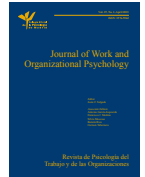




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'Digitalized' Competences. A Crucial Challenge beyond Digital Competences

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A B S T R A C T

Today's societies are experiencing a digitalization that is transforming organizations and jobs. Scholars, practitioners, and policy makers tend to focus on digital competences as a way to adapt the general population and workers to the technological revolution, enhance competitiveness and employability, and reduce social exclusion. It is important to develop "digital competences", but we propose that this strategy only provides a partial view of the necessary capabilities. To achieve a more complete picture, "digitalized competences" should also be considered, that is, non-digital competences that are transformed through the intervention of digital technologies. Increasingly, jobs in which purely digital skills are not core elements change dramatically when they incorporate digital objects and processes. This change forces workers and professionals to perform traditional tasks in a very different way. It is likely that the shift from non-digital to digitalized competences involves a more pervasive transformation for organizations, jobs, and workers than pure digital competences. With this in mind, this article has two main objectives. First, we provide a definition of digitalized competences, linked to job transformation. Second, we use a typology of competences (professional, core cognitive, transversal, and leadership) and some cases to illustrate this change.

Las competencias "digitalizadas". Un reto crucial más allá de las competencias digitales

R E S U M E N

La sociedad actual experimenta un proceso de digitalización que está transformando las organizaciones y puestos de trabajo. Investigadores, profesionales y desarrolladores de políticas tienden a focalizar el reto de esa transformación en las competencias digitales cuando plantean la necesidad de preparar a la población general y a los trabajadores para esa revolución tecnológica, potenciar la competitividad y empleabilidad y reducir la exclusión social. Es importante desarrollar las competencias digitales, pero esta estrategia solo proporciona una visión parcial de las capacidades necesarias. Para conseguir una visión más completa se debe considerar las "competencias digitalizadas", es decir aquellas competencias no digitales que se transforman por la introducción de las tecnologías digitales. De forma creciente, los trabajos en los que las competencias puramente digitales no son el elemento nuclear cambian de forma dramática cuando incorporan objetos y procesos digitales. Estos cambios empujan a los trabajadores y profesionales a desempeñar las tareas tradicionales de formas muy diferentes. Es probable que el cambio de las competencias no digitales a las digitalizadas implique una transformación más importante para las organizaciones, los puestos y los trabajadores que la derivada de la incorporación de las competencias puramente digitales. En este contexto, el artículo se plantea dos objetivos principales: primero, ofrecer una definición de las competencias digitalizadas vinculada a la transformación de los puestos de trabajo y segundo, el uso de una tipología de competencias (profesionales, cognitivas nucleares, transversales y de liderazgo) presentando casos que ilustren estos cambios.

Since the mid-18th century, several technological revolutions have impacted and transformed economic, social, and other important aspects of the world, producing disruptive changes and long-lasting effects in most if not all areas of societies. As a result, each of these technological revolutions has produced dramatic changes in our lives (Pajares et al., 2017). Recently, Industry 4.0 represented

the fourth industrial revolution, with 'the second machine age' (Brynjolfsson & McAfee, 2014) and digitalization (use of digital technologies and digitized information to create value in business and social interactions; see Gobble, 2018) leading to a large number of developments. Despite some obstacles (e.g., societal values, legal constraints), this technological transformation was able to create a

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generalized revolution in current societies, with an impact on large global phenomena and specific aspects of human lives, such as consumption, mobility, education, work, leisure, and many other facets.

More specifically, the acceleration of digitalization (Bradley et al., 2020) has produced new developments and profound technological transformations that affect organizations, labor markets, and jobs. In addition, digital transformations and the shift to new ways of working have been accelerated by the pandemic and subsequent lockdowns due to SARS-CoV2 (Amankwah-Amoah et al., 2021; Lopez-Pelaez et al. 2021; Nagel 2020). For example, telework increased significantly during pandemic lockdowns (Peiró & Soler, 2020). These phenomena are accompanied by different interpretations and evaluations of the meaning and implications of these technological changes, ranging from decided optimism to deep pessimism. A clear manifestation of these approaches in jobs and labor markets is apparent in the debate about the positive or negative (Brynjolfsson, & McAfee, 2014) effects of digitalization on the balance between job destruction and job creation (Autor, 2013, 2015).

Groups and individuals also differ in their degree of preparation to deal with these changes and respond to the new expectations of digitalization, given that they are probably asked to be competent in managing and even taking advantage of this scenario. New digital literacy requirements are needed, and the differences between individuals, groups, and regions in enabling the acquisition of new knowledge and skills may increase the existing inequalities in education, which are also reflected in job qualification, career development, and social and income differences. Digitalization may deepen social differences, increasing social, and educational exclusion and producing important gaps and breaches that contribute to weakening social cohesion and inclusion while increasing social unrest (see Szeles & Simionescu, 2021). In addition, the disruptive shift towards telework, due in part to the pandemic, may have taken place with poor or little planning, poor equipment, and a loss of efficiency because of a lack of preparation and a shortage of the necessary skills.

With this in mind, the current article introduces the concept of “digitalized competences”, which goes beyond digital competences and addresses digital transformation and its demands on workers and organizations in a comprehensive way. Our goal is twofold. First, we define digitalized competences (non-digital competences that are transformed through the intervention of digital technologies). They are the result of the digital transformation of today’s societies and organizations, in a process where non-digital competences are transformed by their embeddedness in technological change. This transformation probably represents a more pervasive change in job organization and workers’ demands than in the case of pure digital competences. Second, this change affects different types of competences. For this reason, we consider a typology of digitalized competences (professional, core cognitive, transversal, and leadership) and cases that represent this transformation. We argue that non-digital competences will continue to be important, but many of them will have to be implemented in other ways in order to be effective, taking advantage of technological change and digitalization. Before this analysis of digitalized competences, however, we describe the debate about the substitution vs. transformation of jobs and professions and the role of digital and non-digital competences in the technological change.

As a preliminary explanatory note to clarify the terminology, it is relevant to point out that, in psychology, “competence” describes the capacity to deal with problems and challenges effectively, going beyond mere adaptation to circumstances and incorporating changes in human behaviors and in the environment (VandenBos, 2015). Consequently, competences improve the understanding and prediction of job performance (Fahrenbach et al., 2019; McClelland, 1973). Nevertheless, throughout this article, we will use the terms

‘competence’ and ‘skills’ interchangeably, given that the literature does not always clearly distinguish between the two terms. For instance, both the PISA and PIAAC studies of the Organisation for Economic Co-operation and Development (OECD) note that these two terms are used to refer to the ability or capacity of an agent to act appropriately in each situation (OECD, 2019a).

A Brief Note about Digital Competences

In 2018, the Council Recommendation on Key Competences for Life-long Learning (22 May 2018, ST 9009 2018 INIT) defined digital competences as those that “involve the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society.” Different efforts have been made to address digital skills at work in response to rapid technological changes and digitalization (Muro et al., 2017). Some initiatives were devoted to identifying and classifying the digital competences. United States O*Net offers detailed information about the digital content of every occupation included in the occupations database. The O*Net taxonomy offers a comprehensive list of detailed occupational descriptions (Fahrenbach et al., 2019).

In Europe, the ESCO (multilingual classification of European Skills, Competences, Qualifications and Occupations - <https://esco.ec.europa.eu/en>) provides a common language for education and employment by including a group of digital competences with six sub-categories: working with computers; programming computer systems; setting and protecting computer systems; accessing and analyzing digital data; using digital tools for collaboration, content creation, and problem solving; and using digital tools to control machinery. Recently, a new version of ESCO (v.1.1) reviewed new skills and knowledge, including in the taxonomy the skills listed in the European Digital Competence Framework for Citizens (DigiComp) (Vuorikari et al., 2022) competence areas (Zignani, 2022). These skills represent a total of 23 competences categorized in five blocks (see Table 1).

Table 1. The DigComp Conceptual Competence Model

Information and data literacy
Browsing, searching and filtering data, information and digital content
Evaluating data, information and digital content
Managing data, information and digital content
Communication and collaboration
Interacting through digital technologies
Sharing information and content through digital technologies
Engaging in citizenship through digital technologies
Collaborating through digital technologies
Netiquette
Managing digital identity
Digital content creation
Developing digital content
Integrating and re-elaborating digital content
Copyright and licenses
Programming
Safety
Protecting devices
Protecting personal data and privacy
Protecting health and well-being
Protecting the environment
Problem solving
Solving technical problems
Identifying needs and technological responses
Creatively using digital technologies
Identifying digital competence gaps

These initiatives aim to guide not only job descriptions, but also educational needs at different stages and levels. As Cedefop (European Centre for the Development of Vocational Training [Cedefop, 2021a; 2021b]) pointed out, this is an effort to connect skills and technology from the perspective of obsolescence and risk of job loss due to technological change. Thus, the DigComp model plays an important role in policy development in education and employment. It also shows its usefulness in identifying gaps and mismatches between the available human capital and labor market needs and demands.

In addition to classification models, some efforts have been devoted to studying different perceptions of the importance of specific digital competences and their consequences. The existence of significant gaps between different stakeholders, such as employers, graduates, and teaching staff, has been confirmed (Różewski et al., 2019; Różewski et al., 2021; Sicilia et al., 2018). Pichler and Stehrer (2021) also confirmed that digital competences are related to a positive occupational status and better labor market opportunities.

Despite the importance of digital competences, it is also relevant to analyze the role of non-digital and digitalized competences in the new era in order to achieve a more comprehensive view of changes and how they affect the required competences.

Non-Digital Competences Remain Important in the Digital World

As mentioned above, in today's societies there is an increasing interest in understanding and training digital competences in workers, students, and the population in general, assuming that they will add value, competitiveness, and employability (e.g., Deming & Noray, 2018; Morandini et al., 2020; OECD, 2019b). This situation sparks a debate: are non-digital competences going to continue to be useful? How are the two types of competences going to coexist and provide positive synergy? Despite the importance attributed to digital competences, a broad range of skills will be needed, including non-digital ones. In fact, Morandini et al. (2020) argued that other competences, beyond digital and cognitive skills, are also becoming increasingly relevant. Examples are adaptability, entrepreneurship, creativity, critical thinking, readiness to learn, and communication and collaboration skills, among others.

The implicit idea in this coexistence is that digital competences are quite relevant in today's context, but they do not operate in a vacuum. In order to add value, other competences are necessary for at least three reasons. First, despite the digitalization process, relevant tasks that require social or relational skills will continue to exist (e.g., negotiation processes, selling, etc.). Ratajczak-Mrozek et al. (2021) pointed out that digital competences alone will not be sufficient, and that the coexistence of digital and relational competences will provide financial and non-financial value. In other words, workplaces will require digital competences, but job demands will not be restricted to them.

Second, digital and non-digital competences are likely to reinforce each other in a virtuous circle. Competences include not only knowledge and technical capabilities, but also attitudes and values underlying aspects such as readiness to learn, creativity, entrepreneurship, etc. These attitudinal aspects are probably precursors or enablers of digital competences. Digital technical capacity alone has little scope if it is not accompanied by other typically human forces that guide actions towards creativity and learning. As Muro et al. (2017) pointed out, inherent human capabilities are essential in the development of digital competences. Workers, organizations, and society will only improve and accelerate the adequate use of technology if technical competences are based on aspects such as adaptability, curiosity, and social intelligence. Likewise, it is reasonable to expect that in the digital era feeling digitally competent stimulates innovation, creativity, and positive attitudes towards personal and professional development.

Finally, we propose that non-digital competences can evolve

into digitalized ones. This is a pervasive phenomenon based on the digitalization and transformation of jobs and professions.

Transformation of Jobs and Professions and Implications for Digitalized Competences

In many ways, digitalization at work has meaningful implications for human work. In a number of occupations, the mechanization of jobs has made them obsolete and taken them out of the labor market. This situation is related to the debate about the destruction vs. creation of jobs due to digitalization (e.g., Reljic et al., 2021). Although the data show lower employment of unskilled labor (and an increase in skilled labor) due to digitalization (Balsmeier & Worerter, 2019), the strongest and most pervasive impact has to do with the transformation of occupations, including professional positions (Pérez et al., 2020). This process can accelerate the relevant transformation of non-digital competences into digitalized competences, a phenomenon that has not received enough attention. For example, changes in legal services are increasingly important, due to greater document automatization and digitalization of legal research, contract reviews, etc., as well as the first steps taken by companies such as Amazon in this sector (Caserta, 2020). A more microscopic view confirms the transformation of tasks in many ways. Pérez et al. (2020) recently analyzed the different processes involved in task transformation. In general, digital technologies substitute the 4D tasks (dull, demeaning, dirty, and dangerous), and this is one of the main effects of the incorporation of robots and cobots into work processes. Nevertheless, the substitution goes beyond this and often covers complex tasks that may become standardized, which has a significant impact on professional work. In addition, substitution is not the only way to change jobs. Cooperative tasks between cobots and humans, augmented reality, virtual reality, artificial vision, artificial intelligence, and digital support of decision making are some of the ways digitalization has changed the required tasks and human work.

The focus on task changes shows that the most important impact of technological changes on work lies not in the destruction vs. creation of jobs, but in job transformation due to more or less profound task changes (Pérez et al., 2020). In order to analyze these changes, it is important to further adapt and develop the taxonomies of tasks and relate these task types to digitalization changes in different jobs. One of the challenges of Work and Organizational Psychology is to examine the ways these tasks are performed, either synchronically or sequentially and individually or in coordination with others with different relational types (functional dependence, interdependence, etc.). In any case, this transformation will require both digital and digitalized competences.

Recently, a number of contributions have developed task taxonomies that may help to better understand the changes produced by digitalization at work. Considering the task categories used by the Occupation Information Network, O*Net, the European Working Conditions Survey (EWCS), and the Programme for the International Assessment of Adult Competences (PIAAC), the European Foundation for the Improvement of Living and Working Conditions (Eurofound, 2016b) developed an integrative taxonomy that considers a number of classification dimensions based on two criteria. The first criterion takes into account the ways of 'dealing' with objects: physical, intellectual (coding, linguistic, numerical, problem solving, and social interaction). The second criterion considers the methods and tools used to perform the task in terms of the work organization (autonomy, teamwork, routine work) and technology used (with or without ICT) (see, for the full development of the taxonomy, Eurofound 2016a; and for a detailed description of the methodology used in the construction of the taxonomy, Fernández-Macías et al., 2016). This taxonomy has made it possible to identify the growth and decline of different jobs in

the European labor market (Eurofound 2016b), identifying those that increase the use of ICT and the countries that move faster or slower in changing the structure of their labor markets. Pérez et al. (2020) mentioned the need to also consider the emotional and affective tasks that were not included in the aforementioned taxonomy.

With this task taxonomy in mind, we can better identify the potential impact of digitalization on jobs. One significant impact could be the fragmentation of jobs into repetitive tasks. A clear example of this type of impact can be found in cooperative platform work, such as Amazon Mechanical Tasks. In addition, the increasing opportunities provided by platform work and other digital developments may also degrade jobs and create precarious work (see O'Shea et al., *in press*). However, platform work is not always related to precarious work, and a large number of diverse cooperative platforms offer workers opportunities to do highly qualified work. At the same time, from a labor relations perspective, it is often challenging to clearly identify the increasingly blurry boundaries between freelance and employed work (see Todolí & Peiró, 2022, for an empirical study on platform workers).

A second impact could be produced by the increase in cognitive and socioemotional tasks on the job and the decrease in routinized tasks, significantly changing the composition of jobs. Digitalization increasingly involves cooperation with digital devices and artificial intelligence (AI) algorithms that clearly transform the tasks the human has to perform in interaction with these systems and their interfaces. In fact, a study by the McKinsey Global Institute (Manyika, Chui, et al., 2017) pointed out that in about two out of three current jobs at least 30% of the tasks could be digitalized. However, only 25% of jobs can digitalize more than 70% of their tasks. Here, we can mention several examples, such as design tools for architects or AI systems for cancer diagnoses, which oncologists use more and more frequently in their medical practice. These technologies substitute a large number of tasks, but they also require performing other new or transformed tasks, usually improving professionals' performance. Several prospective studies pointed out that some professional tasks may be substituted more than others through the increasing digitalization of jobs (Bradley et al., 2020; Manyika, Lund et al., 2021; Susskind & Susskind, 2022; Zahidi et al., 2020).

The World Economic Forum, in a survey on the future of work (Leopold et al., 2018, p. 11), identified expected changes in the ratios of tasks that would be performed by humans and digital devices between 2018 and 2022. Whereas in 'reasoning and decision-making', the substitution of human activity by digital devices was expected to grow by 9% (reaching 28%), the 'information search needed for the job' was expected to increase by 19% in these four years, reaching 55% of digitalized activities.

In the same vein, a number of studies pointed out that professional work would be deeply transformed in the coming decades (e.g., Broadbent et al., 2005). More recently, Susskind and Susskind (2022) analyzed developments in 10 professions and in technology, also considering the impact of SARS-CoV2 lockdowns on professionals. Two avenues are considered in their work. The first consists of changes designed to achieve a more efficient version of current professional realities. The second includes changes that are more transformational because they involve a gradual replacement of professionals by increasingly capable technological systems. In any case, both avenues contemplate significant transformations in tasks performed by professionals in the future.

Pérez et al. (2020) carried out an empirical study to identify the relationships between task types, using the aforementioned taxonomy, and the digital tasks performed in the same occupation or job. Data were obtained from three databases: O*Net, European Working Conditions Surveys, and PIAAC. Results showed a negative correlation between computer use and physical tasks and the use of machinery, whereas the cognitive and social tasks, as well as autonomy and teamwork, showed positive significant correlations.

The use of computers is less frequent when jobs include physical tasks and the use of machinery, whereas it is more frequent in jobs that include creativity, problem solving, autonomy, and teamwork. When variation over time was tested, again increases in digital tasks between 2010 and 2015 correlated positively and significantly with increases in cognitive tasks (creativity and problem solving) and autonomy, as well as social tasks that lead to stress.

Throughout this section, we have highlighted that the digitalization of work and organizations is leading to important changes in jobs and tasks. These changes may produce situations where people become redundant because they are not prepared to perform the new tasks required in digital contexts. Thus, an important challenge is to identify the new knowledge, skills, attitudes, and competences required in the new tasks and working conditions, including the need to develop digitalized competences. If this challenge is not met, the gap between the required competences for work and those built up and developed in education systems will increase, and the effectiveness of the match in the labor market will decline. Moreover, it is important to highlight that the dynamic and accelerated rate of change in jobs creates the need for continuous education and lifelong learning (Peiró et al., *in press*). At the same time, it is important to plan for re-skilling and up-skilling of the workers currently in the labor market to prevent the loss of employability. Identifying the necessary competences for future work is a complex task that requires anticipation and vision. It involves the management of ICT technologies, but also the interaction between humans and cobots, given that many tasks will be distributed and shared based on the strengths of each "actor". Beyond pure digital competences, workers and professionals will be forced to transform their non-digital competences into digitalized skills in order to deal with the challenges of digitalization.

Defining "Digitalized" Competences

Digital competences have been given considerable importance. However, digital competences alone are not sufficient; it is important to go a step further and raise another crucial issue. Most of the 'non-digital competences/skills', when enacted in a digital context, experience important and often subtle transformations. When these changes are overlooked, people's performance at work and in other social contexts may decline and even be erroneous. Thus, we need to consider that digitalization, when transforming tasks, also transforms a wide array of essential, professional, and transversal skills. We characterize these important changes as "digitalized competences". It is our view that, so far, the attention paid to these transformations has been occasional and non-systematic. Because the changes are subtle, it is often assumed that the competence and its enactment stay the same. However, critical changes occur when existing and well-established competences are performed in a digital context.

Thus, we define digitalized competences as non-digital competences that, when carried out in digital contexts (e.g., telework or virtual teamwork,) and/or in cooperation with digital devices or "actors" (e.g., cobots, or artificial intelligence algorithms), are deeply transformed in order to be effective. This transformation often affects the components of the competence: knowledge, skills, attitudes, and the necessary behaviors to enact the competence in the new context. Changes are required to properly perform each digitalized competence in the new context or interact digitally with other human actors (e.g., videoconferencing) and/or some digital devices and actors (e.g., cobots). Because competences always require performing the appropriate actions in a specific context, and given the growing pervasiveness and variety of digital contexts, it is important to develop policies to train people in these digitalized competences. People are often not fully aware of their

deficits and impairments, especially when they are familiar with these competences. However, frequent mistakes show that it is not sufficient to just 'transfer' the knowledge, skills, and attitudes of a given competence from face-to-face or analogue situations to virtual and digital contexts when action is required.

A Typology of Digitalized Competences and Some Examples

In the next sub-sections, we will analyze examples that help to understand these crucial transformations in different types of competences. To do so, we considered a typology based on four groups of competences. Our intention when using this typology is to cover a wide spectrum of competences that can be digitalized in workplaces through technological change. First, we consider "digitalized professional competences", which refer to competences that are specific to an occupation or group of occupations and characterize them (e.g., teachers achieving meaningful learning in students). Second, we refer to the "digitalized core cognitive competences", which are basic competences that our brain is capable of using in human activities (including work), such as thinking, reading, remembering, paying attention, etc. Third, we consider "digitalized transversal or soft competences", which are relevant competences that are transferable from one job to another, such as critical thinking, creativity, communication, sociability, openness, intercultural skills, and empathy, among others. Finally, we also contemplate "digitalized leadership competences", which refer to the specific skills demonstrated by those who occupy leadership positions in organizations.

Digitalized Professional Competences: An Example from Healthcare Professionals

Digitalization challenges the traditional way specific professional competences are used. Developing basic (e.g., using software) and specialized (e.g., programming) digital competences is quite relevant in enhancing competitiveness and employability and avoiding social exclusion situations in the transition towards a digitalized world. However, this is an incomplete picture of professional competencies. Merely acquiring new digital skills is important, but it is not sufficient because specific professional competences change due to the digitalized context. Physicians, teachers, industrial workers, and a growing list of occupations and jobs incorporate digitalization in their day-to-day work, changing the nature of their jobs radically. Specific competences of professions are now increasingly "embedded" in digital technologies and content. For example, teaching has changed significantly. Teaching staff and lecturers not only have to master pure digital competences (e.g., using an electronic platform) but, more importantly, they must also embed their specific professional competences (e.g., achieving a climate for learning in the group of students) in digital technologies to provide added value (e.g., how to use blogs to create a learning climate).

This transformation from traditional professional competences to digitalized skills can be seen today in the healthcare sector. In fact, a wide variety of occupations (physicians, physiotherapists, nurses, occupational therapists, etc.) are affected by the digitalization of their professional competences (World Health Organization [WHO, 2020]). Jarva et al. (2022) examined this competence transformation in different types of healthcare services by conducting 20 semi-structured interviews with professionals in the sector and analyzing their content. They categorized the information into six main categories that included specific indicators. One category was very close to pure digital competences. It was called "Using information technology and digital health systems" (e.g., "Competence in using digital equipment"). However, the other five categories described, according to our perspective in the present work, digitalized

competences: 1) patient-centric care through digital channels (e.g., evaluating the patient's digital competence to ensure equality of optimal care); 2) interacting with the patient through digital means (e.g., guiding the patient to use different digital health solutions); 3) evaluating what digital health is (e.g., using the information provided by digital health services); 4) combining digital means and traditional methods (e.g., digital health is a natural part of work); and 5) evaluating their own digital health competence (e.g., being confident about their own digital health competence). Although Jarva et al. (2022) did not distinguish between digital vs. digitalized competences, it is very revealing that only one of the six categories is purely digital. To a large extent, this confirms the transformative nature of digitalized professional competences.

Digitalized Core Cognitive Competences: Literacy Skills in a Digital World

The recent OECD (2021) publication on 21st century readers provides a clear and fundamental example of the way literacy skills are currently being digitalized. Competent reading in the digital era implies a radical revision of the main components of literacy skills. Therefore, the team working on the PISA 2018 study revised the criteria used to assess competent reading to adapt them to the digital context. As is clearly mentioned in the introduction to this study:

Literacy in the 20th century was about extracting and processing pre-coded and – for school students – usually carefully curated information; in the 21st century, it is about constructing and validating knowledge. In the past, teachers could tell students to look up information in an encyclopedia and to rely on that information as accurate and true. Nowadays, Google presents them with millions of answers, and nobody tells them what is right or wrong, and true or not true. The more knowledge technology allows us to search and access, the more important it is to develop deep understanding and the capacity to navigate ambiguity, triangulate viewpoints, and make sense out of content (OECD, 2021, p. 3).

In fact, in 1997 (PISA 1st ed.) 1.7% of the world population used the Internet, whereas in 2019 this percentage reached 53.6%. In addition, determining the reliability of the sources of information is a challenge. Only 9% of participants (ed. 2018) are able to distinguish fact from opinion. The amount of information available is massive, but fake news in the post-truth era creates important risks (40% of participants answered phishing emails). Moreover, technology makes access to information easier, but algorithms present the information to different groups based on their views and opinions and, thus, contribute to creating "group bubbles" with similar visions and a polarized society ("eco chambers"). Therefore, it is now more important to critically analyze the contents and meaning of the information and the reliability of its sources because information biases are reinforced through the manipulation of information.

All these changes have been reflected in the assessment and analytical framework, which shows the differences in the 2018 edition compared to previous ones (OECD, 2019b). In former editions, the assessment criteria and weights used to evaluate literacy were: accessing and retrieving (25%), integrating and interpreting (50%), and reflecting and evaluation. In the 2018 edition, these criteria had been largely diversified, and a distinction was made between reading a single text or multiple texts. When assessing the single text, the criteria were: scanning and locating (15%), literal comprehension (15%), inferential comprehension (15%), and assessing quality, credibility, and reflecting on content and form (20%). Multiple text reading adds three additional criteria: searching for and selecting relevant text (10%), multiple-text inferential comprehension (15%), and corroborating/handling

conflict (10%). This tremendous change reflects the change in reading skills when they are enacted in a digital environment.

Digitalized Transversal Competences: Communication

Transversal competences are important in many jobs because they are critical for good performance. Communication, providing and receiving feedback, teamwork, conflict management, negotiation, empathy, cooperation, emotional intelligence, creativity, proactivity, critical thinking, problem solving, and resilience are considered transversal competences, and we could mention others. These skills have been relevant for work for a long time, but we would argue that most of them, if not all, have been transformed in the digital environment. To provide a clear example of this digitalization, we will focus on communication skills. One of the transversal competences that undergoes pervasive changes when performed in the digital context or via digital devices is communication.

For several decades, many technologies and applications have changed the ways and modes of communication. They not only require changes in the digital skills involved, but they also deeply digitalize the communication skills. Ratajczak-Mrozek et al. (2021) pointed out that having good communication skills in traditional media (e.g., phone) or through unmediated paths does not ensure the effective communication of thoughts and emotions in immediate digital media (e.g., instant messaging). Even people who handle a digital tool well can fail in this communication because they are not part of a culture based on digital communication. The opposite situation is also possible, that is, the existence of people who have difficulties with face-to-face interaction (e.g., lack of emotional management) but are competent in communication based on digital tools (Ratajczak-Mrozek et al., 2021).

Thus, it is clear that adding value through digital communication at work means becoming competent in the use of digital communication devices, and it requires awareness and knowledge about the features of each communication device. The necessary skills are difficult to master because they are extensive, complex, and constantly evolving. Often, a distinction has been made of synchronous vs. asynchronous communication media, and between 'syntopic' and 'asymptopic', to identify their features. Lojeski and Reilly (2020) extended these categories and identified several features that may be more or less present in each digital communication modality. These authors mentioned the following features: "copresence" of the communicating parties, "visibility" of these parties to each other, "audibility", "contemporality" (each party receives an utterance just as it is produced), "simultaneity" in sending and receiving messages, and "sequentiality" in turn-taking. Moreover, they considered "revisability and reviewability", which are specific to written (email, also video recording) communication. The former is only relevant to the sender, and the latter to both the sender and receiver.

These different features of digital communication media have contributed to theory development. Especially noteworthy is the social presence theory, which focuses on: media differences in creating higher or lower social presence (Burke & Chidambaram, 1999; Lipnack & Stamps, 2000), with their implications of immediacy and intimacy; media richness, which differentiates media on the basis of the amount of information they convey (Carlson & Zmud, 1999; Daft & Lengel, 1986); social information processing (Walther, 1992); the social identity theory and deindividuation effects (Lea & Spears, 1992); and the social structuration theory (DeSanctis & Monge, 1999; DeSanctis & Poole, 1994), which emphasizes the flexibility of the technology and the possibility of adapting it to the purposes of the users. For the adaptation to take place, contrary to the technological determinism tenet, time is needed to learn and master the use of the different digital communication technologies (Orengo et al., 2011).

Taking into consideration a number of basic concepts of these theories, Neeley (2021) presented a comparison of a selection of communication media (video-conference, conference call, shared folder system, social and collaborative tools, instant messaging email, and messaging and face-to-face communication), evaluating capabilities such as delivery speed, variety of expression, fine-tuning potential, and message permanence. The different media profiles provide a large number of options to find the most appropriate medium, which requires additional skills and often a combination of them. All these components have to be mastered in order to become competent in digital communication. However, this is not enough. Transversal communication skills have to become digitalized in order to competently communicate at work and in other contexts. In fact, communication through different media, if properly adapted through skills and behaviors, may be effective. Moreover, it is important to be aware of empirical evidence about the effective uses of digital media. For instance, Orengo et al. (2000) found that uninhibited and flaming behavior showed a higher rate of occurrence in computer-mediated communication than in videoconferencing and face-to-face communication. In addition, when communicating digitally, people tend to focus more on the task (e.g., coordination) than on the socio-emotional interaction component. This is usually attributed to the limitations of the communication media employed to transmit nonverbal information (cues-filtered-out perspective and limited social presence) (Orengo et al., 2011). Because some contextual information is not available, people tend to focus on the tasks (Leung & Peterson 2011) and to behave in a more impersonal and uninhibited manner.

Another function of communication is to negotiate when conflicts emerge. In fact, the number of signals exchanged is instrumental in the regulation of process conflict, and technologies may worsen this process due to coordination problems caused by time lags and sequencing problems (Hinds & Bailey, 2003). Media that filter contextual and nonverbal cues influence the negotiation process. Both parties need to be more explicit in their arguments, considerations, and proposals, which accelerates the process, although not always with more effective results. All these examples show that communication requires a deep transformation of communication skills and the acquisition of new ones in order to fulfil its different functions in different digital contexts and through various devices and modes. This becomes evident when performing a quick search on digital communication skills on the web, where an extensive offer of training in digital communication skills can be found.

Digitalized Leadership Competences: Leading and Supervising People in Digital Environments

Leadership roles and team management and supervision are of paramount importance in digital contexts. The competences required to lead in the digital context, even to fulfill similar functions to those required face-to-face, are often subtly and deeply transformed. This transformation was widely experienced in many companies during the lockdown when telework was massively implemented, often without proper preparation. Today, many companies are fully aware that telework or the hybrid forms adopted (part of the time working at home and part in the office, or some people working at home and others in the company) require the training and education of leaders and supervisors. Research on leadership in psychology and in management has grown fast and produced some conceptualization efforts (Roman et al., 2018), empirical research (Cortellazzo et al., 2019), and practical guides (Pullan, 2022).

Avolio et al., (2014, p. 107) defined e-leadership as a "social influence process embedded in both proximal and distal contexts mediated by AITs [Advanced Information Technologies] that

produce a change in attitudes, feelings, thinking, behavior, and performance." E-leadership is not only about specific tools and communication events; it is also about leading in an increasingly pervasive digital environment characterized by the rapidly evolving nature of communication technologies, putting a strong emphasis on leaders' ability to adopt digitalization in their day-to-day work (Roman et al., 2018). These authors offer a more detailed definition: "E-leadership is a set of technology-mediated social influencing processes intended to change attitudes, feelings, thinking, behavior, and performance, which are based on ability to communicate clearly and appropriately, provide adequate social interaction, inspire and manage change, build and hold teams accountable, demonstrate technological know-how related to ICTs, and develop a sense of trust in virtual environments" (Roman et al., 2018, p. 862). In a way, e-leadership evolves with the development of digital technologies in teams and organization. Larson and DeChurch (2019) distinguished four perspectives in the development of digital technology: 1) as a team context, 2) as socio-material team practices, 3) as a team creation medium, and 4) as a teammate. Interestingly, these authors formulated a number of implications for e-leadership and pointed out the competences required in each stage of technology development.

In order for leaders to exert competent e-leadership, they need to master how to choose, for single or combined use, the media that best suit their purposes and aims. Leaders should be effective in taking advantage of technology that enables virtual work, both synchronously and asynchronously (Pullan, 2022). In fact, most of the training in leading virtually includes a chapter on how to successfully use digital tools for leadership (e.g., Neeley, 2021). Roman et al. (2018) offer several criteria, considering the following aspects of the technology: the richness of the tool, synchronicity, speed of feedback, ease of being understood by non-experts, and reprocessing capability (ability to use the communication artifact multiple times in different venues). They added conveying the right message to the target audience, and the ease of managing urgency and complexity.

However, digital skills on their own do not ensure more effective virtual work. The critical competences in virtual contexts require mastering "digitalized" competences. These skills are not the same as the ones leaders use when leading face-to-face with "traditional social skills". The digitalized skills emerge as an integration of "psychosocial skills" with the actions required when performing them in the digital context and interacting with digital devices. They need to create cohesion between geographically distant followers, foster initiative and change the attitudes of teleworking employees, and deal with complex and fast problem solving.

Several authors have identified key e-leadership competences that can be characterized as 'digitalized'. For instance, Van Wart et al. (2019) formulated the Six E-competency (SEC) model, pointing out the critical competences for effective e-leadership: e-communication skills, e-social skills, e-change management skills, e-tech savvy, e-team skills, and e-trustworthiness. Lojeski and Reilly (2020) emphasized non-digital competences as the basic capital to enhance 'soul-based e-leadership'. Cortellazzo et al. (2019) have also identified e-leadership skills, with a focus on 'digitalized' competences. They explicitly refer to: communicating through digital media; inspiring and motivating employees; supporting and helping followers to deal with the challenges of greater autonomy and higher job demands; creating a positive organizational environment to foster a sense of unity among employees; making decisions at a faster pace (decisiveness and problem-solving abilities) in situations of uncertainty and using new tools and sources such as big data; and managing disruptive change under increasing pressure to innovate and showing more entrepreneurial and risk-taking characteristics than leaders in traditional contexts, as well as managing connectivity to foster network abilities to lobby for resources and stakeholder support.

In a similar vein, but more specifically, Pullan (2022) presents the top 10 tips for virtual leaders: 1) develop your own virtual leadership; 2) choose to be facilitative as a leader; 3) understand yourself first before moving to work with your followers; 4) build and nurture trust as the foundation of effective virtual collaboration; 5) understand your team members as individuals and their perspectives on language, culture, and generation; 6) competent use of technology for virtual work and support others to do so; 7) plan and prepare for your virtual meetings and level the playing field in hybrid meetings; 8) engage people in meetings and beyond; 9) monitor what is happening and be on the lookout for early warning signs of conflict, loss of morale, or poor performance issues; and 10) be able to find ways to address the complications of different time zones, language difficulties, and different cultures and generations in your virtual groups. All these tips focus on human relational skills rather than on merely technical skills.

In sum, e-leadership is about building connections, understanding, trust, and community, and promoting, along with the followers, great work, even when team members are far away from each other. A special situation that requires additional competences from the e-leader occurs when some members meet face-to-face whereas others join virtually. This experience is rather asymmetrical for the different participants in several ways and requires special efforts from the leaders to level the playing field as much as possible, engaging all the participants, both on-site and virtual.

E-leadership is more intense when leading virtual teams. A virtual team is defined as an interdependent group of individuals "that work across time, space, and organizational boundaries with communication links that are heavily dependent upon advanced information technologies" (Hambley et al., 2007, p. 1). This type of teamwork offers a number of benefits while presenting new challenges to the leaders and barriers to overcome. Thus, leading virtual teams requires additional skills to promote shared understanding, vision, and more participatory and distributed leadership, given that these work units provide the structure and opportunities for agile work.

Before ending this section, it is important to note that, so far, the focus has been on people leadership functions. However, CEOs also have other critical functions in the company. CEO leaders make strategic decisions about technology and the transformation of their organizational cultures to adapt their companies to the digital era. Managers need to pay attention to various stakeholders in the digitalization process, integrating technical, human, organizational, market, and ethical issues. Moreover, they need to focus not only on the internal processes, but also on the external ones, such as the image and reputation of the company, to engage stakeholders across the organization's boundaries. Thus, CEOs need to be prepared and competent in using skills related to collaboration, computation, and change. An appropriate combination of these three blocks of competences is needed to build a digital mindset (Leonardi & Neeley, 2022).

Discussion

In the previous sections, we introduced the concept of digitalized competences, using a typology and cases to confirm their pervasiveness in the digital era. These digitalized competences have consequences in terms of new mindsets, practical implications, and future research questions, all of which are discussed below.

A New Mindset to Perform Competently in a Digital Environment

The digitalized competences play a significant role in organizations' digitalization processes and the transformation of work. However, management relies too heavily on thinking and solutions that are

based on outdated assumptions. Thus, several basic new assumptions need to be considered because they form the basis for the mindset that guides and inspires digitalization processes. Here, we will briefly mention the ones we consider the most important.

The first assumption is the approach used to introduce the digitalization changes. As in previous technology transformations, one option is to assume technological determinism. Accordingly, there would only be one way to organize work, and it would be determined by the technology itself and its design. However, this approach, although perhaps efficient in the short run, can lead to some important issues and problems. It disregards important human and social aspects of the interaction between humans and technologies, as well as the processes derived from the digitalization processes. The introduction of digital tools affects the design of work and, particularly, the way people work together (Schwarz Müller et al., 2018). Here, the strategic decisions are essential and may have strong effects and impacts (Guest, in press). The consideration of the way non-digital competences are transformed into digitalized competences is crucial for productivity and the quality of working life, and this goes beyond technological determinism.

Second, the necessary changes in the new leadership mindset have to depart from the traditional one. As Pullan (2022) pointed out, in the 20th century command-and-control was the primary way managers worked, influenced by both the industrial economy of the time and the military leadership styles used in the two world wars and subsequent conflicts. It especially suits areas with lots of repetitive action and unskilled labor, such as factories and mass-production environments. However, in the digital era, this approach may be counterproductive, especially if digitalization generalizes the digitalized competences and increases skilled labor (Balsmeier & Worerter, 2020). Even if control in the digital context can be strengthened and become more sophisticated, its use may hamper trust and make it impossible for the company to excel in reaching its mission and goals and remain productive. Nearly 60% of UK remote workers agreed with the statement “I would not work for an employer that used remote monitoring software.” Of course, they agree that the quality of their work should be checked, but not as a form of external control (Dodd, 2021).

Third, the generalization of digitalized competences is related to the ‘connectivity paradox’. Lojeski and Reilly (2020) stated that “the more connected we become, the more isolated we begin to feel” (p. 8). In the same vein, Leonardi and Neeley (2022) pointed out that “ironically, the digital tools that allow people to work together across time and space create a new problem: psychological separation.” (p. 198-199). Thus, leadership strategies should enhance substantive human relations among the employees and establish rules that avoid abusing employees’ reachability by invading individual private time and space, setting boundaries that protect family and private life. Therefore, leaders have to be competent in cultivating their digital presence, and three components are quite relevant: sending updates instead of waiting, creating a sense of curiosity in the receivers, and communicating on the receivers’ timeline instead of on the leader’s (Leonardi & Neeley, 2022). These authors have described a number of skills in the areas of collaboration, computation, and change. When examining them in detail, we find digital as well as “digitalized” competences, according to our terminology.

However, dealing with digitalization requires going beyond competences used to work with technologies. It is also crucial to develop a mindset by building on the new skills to transform the way the world is seen and change behaviors (Leonardi & Neeley, 2022). This mindset is essential in fostering one’s capabilities to work in a digitalized world. When workers face a robotization or digitalization process, they often fear that the machines or digital devices will make them lose their jobs. On many occasions, this is not a valid fear. Their jobs will probably take on a transformed format, not performed by robots, but by other humans who have

developed a digital mindset. Therefore, training and lifelong learning are necessary to maintain employability, and the acquisition of the new digitalized competences is crucial in this process.

Future Research

The consideration of digitalized competences is a significant challenge for research in Work and Organizational Psychology. For more than a century, psychology in general, and Work and Organizational Psychology in particular, have been developing scientific knowledge that has made it possible to understand not only the behavior of human beings in organizations and at work, but also the design of tools, methodologies, and interventions to improve production processes and workers’ well-being. Although there may be general laws about behavior, this scientific progress has largely been based on the context where it occurred. That is, it is context dependent. The scientific background achieved in Work and Organizational Psychology has largely been based on a context that required workers and professionals whose skills were not digitalized. Therefore, the existence of a mismatch between a reality that is being transformed by digitalization and the prevailing scientific knowledge is quite likely. There is a change in the nature of the competences required, even in the transversal skills used by workers. Examples would be the aforementioned literacy and communication skills. The transformation is widespread and goes beyond adding a few digital skills. The change is deeper. Many of the usual tasks are going to be done (and are already being done) in a different way through digitalized skills. This requires a profound change in our investigation efforts as well, opening up new opportunities to rethink the research areas in Work and Organizational Psychology and respond appropriately to a new context.

One of the areas where research can achieve meaningful results is in the identification of digitalized competences. Systems for the classification and measurement of competences in different jobs (e.g., ESCO) have identified digital competences, but not digitalized ones. At least two complementary strategies can be used to do this. First, researchers can perform a qualitative analysis of the content of each competence in order to identify the degree to which it has elements associated with digitalization. Second, future research can explore the quantitative relationships between non-digital and digital competencies. This will help to explore what non-digital competences can be categorized as digitalized based on their association with digital skills.

The consequences of using digitalized competences can also be investigated in at least two ways. First, scholars can examine the degree to which digitalized competences are associated with employability and quality of employment, including indicators such as type of contract, salary, training in the workplace, trajectory in the labor market, etc. Second, it is possible that digitalized competences are also related to quality of working life indicators such as well-being, health, psychosocial risks, and job satisfaction, among others. After all, developing and using these types of competences should be welcome in the digital era, providing meaningful resources for employees and positively impacting their experiences at the workplace.

This connection between digitalized competences and their possible consequences can be analyzed as a process. To this end, three methodological alternatives are possible. First, traditional longitudinal studies can be carried out that measure digitalized competencies and their effects at several time points, in order to find out whether these competences are precursors of employability, quality of employment, and quality of working life. Second, within-subjects designs can be used to examine whether changes in the digitalized competences over time are accompanied by fluctuations in the consequences. Finally, interventions can be tested. For

example, future research can explore whether training in digitalized competences produces better personal and social resources that, in turn, have positive consequences for the employee.

Practical Implications

Understanding the differentiation between non-digital, digital, and digitalized competences is a challenge for practitioners in Work and Organizational Psychology. Competences are the pillar on which psychologists' tasks in this professional field are largely based. The design and description of jobs, production processes and roles, recruitment and selection, employee training, career development, teamwork, employability, performance evaluations and salary, promotions, the management of psychosocial risks at work, and welfare promotion, among others, are largely based on competences that are relevant to a work activity. In all these tasks, digitalization is becoming increasingly relevant. It is important to ensure that people acquire the necessary digital skills (e.g., learn how to use software), although this is likely to be fairly obvious and easy. However, the greatest challenge is probably knowing how to deal with the transformation of tasks in different jobs due to the implementation of digitalized competences. That is, workers and professionals have to do things in other ways by taking advantage of technology to add value. This includes developing a new mentality where the incorporation of technology is welcome and it is possible to appropriately choose when to perform the task in a traditional (non-digitalized) way, when to do it digitally, when to look for the right combination of types of competences, and how to cooperate fruitfully with artificial intelligence systems. Work and Organizational psychologists have an opportunity to contribute to the organizational processes and the well-being of workers during the digital transformation. To do so, it seems necessary to pay specific attention to digitalized competences and contribute to the existing knowledge. The role of practitioners is not only to apply evidence-based knowledge. The field of Work and Organizational Psychology is a privileged context in which to generate new knowledge, which is necessary during digitalization and the subsequent relevance of digitalized competences. As mentioned above, scientific advances in our area do not occur in a vacuum. They are context dependent. If we want to respond to the challenges of today's societies, cooperation between professionals and researchers is essential because a disruptive transformation is taking place that changes everything and makes it necessary to rethink our understanding of human behavior at work.

Finally, the consideration of digitalized competences is also relevant for policy makers. Governments and institutions are increasingly interested in promoting policies that facilitate the adaptation of the general population and workers to digitalization (High Level Expert Group, 2019). However, distinguishing between digital and digitalized competences is still a pending issue. Of course, the promotion of basic digital competences in the general population, the design and implementation of digital education programs, and support for digital competences as part of workers' training are necessary policies, among others. However, there is a less visible need associated with the transformation of jobs and the required digitalized competences. In addition to digital competences, digitalized skills can also help to increase competitiveness, reduce unemployment, and avoid social exclusion. Policies that pay specific attention to digitalized competences focus on how to help workers and professionals change their mentality (and capacity) and perform their activities in another way, taking advantage of technology when it is necessary and collaborating not only with other people, but also with artificial systems in a qualitatively different way.

Conclusion

Our world is changing dramatically due to the technological changes associated with digitization. Achieving better workers, organizations, and societies will only be possible through a major effort that goes beyond digital competences to also consider digitalized competences in the transformation of jobs. Work and Organizational Psychology must be open to a new vision of human behavior at work if it wants to contribute to a better future.

Conflict of Interest

The authors of this article declare no conflict of interest.

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