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THE ROLE OF ICT IN DEVELOPING AN INNOVATIVE AND REFLECTIVE PROFESSIONAL PROFILE IN TEACHER TRAINING

Abstract

The society of the early twenty-first century is characterized as the knowledge society. Schools cannot afford to remain detached from the fast-moving changes that are taking place and have therefore made innovation one of their main priorities. One of the most profound changes and innovations experienced in the last few years concerns digital technologies. While knowledge and mastery of digital tools and processes are guarantees of equity in the education system, schools also have to face the challenge of making digital tools and applications available to all their pupils without neglecting any aspect of their educational function. At the same time, teachers must also involve themselves in the digital competences that are the unavoidable landmarks of the education of today and of the future. As with other professions in other sectors, being familiar with these digital tools and processes, mastering them and constantly updating them are now components of the teaching profession.

When viewing these new learning environments from a general transformational perspective and the technology-related teacher-training perspective, we need to bear in mind the following three dimensions:

Firstly, both initial and continuous teaching training programs should largely focus on developing the competences teachers need to use information and communication technologies (ICTs) for teaching purposes. Continuous training should be organized around the teacher's autonomous learning but it should also incorporate a training and implementation strategy that is based on work carried out by teams of teachers.

Secondly, the undeniable emergence of new codes and languages that have their origin in digital technologies brings new ways of thinking and doing and new ways of learning and accessing knowledge. It also means that teachers must be prepared to abide by a set of professional ethics

and standards that require them to work individually and collectively to conceptualize the educational role that should be played by digital technologies.

Thirdly, the signs of the times require us to think about creating teaching center models that incorporate pedagogical innovations and open, flexible, creative, real and participatory digital projects and in which digital technologies can be the best pretext for innovation and for encouraging creativity in the classroom in order to introduce cross-disciplinary and organizational changes and open up schools to the community. These digital projects should make teachers question their individual roles, promote teamwork and involvement with others, generate synergies with other departments and areas as well as other teaching centers and their staff, and, finally, help to realize the dream of being "networked and web-based".

Keywords: ICT, initial training, teaching staff, innovation, pedagogy, reflection

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РОЛЬ ИКТ В РАЗРАБОТКЕ ИННОВАЦИОННОГО И РЕФЛЕКСИВНОГО ПРОФИЛЯ В ПОДГОТОВКЕ ПЕДАГОГИ

Аннотация

Общество начала XXI века характеризуется как общество знания. Школы не могут позволить себе оставаться в стороне от происходящих быстро меняющихся изменений и поэтому сделали инновации одним из своих главных приоритетов. Одно из наиболее глубоких изменений и инноваций, произошедших за последние несколько лет, касается цифровых технологий. Хотя знание и владение цифровыми инструментами и процессами являются гарантиями равенства в системе образования, школам также приходится решать задачу сделать цифровые инструменты и приложения доступными для всех своих учеников, не игнорируя при этом ни один аспект своей образовательной функции. В то же время учителя должны также заниматься цифровыми компетенциями, которые являются

неизбежными ориентирами образования сегодня и будущего. Как и в случае с другими профессиями в других секторах, знакомство с этими цифровыми инструментами и процессами, их освоение и постоянное обновление теперь являются компонентами профессии преподавателя.

Рассматривая эти новые условия обучения с общей трансформационной точки зрения и с точки зрения подготовки учителей, связанных с технологиями, нам необходимо иметь в виду следующие три аспекта:

Во-первых, программы как начальной, так и непрерывной педагогической подготовки должны в значительной степени фокусироваться на развитии компетенций, необходимых учителям для использования информационных и коммуникационных технологий (ИКТ) в учебных целях. Непрерывное обучение должно быть организовано вокруг автономного обучения учителя, но оно также должно включать стратегию обучения и реализации, основанную на работе, выполняемой командами учителей.

Во-вторых, несомненное появление новых кодов и языков, берущих свое начало в цифровых технологиях, приносит новые способы мышления и действий, а также новые способы обучения и доступа к знаниям. Это также означает, что учителя должны быть готовы соблюдать ряд профессиональных этических норм и стандартов, которые требуют от них индивидуальной и коллективной работы над концептуализацией образовательной роли, которую должны играть цифровые технологии.

В-третьих, знамения времени требуют от нас задуматься о создании моделей учебных центров, которые включают педагогические инновации и открытые, гибкие, творческие, реальные и совместные цифровые проекты и в которых цифровые технологии могут быть лучшим предлогом для инноваций и поощрения творчества в классе, чтобы внести междисциплинарные и организационные изменения и открыть школы для сообщества.

Эти цифровые проекты должны заставить учителей задуматься о своей индивидуальной роли, способствовать командной работе и взаимодействию с другими, создать синергию с другими факультетами и областями, а также с другими учебными центрами и их сотрудниками и, наконец, помочь реализовать мечту о том, чтобы быть «сетевыми и веб-технологиями». -основанный на".

Ключевые слова: ИКТ, начальная подготовка, педагогический состав, инновации, педагогика, рефлексия.

Introduction

Bearing in mind that technology can help to construct new environments, new perspectives and different educational and cultural modalities, the knowledge society should discern how technology affects the information society, the communication society, and the network society. Some of the questions raised concern the need for new training environments that are in accordance with the teacher's profile; involve issues such as: who generates the contents?, how will these contents be transmitted and evaluated?; and propose the generation of networks for promoting collaborative and cooperative work.

In response to these questions, actions should be proposed that enable educators to become technologically competent and allow the users of this instruction and training process to acquire a set of skills, techniques, attitudes and habits that require the correct use of technological tools and provide for a successful teacher-training process.

We live in a society in which technological change is the order of the day. Pupils are sensitized to the world of technologies. Educators should therefore take advantage of this new source of intrinsic motivation by using these technologies and incorporating them to develop activities that encourage pupils to take an active part in their learning processes. This will increase the possibility of promoting specific types of learning activities, enable the development of thinking strategies, and construct significant types of learning that enable users to interact with each other while also stimulating their personal activity level.

Using technologies enables information to be acquired, processed, stored and disseminated and makes it possible to train individuals who can adapt to the new social challenges.

Teacher training should be geared towards reflections on processes that can lead to projects aimed at promoting the pedagogical use of tools, resources, programs, services and environments that enable technological tools to be made available at any moment.

The contents of teacher training programs should be related to teacher digital competence, the role of teacher training centers, new professional profiles, the professionalization of teachers, and the development of teachers' professional careers.

We need to reflect on processes that may be considered high quality when considering the pedagogical use of the tools, resources, programs, services and environments that readily available technologies can provide us. Proposal should be drawn up whereby teacher training programs and the digital competences these programs teach are directly related and are catalysts for change and educational success.

The main aim of this article is to study and analyze the education process, particularly with regard to the training of teachers. We also present the conclusions of the participatory diagnostic process conducted by a group of national and international experts in this area.

Key ideas

On education policy and initial teacher training

Today's knowledge-generation process contains a mixture of shared learning and collaboration that requires a balanced combination comprising a cognitive component, an emotional component, and a large supply of social skills.

Bearing in mind that information is increasingly accessible thanks to the advent of ICTs, a teaching profile that is based on the mere transmission of teaching content is now meaningless. The teacher's role is no longer to provide pupils with information but to guide them through the process of searching and treating information so that they become responsible for actively and experimentally constructing their own knowledge.

If we take into account society's demand for the technological training of its teachers, the time devoted to ICTs in the curricula of university teacher-training programs is insufficient. Technological training must focus on the pedagogical application of digital tools rather than on their use.

Below are just some of the essential competences teachers need in order to exercise their profession in the twenty-first century:

1. Subject competence
2. Teaching competence
3. The ability to combine theory and practice
4. Cooperation and collaboration
5. Quality assurance
6. Mobility
7. Leadership
8. Continuous learning

On change management

We need to understand and accept that the "map" of teaching and learning processes is not exactly the real "territory" of the classroom or of each pupil. First and foremost, teachers should have an open (which is not to say naïve) attitude. They should be prepared to "explore" the possibilities provided by technological tools for renewing their teaching and learning environments, i.e. they should allow themselves to be surprised and should not have any pre-judgements when meeting the challenges posed by technology.

Secondly, rather than working alone, teachers should work in teams, sharing their classwork with other teachers. Online technology-supported collaborative work can help enormously in this area.

Thirdly, teachers should document what they do and share their innovations. We have excellent professionals who innovate every day but who do not write down what they do.

Fourthly, we need to bear in mind and understand the contexts and the "mental maps" of our teachers regarding innovation and change. Change management has more to do with fear and emotion than with rational concerns.

And finally, we need a vision of innovation that gives us the opportunity to experiment and make mistakes without becoming "paralyzed" or immobile. Learning from mistakes enables us to learn and to progress.
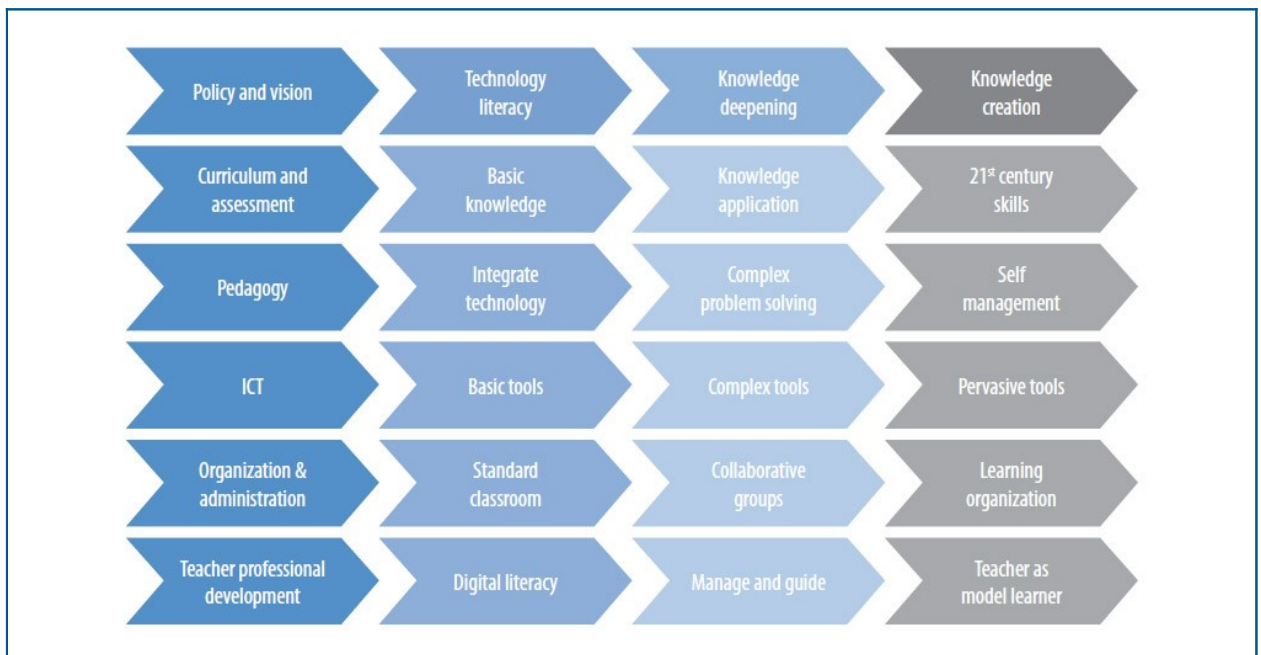
On teachers' skills development

Numerous studies have stressed the importance of developing skills to ensure that individuals take part in the knowledge society of the twenty-first century (Ananiadou & Claro, 2009; Claro et al., 2012; Pedró, 2006; Sánchez, Salinas, & Harris, 2011). These skills, usually termed "of the twenty-first century" (Claro et al., 2012; Partnership for 21st Century Skills, 2014), go beyond functional skills like knowing how to use a computer or different software. Although there are different approaches regarding the nature of these skills, it is usually agreed that they involve higher-level knowledge that is linked to creative activities as well as to innovation, communication and collaboration, information management, problem solving, citizenship and the ethical challenges that have become critical in digital environments (Ananiadou & Claro, 2009; Bennett, Maton, & Kervin, 2008; Claro et al., 2012; ISTE, 2014; Sánchez, Salinas, Contreras, & Meyer, 2011).

For pupils to develop these skills, teachers must be able to master them and be capable of teaching them. Studies on the knowledge and practices teachers need in order to teach these skills are consistent with the importance given to teachers to make improvements in the education systems (Barber & Mourshed, 2007; Darling-Hammond & Bransford, 2005; Twining, Raffaghelli, Albion, & Knezek, 2013).

Numerous countries and organizations have developed standards aimed at improving teacher performance. Some, including the ISTE Standards (formerly the NETS) for Teachers1 and the UNESCO ICT Standards for Teachers (UNESCO 2011) incorporate the knowledge and practices needed to help develop students' twenty-first century skills.

UNESCO ICT Standards for Teachers

Policy and vision	Technology literacy	Knowledge deepening	Knowledge creation
Curriculum and assessment	Basic knowledge	Knowledge application	21st century skills
Pedagogy	Integrate technology	Complex problem solving	Self management
ICT	Basic tools	Complex tools	Pervasive tools
Organization & administration	Standard classroom	Collaborative groups	Learning organization
Teacher professional development	Digital literacy	Manage and guide	Teacher as model learner

On Teacher Initial Training

Studies on incorporating digital technologies into teachers' initial training are still quite rare (Silva, 2014). According to Brun and Hinostroza (2011), ICTs are integrated into the curriculum only in specific areas and are not cross-disciplinary. Moreover, ICT-related teacher competences are present as specific objectives in less than half of thsyllabuses. According to the above authors, the main problem for teachers in training appears to involve how they should integrate ICTs into their future careers as teachers rather than learning how to use the ICTs themselves. From a theoretical point of view, and by way of a framework for reflecting on the integration of ICTs into learning environments, Mishra and Koehler (2009) provided a conceptualization of ICTs that was based on a distinction proposed by Shulman (1986): pedagogical content knowledge, which refers to the instructor's content knowledge that is teachable. The conceptualization proposed by Mishra and Koehler incorporates another type of knowledge: knowledge of technology.

This concept of Technological Pedagogical Content Knowledge (TPACK) is illustrated by Mishra and Koehler using three circles, one of which contains pedagogical knowledge, one of which contains content knowledge, and the other contains technological knowledge, with intersections between all three. The area of intersection between all three circles, i.e. all three types of knowledge, is called TPACK. TPACK is a proposal for constructing a new type of knowledge that is not normally available in training institutions and comprises content, pedagogy and technology. It is a response to the question: What technology linked to what pedagogy can help students to learn what content?

TPACK has attracted growing interest among researchers and has begun to guide efforts to integrate ICTs at various levels of education. Higher educational institutions conducted number of experiments and they helped them to design courses and instruments for measuring TPACK.
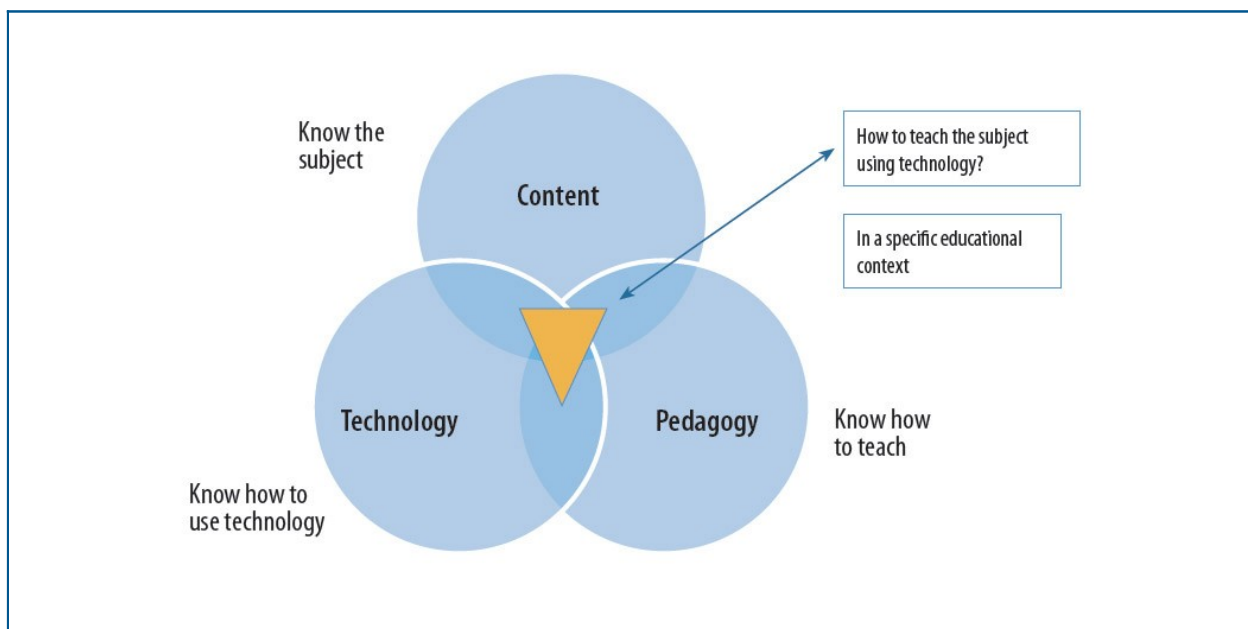
On new proposals for ICTs in education

In an increasing number of countries, attention paid to topics such as "computational thinking" and "programming" as part of the school curriculum is growing. This is reflected in the introduction of new curriculum areas for "Computation", "Computing" and "The Science of Computation", even in the first years of primary education (Berry, 2013). The new curriculum in England, for example, states that: "A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world."2

On challenges or barriers to the integration of ICTs in education

The integration of ICTs into education systems brings with it a series of challenges and barriers that

	Challenge or barrier
1st Order	
The institution	Institutional practices, available ICT structures, flexibility to make changes to the curriculum.
The student	Digital culture and personal ICT infrastructure.
2nd Order	
The teacher	Self-efficacy, attitudes towards ICTs, personal ICT infrastructure, perceived incentives.
3rd Order	
The discipline	Knowledge of the contribution of ICTs to enrichment of learning environments and resolution of learning or teaching nodes in the teacher's specific topic areas or subjects; the type of ICT to use (hardware and software) and how to use them both inside and outside the classroom.

institutions need to tackle as a whole (Zhao, 2002, Yung-Jo, 2012). These challenges and barriers are summarized in the following table.

First-order barrier: the institution and the student. Like all institutions, schools and universities have rules and traditions, a certain level of technological infrastructure, and support services to enable it to be used. The challenge of integrating ICTs into their students' education means that institutions must introduce changes in their curricular structures, update their technological infrastructure, and take other decisions that will directly affect their teachers and students. These challenges, which are called "First-order barriers", comprise the following dimensions:

The "digital culture" of the institution, which is associated with its practices, regulations, and the leadership displayed by its authorities. The recommended way to overcome this barrier is to create an ICT integration project that incorporates objectives, ICT resources, indicators of

integration, monitoring of progress, instruments for assessing students' ICT skills, and recognition of teachers' time commitment and is supported within a significant theoretical framework such as TPACK (Mishra and Koehler, 2009).

The technological infrastructure of the institution and the technical-pedagogical support available for its academic staff. The technological infrastructure is an essential barrier to tackle when integrating ICTs into an educational establishment. One of the first barriers identified (NCES, 2000), it is associated with quality, quantity and availability of ICT resources at an institution, particular for use in the classroom. Other barriers are the speed and efficiency with which problems are prevented or corrected by the institution's technical support staff.

Students' "digital culture" has changed fundamentally in the last decade. The so-called "Digital Natives" or "Learners of the New Millennium" (Pedró, 2006 and 2011; Prensky, 2009) have acquired a basic layer of technological skills. However, recent studies have shown that although students can operate mobile devices, social networks and videogames efficiently, this does not necessarily mean that they are automatically able to use software for educational purposes. Pedró (2006) suggests that when these technologies began to enter people's homes, the ICT-related competences of pupils started to outperform those of their teachers. This author also suggests that we can expect a demand for greater variety and quality in the use of ICTs in schools and universities, particularly with regard to the kind of ICT devices and services available at schools, the frequency of their use, the range of possible teaching activities, the opportunities for collaborative work and networking, and the standards of digital quality in terms of interactivity and use of multimedia resources.

Second-order barrier: the teacher. This barrier is associated with the teachers themselves. It refers to teachers' attitudes towards using technologies in their teaching activities, their sense of self-efficacy when using them in their classrooms, their perception of the effort needed to prepare and teach a class using technology, and their opinion of how efficient this effort is for achieving more or better learning and increasing motivation.

Third-order barrier: the discipline. Even when the institution has overcome the first two barriers, it is still not certain that teachers will introduce ICTs into their teaching strategies because each discipline presents its own specific challenges because of the role, advantages and obstacles inherent in learning resources. The difficulty lies in how to justify the use of technologies in a particular subject and how to respond clearly to the following questions: What do these technologies contribute? Do they help to improve learning? Do they enrich the teaching and learning environments? Do they need special support? Which software should be used? How

can we evaluate learning when using technologies? Will the pupils be able to transfer these practices and technologies to their future work environments?

Overcoming this disciplinary barrier is a long-term endeavour that requires institutional support. Key elements in this endeavour are peer networks to identify practices by other teachers of similar subjects who have successfully tested the use of technologies and can provide models for their use in those subjects (OECD, 2011).

General recommendations

On initial teacher training institutions

In our current socio-technological context, one of the missions of initial and continuous teacher training is to **prepare for the inevitable superseding of teaching practices that are based on the direct transmission of knowledge and a rigid organization of teachings**, especially at the secondary level where curriculums are overloaded with objectives and obligatory contents and evaluation criteria are static. A specific objective of this training should be to provide knowledge of the various types of educational applications (practice, simulations, tutorials, and games, etc.).

On innovation with technological support

The emphasis in current curriculums on the acquisition of competences requires further interaction between pupils and teachers. Attending to a diverse range of pupils and meeting a range of different needs leads to the individualization of learning experiences. Promoting skills for collaboration and teamwork means that **teachers have to organize, observe and support teambuilding**. Enabling students to reflect explain and contribute actively means that teachers have to organize, observe and monitor student discussions, demonstrations and presentations. Bringing teaching activities closer to real external situations means that **teachers have to propose activities that incorporate examples and real-world applications**.

Incorporating digital technologies as a resource for teachers and an instrument that enables students' intellectual work is another of these important changes. This means that teaching can definitely not be considered a static role that is "learned" finally. **The predisposition to lifelong learning that is today required of any educated person** begins with the exercise of the teaching function.

On teacher digital competence

Expressions such as "*digital natives*" and "*the Facebook generation*" express a generational fact that is associated with the familiarity young people have with technology. **Many schoolchildren have a large background of knowledge, experiences and digital skills, which are extensive but rather unstructured and cannot be equated with digital competence** because they do not

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guarantee that children and adolescents will learn and gain added value in their academic work by using technology. As teachers observe every day, being born in a socio-technologically rich context does not automatically imply that one is capable of working and studying in digital environments profitably and efficiently. Frequently using messaging systems and participating in social networks is not synonymous with mastering communication, while searching for information and using office automation tools (often little more than simply copying and pasting) is not the same as producing or managing knowledge.

For this reason, **a leading and integral objective of promoting digital competence in schoolchildren should be to enable them to moderately, judiciously and productively use Internet resources and their available devices to manage their online identity and protect themselves from security risks.**

Digital competence can be understood as the set of knowledge, strategies and skills that enable an individual to solve typical and emerging problems (i.e. those related to the future and to the new situations being produced) associated with the digital world in relation to communicating, selecting information and writing, etc., using a digital support.

Digital competence has an additional dimension that relates to the nature of the technological systems and instruments as the object of knowledge. The intellectual activity associated with programming teaches one to think in an abstract, logical and structured way, fosters the development of an autonomous and innovative mentality, and helps to develop "computational thinking", i.e. the reasoning and intuition that helps learners to develop problem-solving strategies. In some countries, "computational thinking" is gaining importance in compulsory education.

Actions and proposals

ICTs provide an opportunity for changing and transforming education, improving teacher digital competence, updating methodologies, and improving student learning. They should therefore be viewed as an opportunity rather than a threat.

We need to draw up a map of educational innovation and create a research agency or institute for pedagogical innovation that provides ITC support to schools (Living Edulab).

The technological and pedagogical maturity of schools should be evaluated and both teachers and pupils should be provided with accreditation for their ITC competences.

Dialogue should be promoted between the business technology world and the educational environment. The creation of an international event and meeting point for technological innovation applied to education would also be interesting.

The idea is not so much to install technology in the classrooms but to create a new model for schools that incorporates the presence of technology. School management should be empowered with digital competences and teachers should be given the opportunity to develop more efficient teaching and learning processes with the aid of technology while ensuring that the processes work better than when technology is not used.

School autonomy, integrated functioning, decentralized management, flexibility to adapt to the changing needs of society, and the involvement of the school community are the organizational principles that should govern the education system. School governance and educational leadership should respond to these principles, to whose development digital technologies are inherent. The actions of schoolteachers in both public and private teaching institutions should be coherent with these principles.

A technological and pedagogical handbook (for What?, Who?, and How?) should collect and systematize the various education-related technological solutions, identify technology sector suppliers and companies that can offer these services, and outline emerging methodologies and pedagogies related to the use of technology.

A systematic and comprehensive analysis of the most suitable teaching methods for working with technology in the classroom should be drawn up.

An ICT Integration Plan should be drawn up from a pedagogical rather than a technological perspective. While infrastructure should be considered in the development of this plan, the focus should be on the quality and relevance of the use of technology for pedagogical purposes. The plan should include progress indicators to monitor the effectiveness and impact of the strategies adopted.

Diagnoses of the ICT culture prevailing at teaching centers should be made periodically. The quality of the center's infrastructure and services perceived by users should also be assessed, with special regard to their pedagogical uses both inside and outside the classroom. Other aims of these diagnoses would be to identify the challenges or barriers prevailing at the institution, determine what strategies should be used to overcome them, and apply these strategies Incorporation of ICTs in the classroom. The institutions that are the most advanced in their incorporation of ICTs have been able to recognize and overcome numerous barriers to their incorporation, including those related to infrastructure self-efficacy, etc., and to overcome what is considered the most complex barrier, i.e. how to apply ICTs in a specific curricular area, in a particular classroom context, and with a suitable pedagogical method.

Peer networks. Links should be established and promoted between the teachers of different institutions who work in similar contexts. The literature shows that an effective way to progress is to work via horizontal channels with peers who share similar challenges and situations.

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