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**ARTICLE**

# DIGITAL COMPETENCES IN EDUCATION: A DISCUSSION OF THE CONCEPT

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ABSTRACT: This article provides a systematic review of the concept of Digital Competences (DC) in Education. Three databases were used: Capes Thesis and Dissertation Database, Capes Journal Database, and Google Scholar using the keywords Digital Competences, Digital Competence (in Portuguese) and Digital Competence (in English). Publications from 1997 to 2017 were used, excluding repetitive texts. Of the 487 total publications found, 40 were analyzed based their relation to the area and general interest. The importance of understanding the concept of DC was verified. In fact, technological complexity has given rise to different needs. Thus, it was necessary to trace the history of related terms, such as Computational Literacy, Informational Literacy, Media Literacy and Digital Literacy. The majority of the authors treated digital competences as a set of elements, comprised of knowledge, skills and attitudes (KSAs), necessary for the subject to be able to use the technologies.
Keywords: Digital Competences. Education. Digital Technologies.

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## COMPETÊNCIAS DIGITAIS NA EDUCAÇÃO: UMA DISCUSSÃO ACERCA DO CONCEITO

**RESUMO:** O presente artigo trata de uma revisão sistemática acerca do conceito de Competências Digitais (CD) na Educação. Para isso, utilizaram-se três bases de dados: Banco de Teses e Dissertações da Capes, Portal de Periódicos da Capes e *Google* Acadêmico com as palavras-chave Competências Digitais, Competência Digital e *Digital Competence*. Utilizaram-se publicações feitas entre 1997 e 2017, exclusão de textos coincidentes e seleção de textos de interesse. No total, foram levantadas 487 publicações tendo sido analisadas 40. Constatou-se a importância em compreender o conceito de CD, já que a complexidade tecnológica fez emergir diferentes necessidades. Assim, foi preciso traçar um histórico de termos que se relacionam, como Letramento Computacional, Letramento Informacional, Letramento em Mídias e Letramento Digital. Verificou-se que a maioria dos autores trata as competências digitais como um conjunto de elementos, a saber – conhecimentos, habilidades e atitudes (CHA), necessários para que o sujeito atue por meio das tecnologias.

**Palavras-chave:** Competências Digitais. Educação. Tecnologias Digitais.

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## INTRODUCTION

By increasing the use of Digital Technologies (DT), Brynjolfsson & McAfee (2014) argue that the parts of the knowledge society have modified and conditioned how we live, relate, communicate, learn, and generate new knowledge. This requires subjects to have Digital Competences (DC) in order to handle all of these changes. Studies on the concept of DC, such as OECD (2003), Unesco (2006), and European Commission (2012), have defined a list of digital competences for the profile of subjects using these technologies based on an international context. According to UNESCO reports (2006), digital competence is one of the eight core competences for lifelong development. However, the context and data is primarily European and few studies have been conducted in Brazil to understand the concept of these skills in education in this context.

Analysis of these studies shows that DC have been interpreted in different ways, therefore producing multiple meanings and a broad range of nomenclatures. Although there is a vast bibliography conceptualizing the term, its definition is not always clear. In fact, all descriptions seek to refer to how people should deal with Digital Information and Communication Technologies (DICT)[1] in different areas of life. Thus, there is no common, or globally agreed upon,

concept of digital competences, making it quite difficult to understand and properly use them in the educational context.

Hence we believe that a systematic review will help to provide a clearer understanding of the concept of DC, define it from an educational point of view, and clarify the difference between related terms, such as Computational Literacy, Informational Literacy, Media Literacy, Digital Literacy, among others that are found within the studies.

This work therefore aims to provide a broad view of the field of education related to the concept of Digital Competences by presenting research that has been carried out in the area.

This article is organized in five sections, beginning with the introduction. This is followed by the methodology, discussion of the results, and lastly the final considerations.

## A SYSTEMATIC REVIEW OF DIGITAL COMPETENCES

A systematic analysis was carried out in order to clarify the concept of digital competences and to compare different terms. The following steps were taken:

1. Keyword Selection: due to the lack of descriptors for digital competences, the following keywords were selected: digital competences and digital competence (in Portuguese and English).
2. Database Selection: Three databases relevant to the educational area were selected: Capes Dissertation and Thesis Database, Capes Periodical Database, and Google Scholar.
3. Definition of criteria for refinement:

   a. Beginning in 1997, the year in which the expression Digital Literacy was diffused nationally and internationally by Gilster (1997) as one of the key concepts to understand the digital competences;

   b. Selection of works which contained the key terms in the title;

   c. Language: Portuguese, English and Spanish;

   d. Works of an Educational nature.

The data from the searches, which were conducted in 2017, were organized in tables by database, containing the year, title, authors, type of publication, and language. The analysis of the data was done by

reading the full article, identifying the author's definition of the concept of Digital Competences, and then reflecting and discussing the concept based on the differences and similarities presented by the authors.

## RESULTS OF THE SYSTEMATIC SURVEY

Three Master's Theses were found in the Capes Thesis and Dissertation Database, see Table 1.

**TABLE 1.** Selections from the Capes Thesis and Dissertation Database

| Year | Title | Author(s) | Type of Publication | Language |
|---|---|---|---|---|
| 2015 | Percepção docente sobre os indicadores de competência digital | ESPINDOLA, Joice de. | Master's Thesis | Portuguese |
| | Habilidades informacionais dos estudantes de artes visuais multimídia: uma abordagem da competência em informação e competência digital | BOCHNIA, Bruna Amanda | Master's Thesis | Portuguese |
| 2016 | Competências digitais para o trabalho na sociedade conectada: estudo de caso em uma organização pública | BARROS, Robson Santos | Master's Thesis | Portuguese |

**Source:** created by the authors (2018).

A total of 93 articles emerged from the search of the Capes' Periodicals database, based on the previously mentioned criteria. However, only 16 papers were selected for final analysis, based on their focus on the concept of digital competences. The majority were based on experiments carried out in European countries, such as Spain, Russia, Norway, Portugal, Slovakia and Poland, as illustrated in Table 2.

**TABLE 2.** Selections from the Capes' Periodicals Database

| Year | Title | Author(s) | Type of Publication | Language |
|---|---|---|---|---|
| 2010 | *Trends and models of Media literacy in Europe: between digital competence and critical understanding* | TORNERO, José Manuel Pérez *et al.* | Article | English |
| 2012 | *De la competencia digital y audiovisual a la competencia mediática: dimensiones e indicadores* | AMOR, Perez, Ma. | Article | Spanish |
| | *Educación para los medios, alfabetización mediática y competencia digital* | GUTIÉRREZ, A; K Tyner | Article | Spanish |
| 2013 | *Aproximación a la competencia digital* | POVEDA, Lucía Amoroso | Article | Spanish |
| 2014 | *Estilos de coaprendizaje y algunos indicadores de competências digitales* | BARROS, Daniela Melaré Vieira | Article | Spanish |
| | *Diseño en entorno 3D para el desarrollo de la competencia digital docente en estudiantes universitarios: usabilidad, adecuación y percepción de utilidad* | ESTEVE, Mon; Francesc Marc; SEGURA, Jordi Adell; CERVERA, Mercè Gisber | Article | Spanish |
| | *La competencia digital en la formación de los futuros maestros: percepciones de los alumnos de los Grados de Maestro de la Facultad de Educación de Albacete* | GUTIÉRREZ, Ramón Cózar; COLMENERO, Manuel Jacinto Roblizo | Article | Spanish |
| | *Assessment of the digital competence in Russian adolescents and parents: Digital Competence Index* | SOLDATOVAA, Galina V.; Rasskazova, Elena I. | Article | English |
| | *Digital competence — an emergent boundary concept for policy and educational research* | ILOMÄKI, Liisa et al. | Article | English |

| | | | | |
|---|---|---|---|---|
| 2015 | *El trabajo en el aula y la competencia digital en el modelo 1a1 de la Comunidad de Madrid* | MUÑOZ ALVAREZ, Tania; SÁNCHEZ ANTOLÍN, Pablo; PAREDES LABRA, Joaquín | Article | Spanish |
| | *La competencia digital en la enseñanza del diseño. El caso de BAU Centro Universitario de Diseño de Barcelona (Uvic)* | DEUMAL, Gloria; GUITERT CATASÚS | Article | Spanish |
| | *Conocimiento profesional y competencia digital en la formación del profesorado. El caso del Grado de Maestro em Educación Primaria* | GEWERC, Adriana; MONTERO, Lourdes | Article | Spanish |
| | *El desarrollo de la competencia digital docente a partir de experiencia piloto de formación en alternancia en el Grado de Educación* | LAZARO CANTABRANA, José L. Lázaro; CERVERA, Mercè Gisbert | Article | Spanish |
| | *Predictors of digital competence in 7th grade: a multilevel analysis* | HATLEVIK, Ove Edvard; OTTESTAD, G.; THRONDSEN, I. | Article | English |
| | *Professional development in teacher digital competence and improving school quality from the teachers' perspective: a case study* | CERVERA, G. Mercè; CANTABRANA, Lázaro; LUIS, José | Article | English |
| | *Digital kompetanse på videregående skole, em idéanalyse av digital kompetanse i stortingsmeldingene* | HOLMES, Alan Richard | Article | Norwegian |

**Source:** created by the authors (2018).

Furthermore, a total of 391 papers were found through the *Google* Scholar search. Then 21 were chosen for analysis, 5 of which are Brazilian publications, according to Table 3. The same criteria was used for selecting the papers, and in this case most relevant works were chosen.

**TABLE 3.** Selections from *Google Scholar*

| Year | Title | Author(s) | Type of Publication | Language |
|---|---|---|---|---|
| 2007 | Competências digitais dos profissionais de comunicação: confrontando demandas de mercado e experiências pedagógicas | MACHADO, Elias; PALACIOS, Marcos | Journal article | Portuguese (Brazil) |
| 2008 | Digital Competence, for a Life Long Learning | ALA-MUTKA, Kirsti; PUNIE, Yves; REDECKER, Christine | European Commission | English |
| | Competência Digital: uma vertente da competência informacional | SANTOS, Hemanuela Fernandes Melo dos | Undergraduate thesis | Portuguese (Brazil) |
| | *Situated learning and teachers' digital competence* | KRUMSVIK, Rune Johan | Springer Event | English |
| | O papel dos videojogos no desenvolvimento de competências digitais | PEREIRA, Luís | Magazine article | Portuguese (Portugal) |
| 2009 | *Models and instruments for assessing digital competence at school* | CALVANI, Antonio *et al.* | Journal article | English |
| 2011 | *Mapping Digital Competence: Towards a Conceptual Understanding* | ALA-MUTKA, Kirsti | European Commission | English |
| | *Digital competence in the Norwegian teacher education and schools* | KRUMSVIK, Rune Johan | Magazine article | English |
| 2012 | Competências Digitais dos docentes do ensino superior | LEMOS, Susana; PEDRO, Neuz | Event | Portuguese (Portugal) |
| | *Educación para los medios, alfabetización mediática y competencia digital/Media Education, Media Literacy and Digital Competence* | GUTIÉRREZ, Alfonso; TYNER, Kathleen | Magazine article | Spanish |
| | *Digital Competence in Practice: An Analysis of Frameworks* | FERRARI, Anusca | European Commission | English |

| | | | | |
|---|---|---|---|---|
| 2013 | *DIGCOMP: A Framework for Developing and Understandig Digital Competence in Europe* | FERRARI, Anusca | European Commission | English |
| | *Digital competence at the beginning of upper secondary school: Identifying factors explaining digital inclusion* | HATLEVIK, Ove Edvard; CHRISTOPHERSEN, Knut-Andreas | Magazine article | English |
| 2014 | As competências digitais dos professores em redes de aprendizagem online: o caso da rede VoiceS — The voice of the European Teachers | BARBOSA, Elaine Cristina de Andrade | Master's Thesis | Portuguese (Portugal) |
| 2015 | Competência digital: pilar das políticas europeias para educação aberta | DEVINE, Jim | Magazine article | Portuguese (Portugal) |
| | Competência Digital e possibilidades de colaboração com recursos educacionais abertos (REAS) | ESPINDOLA, J. de; PEREIRA, AM de A.; ALVES, Thelma Panerai | Event | Portuguese (Portugal) |
| | Competências digitais e informacionais no ensino superior: um estudo com acadêmicos na Universidade Federal do Rio Grande — FURG | GODINHO, Natalia Bermudez; GONÇALVES, Renata Braz; DE ALMEIDA, Alex Serrano | Magazine article | Portuguese (Brazil) |
| | *Digital Competence in the Knowledge Society* | GALLARDO-ECHENIQUE, Eliana E. *et al.* | Magazine article | English |
| 2016 | Competência Digital: conhecer para estimular o ensino e a aprendizagem | PATRÍCIO, Maria Raquel; OSÓRIO, António | Event | Portuguese (Portugal) |
| | Competência Digital: um estudo com alunos ingressantes no ensino superior | DE MOURA, Flávio Aparecido Antonio | Master's Thesis | Portuguese (Brazil) |
| 2017 | Competências Digitais: Comportamentos, percepções e atitudes dos docentes / pesquisadores dos PPGCIS — 2008 a 2012 | AUTRAN, Marynice Medeiros Matos; BORGES, Maria Manuel | Event | Portuguese (Brazil) |

**Source:** created by the authors (2018).

A total of 40 works were used in this study, 8 were Brazilian. The first publication is from 2007 from Palácios, presenting the European Commission's concept of digital competences. Other works were developed subsequently, however a surge in publications can be seen since 2012. These are primarily international, promoting and discussing models of digital competences focused on subject profiles. Few Brazilian publications on the subject of digital competences were found. Since the first published work in 2007 until the most recent in 2017, only eight Brazilian articles were found that discuss digital competences focused on education.

Thus, the following section presents a discussion of the analysis of the articles, beginning with the concept of Digital Competences. It then discusses concepts that are often used as synonyms for Digital Competences but are understood as foundations for understanding digital competence. The initial purpose is to clarify the concept of DC and then present how it differs from the terms that are commonly associated with it.

## DISCUSSING DIGITAL COMPETENCES

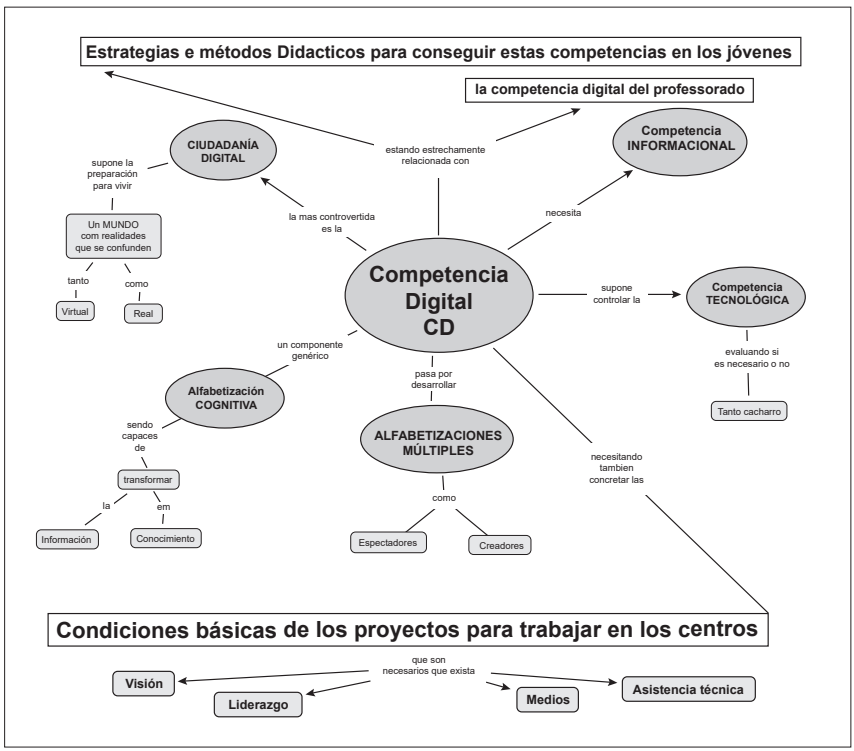
The term Digital Competence first appeared in 2006 in the report on key competences for lifelong education and training,[2] from the European Parliament in conjunction with the European Commission on culture and education. This document aimed to identify emerging European approaches and trends in Media Literacy by presenting eight core competences for lifelong learning. One was digital competence, which was defined as secure and critical use of information technologies for work, leisure, and communication. Therefore based these reports, in 2006 Europe began developing research focused on the concept and frameworks for digital competences for European citizens.

In the same year in Norway, research projects emerged that were aimed at developing and conceptualizing digital competences in education by changing school curriculum. This new model incorporated the development of digital competences specifically for the Norwegian context into each level of the curriculum. The concept of DC was based on ITU (2005) and Erstad (2005). According to ITU (2005, page 7), digital competence is understood as "skills, knowledge, creativity and attitudes required to use digital media for learning and comprehension in a knowledge society." Erstad (2005, p. 133) strengthens this concept, adding that digital competences

are "skills, knowledge, creativity and attitudes required to use digital media for learning and comprehension in a knowledge society."

Furthermore, Jorgi Adell (2005, 2007) argue that digital competences can be systematized in five points: 1. Information Competence; 2. Technological Competence; 3. Multiple Literacy Competence; 4.Cognitive Literacy Competence; and 5. Digital Citizenship Competence. The author presents a relational map between the competences, with their levels of dependence, presented below in Figure 1.

**FIGURE 1.** Relational Map of Digital Competence



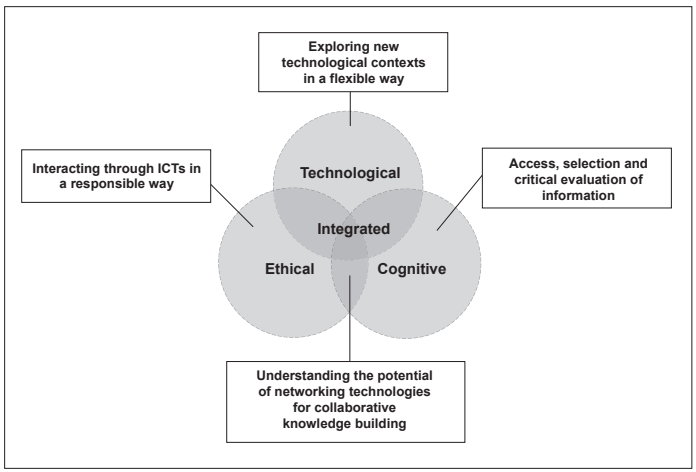

**Source:** Jordi Adell (2010).

In 2008, Calvani, Cartelli, Fini and Ranieri (2008, p. 186) defined a digital competence as:

> Being able to explore and face new technological situations in a flexible way, to analyze, select and critically evaluate data and information, to exploit technological potentials in order to represent and solve problems and build shared and collaborative knowledge, while fostering awareness of one's own personal responsibilities and the respect of reciprocal rights/obligations.

Then in 2010, the authors presented the three dimensions of digital competences, being technological, cognitive, and ethical, as shown in Figure 2.

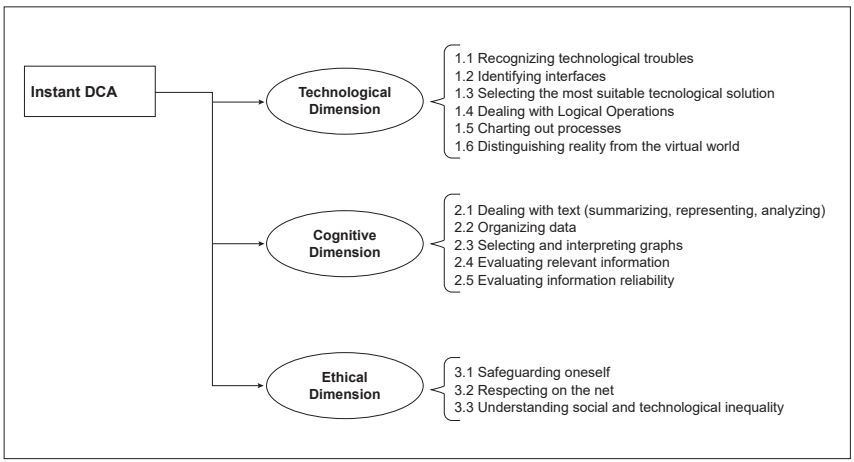
**FIGURE 2.** Digital Competence Framework




**Source:** Digital Competence in K-12: theoretical models, assessment tools and empirical research

The authors point to subdivisions for each dimension, which can be seen in detail in Figure 3.

**FIGURE 3.** Digital Competence dimensions and subdivisions




**Source:** Digital Competence in K-12: theoretical models, assessment tools and empirical research

In 2010, the European Commission mapped Digital Competences in knowledge, skills, and attitudes. Knowledges includes: understanding the functioning of computer applications, the risks of the Internet and online communication, the role of technology to support creativity and innovation, the truthfulness and reliability of online information, and ethical principles and legal aspects of collaborative tools. Skills include: information management, the ability to distinguish the virtual from the real world and see the connections between these two domains, the ability to use basic internet services to support creation and innovation. In terms of attitudes, one must be critical and reflective regarding information.

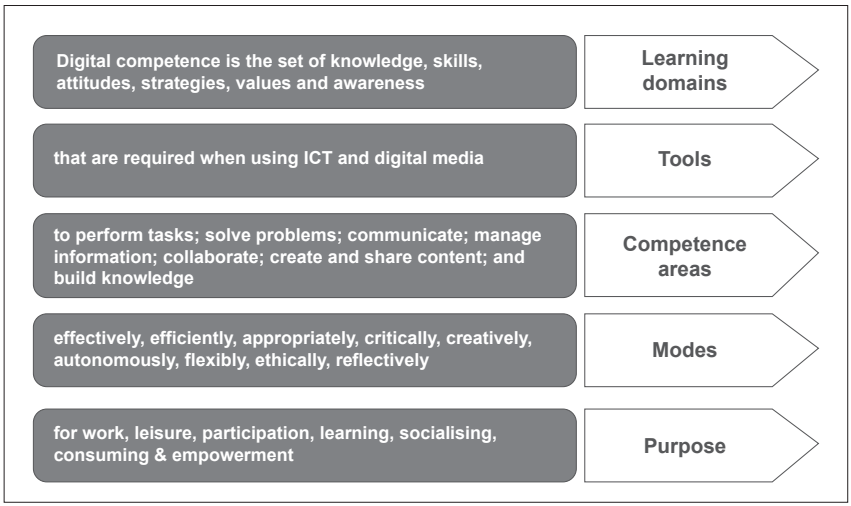
Based on different authors' definitions, Gutiérrez (2011, p.21, author's translation) defines digital competence as "the set of values, beliefs, knowledge, abilities, and attitudes to properly use technologies, including computers as well as different programs and the Internet, that allow and enable one to search, access, organize, and use of information in order to build knowledge."[3]

Gisbert and Esteve (2011)[4] present a very similar definition, being the sum knowledge skills and, attitudes not only in terms of their technological aspects, but also informational, multimedia, and communication. Based on all of these works, Ferrari (2012) defines a digital competence as:

> The set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming, and empowerment.

Ferrari's construction of digital competences is presented in Figure 4.

**FIGURE 4.** Parts of the division of the concept of Competences




**Source:** Ferrari (2012).

Figure 4 first lists the primary elements of competences (knowledge, skills, and attitudes) together with domains, strategies, values, and awareness. The tools are then presented, followed by the areas of competence. Therefore the teacher can best determine how to organize activities based on competences.

In 2013, the DIGCOMP report (Ferrari, 2013) defined it as knowledge, skills, and attitudes required to be digitally proficient in twelve different areas.

Similarly, Larraz (2013) understands Digital Competences as: the ability to mobilize different literatures, to generate information and communicate knowledge by solving situations in a constantly evolving society (LARRAZ, 2013, p. of the author).

This author argues that four literacies are necessary: 1. Information Literacy, to manage the digital information; 2. Technological Literacy, to analyze of the data in different formats; 3. Multimedia Literacy, to analyze and create multimedia messages; and 4. Communicative Literacy, to participate through a digital identity in a safe, ethical, and civic way.

Table 4 presents and organizes all of the concepts of digital competences addressed in this section.

**TABLE 4.** Main concepts of Digital Competence

| Year, Author | Concept |
|---|---|
| (2005) ITU | The knowledge, creativity, and attitudes required to use digital media for learning and understanding in the knowledge society. |
| (2005) Erstad | Skills, knowledge, and attitudes through digital means to master the knowledge society. |
| (2006) European Union | Safely and critically using of information technologies for work, leisure, and communication. This is supported by basic ICT skills: using the computer to obtain, evaluate, store, produce, share, and exchange information, as well as communicate and participate in collaborative networks through the Internet. |
| (2008) Calvani, Cartelli, Fini e Ranieri | To be able to explore and confront new technological situations in a flexible way, to critically analyze, select, and evaluate data and information, to harness their technological potential in order to represent and solve problems, and to build shared and collaborative knowledge, while fostering awareness of one's own personal responsibilities and reciprocal respect for rights and obligations. |
| (2011) Gutiérrez | The set of values, beliefs, knowledge, skills, and attitudes to appropriately use technologies, including computers, programs, and the Internet, which allow and enable searching for, accessing, organizing and using information in order to build knowledge. |
| (2011) Gisbert e Esteve | A digital competence is the sum of skills, knowledge, and attitudes regarding not only technological, but also informational, multimedia and communicative aspects. |
| (2012) Anusca, Ferrari | [...] a set of knowledge, skills, and attitudes, strategies and sensibilities that become necessary when using ICTs and the digital means to perform tasks, solve problems, communicate, generate information, collaborate, create and share content, build knowledge in an effective, efficient, critical, creative, autonomous, flexible, ethical, reflective for work, leisure, participation, learning, socialization, consumption and empowerment. |
| (2013) Larraz | The ability to mobilize different literacies, to generate information and communicate knowledge by resolving situations in a constantly evolving society. |

**Source:** Created by the authors (2018).

These elements were then selected and arranged with the authors to tabulate and compare the most recurrent. The last column presents the total amount of times this term was used, which can be seen in Table 5.

**TABLE 5.** Selection of elements and total

| Elements/ Authors | ITU (2005) | Erstad (2005) | Eshet-Alkalai (2004) | União Européia (2006) | Calvai *et al.* (2008) | Gutiérrez (2011) | Gisbert e Esteve (2011) | Ferrari (2012) | Larraz (2013) | DIGICOMP | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Knowledge | 1 | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| Attitudes | 1 | 1 | | | | 1 | 1 | 1 | | 1 | 6 |
| Skills | | 1 | 1 | | | | 1 | 1 | | 1 | 5 |
| Digitais/ technological means | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| Solve new problems/address situations | | | | 1 | 1 | | | 1 | 1 | 1 | 5 |
| Creativity | 1 | | | | | | | 1 | | 1 | 3 |
| Safe use | | | | 1 | | 1 | | | | | 2 |
| Critical use | | | | 1 | 1 | | | 1 | | 1 | 4 |
| Explore | | | | | 1 | | | | | | 1 |
| Evaluate | | | | | 1 | | | 1 | | 1 | 3 |
| Select | | | | | 1 | | | 1 | | 1 | 3 |
| Collaborate | | | | 1 | 1 | | | 1 | | 1 | 4 |
| Share | | | | | 1 | | | 1 | | 1 | 3 |
| Responsibility | | | | | 1 | | | 1 | | 1 | 3 |
| Respect | | | | | 1 | | | | | | 1 |
| Values | | | | | | 1 | | | | | 1 |
| Beliefs | | | | | | 1 | | | | | 1 |
| Abilities | | | | | | 1 | | | | | 1 |
| Strategies | | | | | | | | 1 | | 1 | 2 |
| Literacy | | | | | | | | | 1 | | 1 |
| Socioemocional | | | 1 | | | | | | | | 1 |

**Source:** created by the authors (2018).

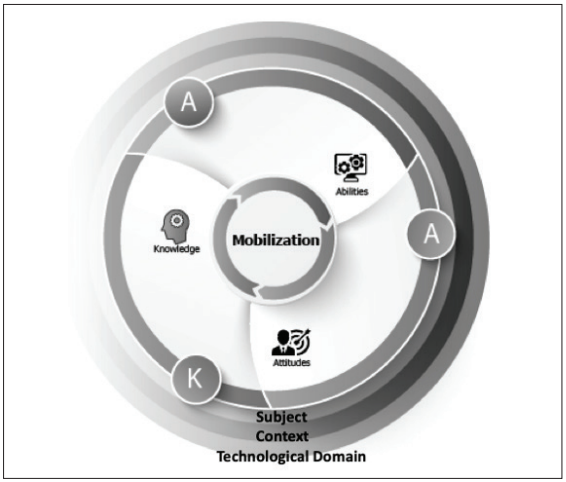
In summary, as can be seen in Tables 4 and 5, most authors treat digital competences as a set of elements, *Knowledge, Skills and Attitudes, Digital/Technological Means and problem solving*. However, three distinct groups of concepts were found. According to the authors of the ITU, 2005; Erstad, 2005; Gutiérrez, 2011; Gisbert and Esteves, 2001; Ferrari, 2012, digital competence is composed of knowledge, skills, and attitudes.

On the other hand, the European Union (2006) and Calvani, Cartelli, Fini and Ranieri (2008), the concept is the explanation of how the subject should act in when faced with ICTs, unlike Larraz (2013), who presents the concept of digital competence as the sum of multiple literacies.

According to Ferrari, Punie and Redecker (2012), there are two camps regarding the concept of digital competences. The first understands digital competence as the convergence of literacies, whereas the second sees it as a new literacy, with new components and greater complexity. In fact, it sees that digital literacy is modified with the emergence of new technological tools and societal needs, meaning that new situations and necessary competences are increasingly arising. This treating digital competence as a new literacy is not enough, since the concept of competence is complex and involves a set of elements that must be mobilized to address each new situation.

In light of the concepts presented, Digital Competences are understood to be linked to the technological domain by mobilizing a set of knowledge, skills, and attitudes (KSA) to solve problems in digital media. It is important to emphasize that digital competences are linked to a specific context and subject profile, as can be seen in Figure 5.

**FIGURE 5.** Representation of Digital Competences




**Source:** created by the authors(2018).

In the educational case, the context is education, the subjects are all of those involved in this context.

In addition to the main concepts and authors, the data also revealed a range of terms presented by different references that are used synonymously and/or erroneously for digital competences. This highlighted the need to clarify these expressions. The following section will therefore present the history of these concepts, which will be presented in the next section.

## DISCUSSION OF THE TERMS LINKED TO DIGITAL COMPETENCES: FROM COMPUTER LITERACY, TO DIGITAL FLUENCY.

The Concept of Digital Competences is commonly linked to different terms and concepts found in the literature reviewed, including: Computer Literacy, Information Literacy, Media Literacy, Digital Literacy, Digital Fluency.

In order to clarify the different terms and concepts, we illustrated the history based on the literature review. The term Computer Literacy was coined in the 1980s, and its variations, ICT Literacy, IT Literacy, Technology Literacy, which dealt with levels of experience and familiarity with the computer, especially with applications, according to Hawkins and Paris (1997). ICT Literacy, which was used at the time as a synonym for Computer Literacy, was actually understood as a part of Computer Literacy and focused on information skills, according to Katz (2005). According to the ICT International Literacy Panel (2002),[5] ICT Literacy is using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society.

Next the term Information Literacy arose in the 1990s due to needs beyond computer use, according to Bawden and Robinson (2002). The concept emphasizes identifying, locating, and evaluating information. Moreover, Alexandria (2005) adds that Information Literacy empowers people in all walks of life to seek, evaluate, use, and effectively create through information. Many authors point to critical thinking as one of the main components of Information Literacy, which has become even more important when linked to digital media, due to the vast amount of information available.

In Brazil, there was no specific translation for the term Information Literacy. Hatschbach (2002) points out that the diversity of uses of expressions makes solidifying this area even more difficult

in Brazil. At the time, Hatschbach (2002) presented some terms that translated the expression. However, there was a great deal of controversy regarding the translation itself, and several researchers did not use the expression in Portuguese. This began the discussion about the translation of Literacy into Portuguese in Brazil, and it only intensified with the expression Digital Literacy in 1997.

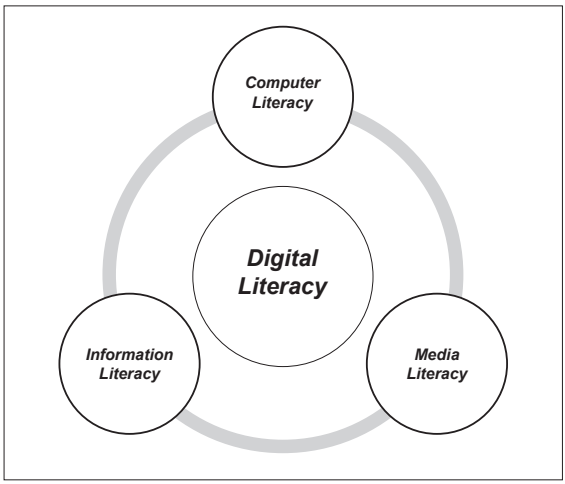
However in the 1990s, terms related to Media Education and Media Literacy were also discussed. Media Literacy was understood as a part of Information Literacy, focused on how information is accessed, evaluated, defined, constructed, and interpreted. It's one's ability to deal with information in different formats, such as print and audiovisual media (radio and television).

Originally, Media Literacy composed a field of research seeking to evaluate mass media. Authors Thoman and Jolls (2003) define it as the ability to access, analyze, evaluate, and create media in a variety of ways. Brandtweiner, Donat & Kerschbaun (2010) add critical and reflective thinking based on four dimensions: 1. Selecting and using appropriate media and content (knowledge about media, use, and participation); 2. Understanding content and evaluating media (analysis and evaluation); 3. Recognizing and responding to the influences of media content; and 4. Identifying and evaluating the circumstances of production (seriousness and credibility).

The concept of Digital Literacy, coined by Gilster (1997) in his book with the same name, defines the term as the ability to understand and use information in multiple formats from a wide range of sources through the computer. Therefore, terms related to Literacy, such as Technology Literacy or Technological Literacy, New Literacies, ICT Literacy, Media Literacy, eLiteracy, are included.

Gilster (1997, apud Bawden, 2002, p.395) also adds that "[...] Digital Literacy has to do with the domain of ideas rather than the keys." Thus, the concept is linked more closely with critical thinking about use of digital technologies than with the technical aspects. It absorbs many of the elements of Computer Literacy, Information Literacy, and Media Literacy, as shown in Figure 6.

**FIGURE 6.** Elements of Digital Literacy




**Source:** Created by the authors (2018).

Though Figure 6 represents a model to exemplify the relationships between these concepts, according to the authors, it does not mean that Digital Literacy is the sum of these literacies. Aquino (2004) for example, treats Digital Literacy as an evolution of Information Literacy, since the transition from print culture to digital culture has affected environments multiple environments. They are required to adapt to new formats, including the acquisition of new skills and abilities for the development of information services.

According to Eshet-Alkalai (2004), the concept is more than the ability to use software or operate a digital device, a user must also have a variety of emotional, motor, and cognitive abilities to function in digital environments. Jones-Kavalier and Flannigan (2006) argue that Digital Literacy represents a person's ability to perform tasks efficiently in a digital environment. Moreover, Martin & Grudziecki (2006) add that there are individual attitudes and skills to properly use digital tools: identifying, accessing, analyzing, and synthesizing resources, building new knowledge, communicating, and other situations in digital contexts.

Lastly, the European Commission (2007) defines Digital Literacy as abilities similar to reading and writing, but using new technologies. Gilster (1997) argued that new technologies require new skills. One must not only to find information, but also to acquire the skills to use it in one's life. Table 6, below, presents the main concepts discussed so far according to the analysis of the articles, along with their definition, authors, and variations.

**TABLE 6.** List of Concepts and their variations

| Year | Literacy | Concept | Reference | Variations |
|---|---|---|---|---|
| 80s | Computer Literacy | Level of experience and familiarity with a computer. | Hawkins & Paris (1997) | ICT Literacy, IT Literacy, Technology Literacy |
| 90s | Information Literacy | Ability to identify, search, evaluate, use, and create through information, which goes beyond the use of the computer. | Alexandria (2005) | |
| 90s | Media Literacy | Ability to access, analyze, evaluate and create media in a variety of media. | Thoman e Jolls (2003) | Media Education |
| 1997 | Digital Literacy | Ability to understand and use information in multiple formats from a wide range of sources through the computer | Gilster (1997) | Technology Literacy, Technological Literacy, New Literacies, eLiteracy |

**Source:** created by the authors (2018).

Regarding the works published in Brazil using the concept of Digital Literacy, different translations are found: *Alfabetização Digital, Letramento Digital, Fluência Digital* and even *Competência Digital*. Digital Literacy was the translation chosen by some authors such as Educarede (2008), Xavier (2003) and Buzato (2003).

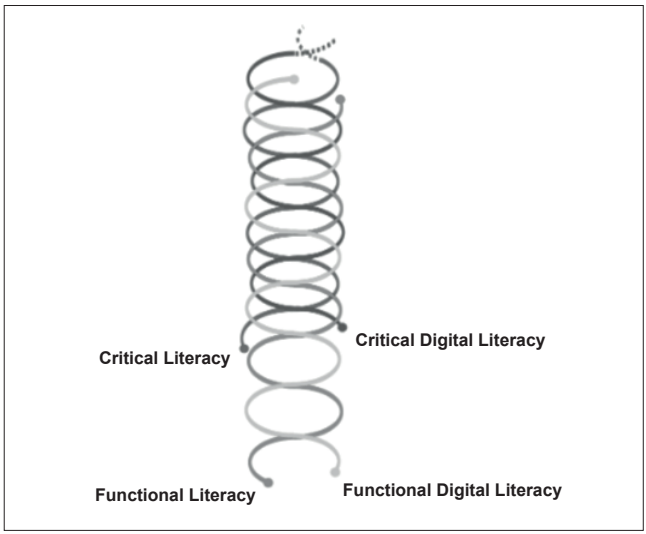
However, these terms are understood as different processes, the correct translation is *Letramento* or Critical Digital Literacy (from English to Portuguese in Brazil). In the United States and England, Soares (2004) points out that there are different levels of literacy, such as Reading Instruction and Beginning Literacy, which focus on traditional reading and writing literacy. The concept of Literate was introduced later, with research on the understanding of reading and writing acquisition and its social role. In this context, in order differentiate those who could use reading and writing socially, were referred to as Functionally Literate, a term coined by the United Nations Educational, Scientific and Cultural Organization (UNESCO ). The author also points out that this discussion occurred in the 1980s in the United States, although the word Literacy had already been in the dictionaries since the end of the XIX century.

In Brazil, these levels are differentiated through the concepts of functional literacy and Critical literacy, or *Literacia* in Portugal. According to Soares (2003), literacy in its own specific sense would be the system of acquisition of written code, reading, and writing skills. Thus, the literate individual is one who can read and write. For Buzato (2006, p. 5), literacy is a way of acting, affirming, constructing, and sustaining a worldview shared by a group and, therefore, carries the identity and significant traits shared by this group. The literate individual has the knowledge and practice to speak, read, and write in a variety of ways. Based on the situations or activities one is involved in, the individual can elevate the degree of literacy. Thus for Soares (2004), critical literacy is beyond functional literacy.

With the incorporation of technologies, literacy has been changing over time. It has been integrating the new competences of the DICTs through reading and writing practices that transform according to social needs. According to Teberosky (2004: 160), "technology can influence the way in which reading and writing are defined." That is, with technological changes, literacy can no longer be presented only as the comprehension of written and spoken the language without including the digital. Instead they must be treated as complementary processes. According to Coll and Illera (2010: 290), speaking of Digital Literacy is equivalent to postulating that, just as in literate societies it is necessary to have a functional domain of reading and writing technologies to have access to knowledge, in the Information Society (IS) it is imperative to have a mastery of digital reading and writing technologies. In other words, speaking about "functional digital literacy" implies accepting, that the learning how to master and manage DITCs are as basic in the IS as learning related to reading and written in literate societies.

The term Digital Literacy for Soares (2002, apud COUTO, 2012, page 48) is a state or condition acquired by those who master the new digital technology and read and write on the screen, different from the state or condition of literacy of those who read and write on paper. The digitally literate person interacts with the technologies and knows how to search, select, evaluate information, make exchanges between peers, share, and author, always using Web resources and different tools (Silva, 2012). Silva (2012) proposes a vision about the appropriation of functional and critical literacy and digital literacy, according to Figure 7.

**FIGURE 7.** Appropriation of functional and critical literacy




**Source:** Silva (2012).

According to Figure 7, the interlaced lines correspond to different learning moments, starting with functional literacy, then functional digital literacy, moving on to critical literacy and critical digital literacy. Although both literacies develop together, they concretely still happen at different moments. However, functional literacy is of a finite character, and the lines of begin and have an end, whereas those of critical literacy are continuous and unending. According to Silva (2012), digital literacy is a process that does not depend on functional literacy, but when it comes to digital literacy, we need functional literacy, which will develop precisely in the context of social practices of reading and writing in the virtual environment, with activities focused on functional literacy.

However, there was still confusion regarding the translations carried out in Brazil, mainly focused on technology. The expression Digital Literacy was translated as Functional Digital Literacy and now as Critical Digital Literacy.

In order to minimize the difficulty of differentiating the concepts of Digital Literacy, in 1999 the Committee of Information Technology Literacy, created by the USA's National Research Council, proposed the notion of Digital Fluency in contrast to Digital Literacy. This study entitled "Being Fluent with Information Technology," defines digital fluency as the ability to reorganize knowledge, to express oneself creatively and appropriately, as well as to produce and generate information (rather than merely understanding it) (1999, p.VIII).

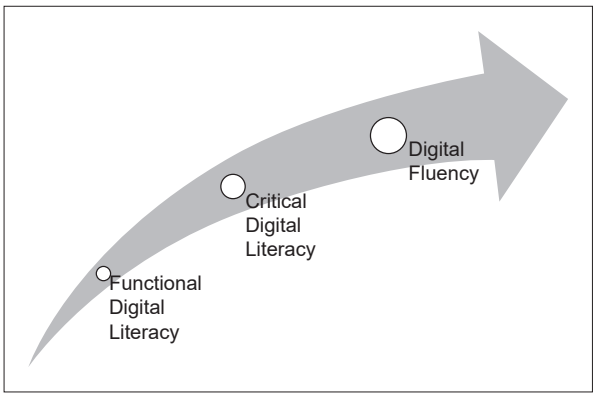
Fluency according to the Michaelis dictionary (2017) is defined as: "1 Quality or nature of what flows; fluidity; 2 Characteristic of what is spontaneous, natural; spontaneity." In learning a language, it means ease of use of the language, and according to Ager (2009, p. 5 apud NIESSEN, 2015, p.4):

> Communication involves both the out flowing aspects, such as speech, writing, and representing and the inflowing aspects, such as hearing, reading, and viewing. Each of these require abilities in understanding and interpreting, and at the level of fluency this would involve understanding humour, catching nuances, irony–all of which involve 'not only speaking the language effortlessly and accurately, but also being familiar with different registers of the language'.

Tarouco (2013, 285) argues that while both students and teachers, are "functionally literate" in the digital world, they need more to effectively function in the information society. This implies the notion of fluency, which according to Tarouco (2013) is a personal capacity, in the sense that fluent individuals in information technology evaluate, select, learn and use new information technologies appropriately for their personal and professional activities (p. 297).

In summary, functional digital literacy, critical digital literacy and digital fluency can be understood, according to Figure 8, as different interconnected processes that represent the subjects' experience and practice regarding the use of digital technologies.

**FIGURE 8.** Functional Digital Literacy, Critical Digital Literacy and Digital Fluency




**Source:** created by the authors (2018).

Thus, Table 7 (below) aims to summarize the relationship between these three concepts.

**TABLE 7.** Relationship between processes of functional literacy, critical literacy, and fluency

| Functional Literacy | Functional Digital Literacy |
|---|---|
| Literacy in its proper specific sense would be the system of acquiring the written code, of reading and writing skills. Thus, the literate individual is one who can read and write (Soares, 2013). | Teberosky (2004, p. 160): ""Technology can influence the way in which reading and writing are defined." That is, with technological changes, literacy can no longer be presented only as the understanding of written and spoken the language, without the digital. They must be treated as complementary processes. |
| Critical Literacy | Critical Digital Literacy |
| Literacy is a form of acting, affirming, constructing, and sustaining a worldview shared by a group and therefore carries identity traits and meanings shared by that group (Buzato, 2006). | Ability to understand and use information in multiple formats from a wide range of sources through the computer (Gilser, 1997). Digital literacy is a state or condition acquired by those who master the new digital technology and therefore read and write on the screen, which is different from the state or condition of the literacy of those who practice reading and writing on paper (Soares, 2002 apud COUTO, 2012). |
| Fluency | Digital Fluency |
| 1 Quality or nature of what flows; fluidity; 2 Characteristic of what is spontaneous, natural; spontaneity, fluid: "She speaks English with great fluency" (Michaelis online, 2017). | Digital Fluency is a personal capacity, in that individuals fluent in information technology evaluate, select, learn and use new information technologies appropriately according to their personal and professional activities (Tarouco, 2013). |

**Source:** created by the authors (2018).

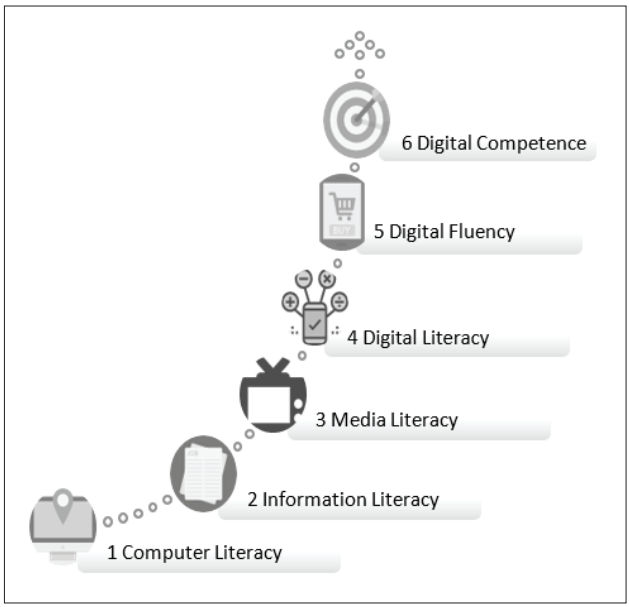
Based on this survey of the terms linked to the concept of digital competences, it is clear that a new process of socialization and culture has arisen through the DITCs. This has therefore influenced ways of learning, communicating and interacting, transforming the manner in which one interprets and responds to the real and virtual world. Hence, the concept of digital competences emerges as a response to these transformations. It has been demonstrated to be is a concept that goes beyond literacy, since it is a complex concept that involves a set of elements, KSA, that must be mobilized to address a new situation.

## FINAL CONSIDERATIONS

We will conclude with a discussion based on our systematic analysis of national and international data that is considered relevant for understanding the concept of digital skills in education. At the international level, there have been various efforts to define digital competences in education. However they translate a subject profile and educational level that does not fit with the Brazilian reality. There are few published works on the subject in Brazil, which make international works the primary reference.

The concept of digital competences was identified as emerging as DITCs provoked transformations in all areas of society. Since then, technological complexity has continuously created ever increasing distinct needs, because having digital tools does not guarantee that the subject is digitally competent. Thus, it is understood that the concept has a particular resonance in the current context, just as different terms have made more sense in different time periods. Figure 9 summarizes and highlights the expressions used through to the current discussion about the concept of digital competences

**FIGURE 9.** Construction of the concept of digital competence




**Source**: created by the authors (2018).

Therefore, it is clear that the changes in relation to concepts are linked to technological development, emerging new needs and ways of dealing with DITCs in everyday life. In the 1980s, the need was to understand how to use the computer; in the early 1990s, the use of information and different media. Since 1997, digital literacy is needed to deal with digital tools and the internet.

The figure above illustrates why some authors conceptualize digital competences as the sum of literacies, since they adopt the historical formation as a constituent element of the concept. However, Krumvisky (2011) argues that the definition of digital competence is broader and more complex, going beyond Larraz's (2013) multiple literacies. In fact, soon new elements will need to be incorporated and the concept adapted.

Hence, the issues related to the concept are not simple or clear, as the literature review demonstrates the extensive theoretical diversity around the term which has created terminological chaos for various reasons (LARRAZ, 2013). However, it was possible to elaborate a definition of Digital Competences based the review that was carried out. In spite of the diversity of documents and ways of approaching the concept, there is a tendency with respect to the compositional elements. These elements are understood as knowledge, skills, and attitudes, aimed at the use of DITCs and considered fundamental for this society that is fully utilizing exploring the possibilities of technologies.

Lastly, a digitally competent subject is a subject can understand technological means media enough to know how to critically use the information and be able to communicate using a variety of tools. This article was aimed to provide a better understanding of the concept of digital competences, highlighting that technology constantly evolves which generates great transformations in education, society, and beyond. Digital competences are therefore dynamic and must be constantly updated.

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## NOTES

1 This term was chosen because it reflects that digital elements are embedded in Information and Communication Technologies (ICTs), according to Fontana; Cordenonsi (2015). Digital Technology (DT), according to Kenski (2012), has caused radical changes in people's lives, especially when it comes to instant communication and searching for information, with the main devices being the computer, cell phone, smartphone, among others, along with the Internet.

2 The report can be accessed at the following link: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2006-0365+0+DOC+XML+V0//PT - BKMD-11

3 "El conjunto de valores, creencias, conocimientos, capacidades y actitudes para utilizar adecuadamente las tecnologías, incluyendo tanto los ordenadores como los diferentes programas e Internet, que permiten y posibilitan la búsqueda, el acceso, la organización y la utilización de la información con el fin de construir conocimiento" (original text in Spanish).

4 "la competencia digital es la suma de habilidades, conocimientos y actitudes no solo en aspectos tecnológicos, sino también informacionales, multimedia, y comunicativos que dan paso a lo denominan una (alfabetización múltiple compleja)" (original text in Spanish).

5 The panel was a study conceived in 2001 by the Educational Testing Service (ETS) aimed at building a panel on ICT literacy. The result can be accessed at the link: https://www.ets.org/research/policy_research_reports/publications/report/2002/cjik, it is entitled Digital Transformation: A framework for ICT Literacy.

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