the end of implementation of the education strategy and/or practice using ICTs. The assessment can take place in person or remotely.

Once the feedback has been received from the pedagogical assessor in phase 4, relevant adjustments will be made to the education strategy and/or practice using ICTs (in accordance with the guidelines provided by the assessor). This is the time to refine the practice, as well as systematizing and documenting it for potential replication.

Phase 5: systematization of successful ICT-enabled education practices

After peer review, the practice will form part of a database of effective education strategies and/or practices suing ICTs at the University's institutional repository that runs the Training route. Once it has been reviewed and amended, the education strategy and/or practice is sent off for expert peer review. The results of the peer review are then used to validate the project to be part of the Open Educational Resources managed by the Pontificia Universidad Javeriana Cali in Colombia (the institution backing the Training Route).

Lastly, moving through the phases of the Training route will demonstrate the level of adoption of ICT competencies based on education practices and strategies (which will make a contribution to education quality).

5

Teaching-practice assessment methods based on adoption levels

The above-mentioned levels of adoption are an instrument to analyse how teachers at various levels of education incorporate ICTs into teaching. It is a versatile instrument as it can be used in many ways and for various purposes: to design ICT-enabled education practices and to assess and identify strengths, weaknesses and opportunities for improvement in technology-enabled teaching practices. Below is a description of how adoption levels have been used to assess ICT-enabled teaching practices.

Defining the aims of analysing adoption levels

The starting point is to define the reason for using adoption levels, the purpose for analysing teachers' education practices, the role to be played by the study's results and whether to assess courses, programmes, success stories and failures, specific tasks and/or the impact of intervention programmes on ICT-enabled teaching. The answer to these questions shapes how the instrument is used. For instance, assessing a virtual diploma in family processes could involve studying most – if not all – ICT-enabled teaching processes. For studying success stories by using collaborative conceptual maps to support an anthropology class, it might be sufficient to analyse practices where ICTs played a relevant role in achieving learning objectives.

Work unit

After establishing the purpose of the levels of adoption, it is vital to specify which education practices will be analysed: teacher explanations, tasks (workshops and assessments) or feedback and interactions. The norm is to analyse tasks that teachers set students. Tasks refer to problem-solving situations that require activities to be carried out (workshops, exams, message boards or project development) in order to achieve the learning objectives. It is often necessary to define the characteristics of the tasks to be analysed. Aspects relevant here include the type of task (open, closed, individual, group or mixed) and the range of tasks to be examined.

These decisions are taken because individual tasks require differentiated analytical processing. For instance, a project in the road design element of a civil engineering course involves various tasks that are made up of smaller tasks: simulation work to explore different possibilities in road layout, exploration of existing roads with multimedia support (photographs, videos and plans), cost analysis using dynamic spreadsheets and documents from public calls for bids on road construction. Rather than analysing the project as a whole, the subtasks that make up the project form the focus. Analysing the entire project increases the possibility of omitting relevant information and attributing general

characteristics to elements that have major differences. Some project tasks may require the transmission of information (reading documents), while others may involve using the dynamic and multimedia properties of ICTs (layout simulation, cost projection on spreadsheets and exploration of multimedia content on roads). This avoids having to omit or prioritize one of the two requirements of an ICT-enabled education practice.

It is also vital to establish whether a workshop warrants the same treatment as a project, given that they are also often comprised of subtasks (each item or question). For a webquest (a guided online search for knowledge construction) on understanding and exploring the main concepts and approaches for restorative justice, a holistic overview might be a better fit than an analysis of each step in the webquest (seeking various online information sources; acquiring multimedia support material such as videos, images and audio files; classification of legislation available on State websites; and discussion and organization of material). Each choice has advantages and disadvantages. Examining detail is time consuming, while studying the overview runs the risk of omitting relevant information. It is advisable to choose a lens or vision with the right breadth.

Information sources

The next stage is to specify the information sources for the analysis of selected teaching practices: teachers? students? student outputs? the ICT-enabled teaching situation? the ICT-enabled teaching materials? In previous research (Chávez & Caicedo, 2014; Montes & Ochoa, 2006a; Valencia & Caicedo, 2013), various information sources have been used. These have mainly taken the form of teaching materials, teaching situations and teachers. There are several reasons for those choices: (a) teaching materials show the explicit instructions given to students and therefore the requirements in terms of knowledge construction, (b) teachers provide information that increases understanding of the tasks set and the underlying educational intent, and (c) teaching situations reveal first hand how tasks are set, the differences between what teachers say and do and the place of ICTs within those situations.

Information collection techniques

Next we describe the information collection techniques to be used: observations, interviews and records (communications, texts, workshops, bibliographies, audio/video recordings and images). Observations and interviews involve other decisions such as the type of observation/interview (structured, semi-

structures or unstructured). Previous research has involved observations and semi-structured interviews (Montes & Ochoa, 2006a; Valencia & Caicedo, 2013). These information collection techniques require the production of new instruments based on levels of adoption put forward in the model. Observations require a grid containing features or indicators used for codifying or categorizing. That in turn necessitates the use of indicators provided for in the descriptions of adoption levels. As for interviews, they involve drafting a script of questions to explore dimensions of adoption levels (competencies and means of representing the educational applications of ICTs). At least in terms of competencies for designing ICT-enabled education situations, interviews have a key role to play as they analyse tasks that have been implemented (which implies a retrospective reproduction of situations). Furthermore, those assessing education practices need to choose the information sources covered in the interview: teaching material, verbal instructions, questions or the explanations provided to students.

Unit of analysis and information collection process

The following two activities are next: defining the unit of analysis and specifying the information collection process. The former requires knowing which aspects of observations, interviews or records will be analysed. For observations, a decision is made about whether to consider actions, gestures or words. In interviews, it is possible to choose the type, length and content of responses to be analysed. For tasks, one can select the aspects to be analysed: formal features, structure or the cognitive demands on students. Analysis has tended to focus on instructions. Instructions provide information about how teachers incorporate ICTs into teaching and learning processes, as well as indicating the cognitive activities that students carry out to complete the tasks.

Specifying the information collection process involves knowing: how often information will be collected, when, and where. The answers must be in keeping with the aim or purpose of analysing the levels of ICT adoption. Assessing an entire virtual course is not the same as assessing a successful educational application of ICTs (as the example in the section on unit of work). The virtual course would involve collecting information throughout the course and a more longitudinal follow-up, whereas the educational application of ICTs would only require a much more time-specific approach.

Information collection usually involves: asking teachers (formally or through informed consent) for permission to analyse their education practices; carrying out an initial interview to explore how he/she uses ICTs in teaching; attending class or requesting access to classrooms/virtual

classes; collecting teaching materials used; and carrying out interviews to use the information collected to increase understanding of the educational uses of ICTs. Depending on the meaning or purpose of applying adoption levels, the process would have to be carried out several times with the same and other teachers.

Data analysis

The choice of analytical processing of collected data will depend on the ultimate purpose of the adoption levels, education practices, information sources, information collection techniques and the unit of analysis. There are various paths or approaches available. While this cannot be an exhaustive list, it is possible to describe features of procedures carried out to date. A qualitative approach aims not only to identify the level of ICT adoption but also to understand why teachers use certain teaching methods. In contrast, a quantitative approach tends to involve descriptive statistics of commonly observed ICT adoption levels. The aim is to gain on overview of how ICTs are being used to teach and what they are contributing to education practices.

Given that the idea is to promote the adoption of educational uses of ICTs, they are analysed, designed, implemented and assessed using a qualitative approach. This approach involves various recursive and iterative activities: comparing data collected on teaching practices (teaching materials, teaching situation and interviews) with technology adoption levels (instrument of analysis); identifying aspects of education practice associated with adoption levels; using evidence and triangulated sources to explain why certain features of teaching practices are located in a certain level of adoption; analysing justifications, comments or notes to identify patterns, trends, links, similarities, differences, paradoxes and contradictions; and drawing conclusions on ICT-enabled teaching practice to identify strengths, weaknesses and opportunities for improvement.

The conclusions can be used to develop intervention proposals that can help to overcome weaknesses and boost the strengths of education practices analysed on the basis of adoption levels.

6

Scope and limitations of the model

Integrating ICTs into education is a rigorous, painstaking and deliberate exercise to adopt technologies to enrich and transform education practices aimed at promoting knowledge construction among learners. In the model presented, adoption is determined by the teacher's level of knowledge on ICTs, their characteristics and their potential educational application: the use he/she makes of them and how the teacher adapts the use of ICTs in teaching practices to move towards reflective and critical practice. The latter goes beyond an instrumental use of ICTs towards rediscovering their pedagogical potential in specific subject settings.

One of the contributions of this model is that approaching the ICT adoption process from the viewpoint of knowledge (declarative knowledge), know-how (procedural knowledge) and know-how in context (conditional knowledge) fits with the competency based training proposal in current education programmes for teachers and students. In that sense, the model is relevant and suited to the current demands of education in responding to modern dynamics.

Similarly, the model also sits among current attitudes of change as variability, with participants in educational situations following non-linear learning and performance trajectories. This non-linearity is understood as the individual tendency to have variable functioning as people carry out activities in variable conditions that result in performances attributable to many interacting factors. For instance, a teacher does not always design or implement the same education practice, as this depends on his/her knowledge of the content (new knowledge and examples and applications); the education aims proposed; student characteristics; prior knowledge; aptitude and attitudes to the practice; and the interaction that the teacher establishes with students and the content to be covered.

This model's proposed indicators, categories and levels will reveal to teachers adoption levels in the educational use of ICTs. They will then be able to define their current performance profiles and access a potential learning or adoption itinerary to move towards more sophisticated levels of ICT use based on their teaching objectives. They will also be able to define current performance levels of their students and promote progress towards higher levels of competency or adoption. The model has been designed in a way that enables teachers to deliberately use each level and competency's indicators as tools to follow up and monitor their own practice.

One key aspect is that adopting technologies under this model requires teachers to review, reflect on and improve their teaching competencies. This is because successfully integrating ICTs into teaching practices requires clarity on education objectives; achievement indicators; structure of teaching practices (instructions and procedures); assessment

methods; content characteristics; the cognitive, motor, emotional and attitude requirements on students meeting education objectives; and the characteristics of ICTs that are conducive to fulfilling those objectives.

The proposed approach for ICT-enabled education practices is qualitative involving observations, rigorous and detailed practice analysis and reflections on education objectives from a constructivist perspective. While this has the previously mentioned advantages and achievements, there are also major limitations (with the lack of standardization meaning that application can be economically costly and time consuming in terms of the design, implementation and assessment of education practices).

For teachers and their adoption process, assessors providing support or the work of teaching teams, the design or transformation of practices that include ICTs as psychoeducational instruments for constructing knowledge requires ongoing review, reflection and assessment of one's own teaching practice. Generally speaking, this type of work always requires major efforts and cannot always be replicated for all education actors and contexts.

Lastly, this proposal has been the subject of research and application in higher education (where it was proved useful and relevant). It is therefore necessary to replicate and adapt it in the design of education practices in pre-school, primary and secondary education where the proposal is conceptually and methodologically applicable.

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The Information and Communication Technologies (ICT) are transforming the ways in which society and culture are organized, with a significant impact on challenges in education. They undoubtedly have the potential to improve both teaching and learning in important ways; as a result, many new programmes and initiatives are emerging as part of efforts to integrate their use within educational systems. However, these programmes and interventions frequently lack the appropriate pedagogical foundations that would allow them to fulfill their considerable potential.

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