From digital immigrant to digital citizen: a psico-pedagogical intervention to foster digital skills in teachers
Da migrante digitale a cittadino digitale: un intervento psico-pedagogico per rinforzare le competenze digitali negli insegnanti

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Abstract

Prensky (2001) coined the term digital immigrant indicating one who resists digital change. The European Digital Agenda since 2014 has defined various measures and allocated resources to reduce the phenomenon of the digital divide (AgID)[1]. Today, it is increasingly urgent to develop a new skill in trainees, namely Digital Citizenship, which is related to artificial intelligence (Wong 2019). This relationship requires individuals to be critical and aware digital citizens (Isman & Gungoren, 2014) who can express and enhance themselves, using digital tools in an autonomous and responsible way, detecting any deviated Artificial Intelligences (Zanetti et al. 2020). The teacher has the responsibility to act on the digital divide starting from him- or herself. It is thus presented a proposal for an experimental psycho-educational intervention aimed at teachers, which acts on specific digital skills,

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[1] In Italy: Agenzia per l'Italia Digitale https://www.agid.gov.it/it

critical thinking and resistance to change.

Keywords: digital citizenship; digital immigrant; teachers; digital divide.

Abstract

Prensky (2001) ha coniato il termine migrante digitale indicando colui che resiste al cambiamento digitale. L'Agenda Digitale Europea dal 2014 ha definito diverse misure e stanziato risorse per ridurre il fenomeno del digitale divide (AgID)[2]. Oggi è sempre più urgente sviluppare nei soggetti in formazione una nuova competenza, la Cittadinanza Digitale che è in relazione all'Intelligenza artificiale (Wong 2019). Tale relazione richiede agli individui di essere cittadini digitali critici e consapevoli (Isman & Gungoren, 2014) che possano esprimere e valorizzare sé stessi, utilizzando gli strumenti digitali in modo autonomo e responsabile, rilevando eventuali Intelligenze Artificiali deviate (Zanetti et al. 2020). L'insegnante ha la responsabilità di agire sul *digital divide* a partire da sé stesso. Si presenta una proposta di intervento psico-educativo sperimentale rivolto agli insegnanti, che agisce su competenze digitali specifiche, su pensiero critico e resistenza al cambiamento.

Parole chiave: cittadinanza digitale; migranti digitali; insegnanti; digital divide.

1. Introduction[3]

Technology is increasingly integrated in everyday life and this is why the analysis of technological evolution in relation to the impact on human beings, in all possible aspects, is a source of interest and study for the scientific world.

The analysis of the italian population proposed by ISTAT, considering the relationship with technology (Internet @ italy 2018) starts the subdivision into categories from the "Generation of Reconstrucion" to arrive to the "Generation of Networks" (see Figure 1).

Generations		Definition	Age of generations and corresponding calendar years			
Starting Date	Ending Date		20 years old		30 years old	
1926	1945	Generation of Reconstruction	1946	1965	1956	1975
1946	1955	Generation of Involvement (Baby boom 1)	1966	1975	1976	1985
1956	1965	Generation of Identity (Baby boom 2)	1976	1985	1986	1995
1966	1980	Generation of Transition (Generation X)	1986	2000	1996	2010
1981	1995	Generation of Millennial (Millenial)	2001	2015	2011	2025
1996	2015	Generation of Networks	2016	2035	2026	2045

Figure 1 – ISTAT and Ugo Bordoni Foundation – Division of generations (2018)

In 1997 Don Tapscott described people born after 1978 as the "net generation", in 1999 Horst Opaschowski dubbed them the "@ generation" and in 2000 Neil Howe and William Strauss coined the term "millennials" to refer to those born in 1982. Prensky (2001) coined the terms 'digital natives' and 'digital immigrants' comparing the generational shift to the phenomenon of immigration. Today, the term "net generation" is indicative of the phenomenon of always being connected (Piceci et al. 2019).

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[2] Ibidem

[3] The manuscript is the result of a collective work of the authors, whose specific contribution is to be referred to as follows: Anna Maria Mariani paragraphs 3, 4, 4.2, 5, 6; Luigi Piceci, paragraphs 1, 2, 4.1, 6.

The great evolution of computing has developed mainly over the last 80 years. Thinking about the Apollo 11 computer, responsible for the calculations for the moon landing, with a capacity of 152Kbytes and a weight of 32kg, it seems incredible to compare it with a smart phone that, today, has a memory capacity that exceeds even 12Gbite, corresponding to 12,582,912Kbytes (Piceci 2020).

The evolution started from large and expensive computers that only did calculations to today's extremely complex systems that use Artificial Intelligence algorithms (henceforth AI). The scholars considered to be the fathers of AI are: Alan Turing, John von Neumann, Marvin Minsky and Claude Shannon. In particular, Turing in his publication entitled "Computing Machinery and intelligence" (Turing 1950), constructing the famous "The imitation game", lays the basis for what is now known as the "Turing Test", starting from the apparently simple question: "Can machines think?". This test involved two challengers, a man and a machine, and a judge who, through questions and answers, had to assess which of the two was the human being and which the machine. Criticism of this test, especially by Penrose (physicist) in 1994 and Searle (philosopher) in 1980, partly resized Turing's test, without however taking away from this scholar the merit of having been among the first to deal with such matters.

AI in education (Artificial Intelligence in Education -AIED) is currently one of the major points of attention in literature even though, as a matter of fact, it has so far only expressed its potential (Simonsen, Bidarra 2020). The focus has shifted to the educator both from a human point of view and with respect to the role they play (Zawacki-Richter et al. 2019), as the process of technological renewal is directly proportional to digital illiteracy and resistance to change, as emerged during 2020 with the pandemic and the impacts on distance learning and teachers (Piceci et al. 2020b). In addition to this, European institutions are discussing about the issue of Digital Citizenship and the increasing use of digital identity in the European Community. This paper aims to show a review of the literature about the topic and to propose a psycho-educational intervention for teachers who are dealing with the double task of becoming digital citizens and of supporting and guiding their pupils in their acquisition of Digital Citizenship. The review of the literature was carried out taking into consideration the publication time, the main focus of the article, the experimental research design and the measured outcomes.

2. AI in Educational Field

The interest in the implementation of AI infrastructures in the educational sphere falls within the strand of mass education, a movement that started in the 1800s. In that historical period, mass education was a necessity to respond to the need for education and participation in public life of the new social classes, which emerged as a result of industrialisation (Caligiuri 2018). Today, globalisation has led to an intensification of physical and social distances and an acceleration of operating times. All this significantly affects education and teaching, and AI could be a crucial resource, as it is capable of creating massive open online courses (MOOCs), sized on the training needs and characteristics of the individual. Holmes et al. (2019) state how much a general pedagogical framework is needed for the use of AI in education and denounce the need for its implementation, also imagining several possible applications. However, they as well as others do not propose a general pedagogical framework, and this might entail the risk of missing some of the huge positive impact that implementing AIED teaching could have. It becomes more and more important to approach AIED in a way that takes into account the specificity of the target group and does not get caught up in technological fascination, but sets clear learning objectives that the technology must meet (Simonsen, Bidarra 2020). In addition to all of this, it

is also necessary to assess the opportunities and possible problems. UNESCO (United Nations Educationl, Scientific and Cultural Organization) in the context of The Global Education 2030 Agenda (Pedrò et al. 2019) tackled the issue, stating that AI can be a strong driver for important changes in social interactions. Furthermore, it analysed the possible uses of AI for producing better outcomes with respect to learning, quality of delivery, equity with respect to peoples and nations, becoming an amplifier of literacy, especially in countries currently lagging behind. If we compare a class of students of the last century and one of today, if we exclude the acceleration of DAD (distance learning) in the Covid-19 period, everything has remained the same: today we have teachers and desks as there were in that century, while the world around the school has changed and renewed, adapting to the progress in progress.

While on the one hand AI represents an opportunity for the massive dissemination of knowledge, it should not be forgotten that it can also be the bearer of phenomena of digital deviance. It would seem to be established that not only AI can deviate but it can also do so in different ways, there are cases cited with racist Google and gender discrimination in Amazonia (Zanetti et al. 2019). In the supply-user chain, AI is the ability of a technological system to be able to populate itself with information with the aim of creating a database to be delivered to the user according to its specificities. This flexibility could be the answer to the need to have a teacher for every pupil, which is currently impossible due to both the costs involved and the structure of the current educational system (Bloom, 1984). The creation of the 'digital knowledge' of the AI systems takes place through a flow of data that is subsequently processed to become the 'knowledge' of the machine, which is responsible for delivering the information to the learner. Another major issue concerns algorithms. Little or nothing is known about the control algorithms that avoid the creation of feeds that give a 'biased' connotation and thus can be the cause of a 'biased' educational performance. The companies providing such systems are mostly private or governmental and not at all inclined to make public what may in fact be industrial secrets, rather than national security tools. All of the above leads us to say that teachers need to be as knowledgeable as possible about the digital world, its potential but also the risks it may entail, developing critical thinking that can help them in guiding their students.

3. Defining Digital Citizenship

Law No. 92 of 20 August 2019 entitled "Introduction of Civic Education in Schools" provides for the inclusion of the teaching of Digital Citizenship in the Civic Education discipline. The subsequent Guidelines issued by MIUR [4] define "Digital Citizenship" as an individual's ability to make conscious and responsible use of virtual media. It is not only a question of knowledge and effective use of technological tools but also, and above all, of a creative, conscious and critical approach to them. In the international scientific literature, there are different definitions of Digital Citizenship, depending on the perspective taken. An interesting study by Choi (2016) identified four different categories for classifying the concept: Ethics, Media and Information Literacy (MIL), Participation/Engagement (P/E), and Critical Resistance (CR) (Figure 2). Etichs recognises virtual communities as a space for expression and interaction and identifies behaviours under the aspects of safety, ethics (Afshar, 2013; Winn, 2012; Ribble, 2004), responsibility (Ohler, 2012; Ribble, 2004) and awareness (Hollandsworth, Dowdy, Donovan, 2011; Ohler, 2012). MIL highlights the aspects of access to and use of digital technologies, also referred to as digital divide (Moeller et al., 2011; Mossberger, 2009), of critical thinking and of the ability to collect, evaluate and communicate

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[4] Decreto Ministeriale n.35 - 22 June 2020

information (Marcinek, 2013; Ohler, 2012; Simsek & Simsek, 2013). P/E, on the other hand, focuses on active participation in issues of political, economic and social life (Raoof, Zaman, Ahmad, Al-Qaraghuli, 2013; Bennett & Fessenden, 2006; Crowe, 2006) and personal involvement in issues of civic concern, such as online petitions, anti-poverty activities, etc. (Kahne, Lee, Feezell, 2013; Lenhart et al., 2011; Tatarchevskiy; 2011). CR takes its cue from Banks' (2008) definition of deep involvement in social life in terms of criticism of existing power structures (Glassman, 2013; Herrera, 2012; Longford; 2005) and political activism (DeLuca, Lawson, Sun, 2012; Glassman, 2012; Mansour, 2012).
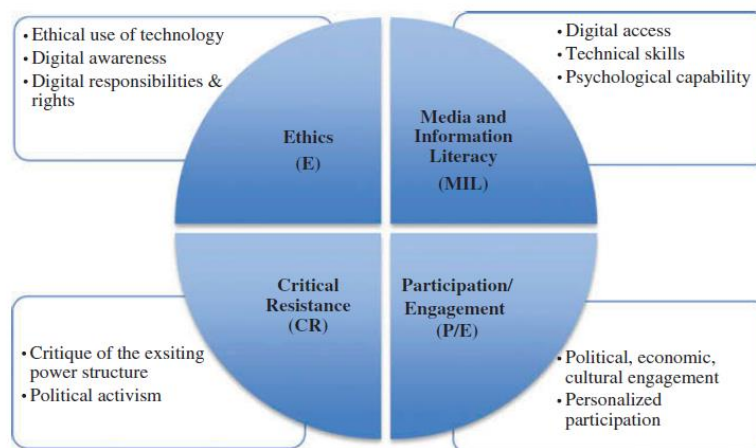

Figure 2- Four Categories of Digital Citizenship (by Choi, 2016)

An important contribution to the definition of Digital Citizenship has been provided by the studies carried out to define a scale for measuring this concept. Choi, Glassman, and Cristol (2017) identify five elements (e.g., Internet Political Activism, Technical Skills, Local/Global Awareness, Critical Perspective, and Networking Agency), while Jones & Mitchell (2016) focused on online respect and online civic engagement as the two essential factors for defining digital citizenship. Kim and Choi (2018) add an additional factor, particularly linked to adolescence, which is identity, a determining element in this age group, defining a structure with four categories (Self-identity, Activity in online, Fluency for Digital environment and Ethics for Digital environment) in accordance with what is defined by ISTE (2016).

4. Teaching Digital Citizenship at school

Schools are the place to support the balanced development of children by working on specific and transversal skills. Digital competence has only recently become part of the school curriculum and has found educational institutions not fully aligned to this new challenge. Young people need to learn a conscious and responsible way to express their digital citizenship. Teachers, likewise, need to become digitally aware citizens themselves but, at the same time, they are responsible for teaching this competence to their pupils; educational institutions need to ensure a physical and virtual environment conducive to learning. It becomes thus important to act on several levels: to educate young people to exercise awareness and responsibility, to provide resources to teachers, who have the task of preparing them to live, work and play with the new digital society, and to equip facilities with the necessary tools for effective learning processes. In this article, we focus in particular on teachers and the resources they need to carry out this important task of leadership in an ever-changing digital world. In order to better

identify the resources needed by teachers, it is important to start by defining the educational objectives envisaged for students in this field.

4.1 Digital Citizenship for students

ISTE (2016) defined the objectives to be pursued with students in teaching digital citizenship:

- Empowered Learner: students who are aware of their learning and act on it themselves by consciously defining competence gaps and consequent goals;

- Digital Citizen: students who recognise the ethical, legal and security boundaries of the global digital world and who are able to express their rights and exercise their responsibilities and opportunities for growth;

- Knowledge Constructor: students who are able to use digital resources to construct knowledge and generate meaningful learning experiences for themselves and others through the use of their creativity;

- Innovative Designer: students who practice critical thinking and problem solving to overcome critical situations using technology and their own creative skills;

- Computational Thinker: students who can develop and employ computer-based methods to understand and solve problems using the power of technology;

- Creative Communicator: learners who can clearly express their ideas and themselves using different tools, platforms, digital and non-digital formats, discerning between those most appropriate for their purpose;

- Global Collaborator: learners who know how to use digital tools to expand and enrich their learning perspectives, collaborating with other groups locally and globally.

4.2 Teachers' competences and behaviours in Digital Citizenship

The competences described above, according to Ribble (2008), can be developed in students using a circular learning process that develops in four stages and ensures that students not only gain knowledge but also apply the competence in everyday life (Figure 3):

- Awarness: developing awareness about the need to be digitally literate, understanding needs and distinguishing between appropriate and inappropriate behaviours;
- Guided Practice: experimenting with digital technologies under adult guidance in protected environments, where there is the possibility of taking risks and making mistakes;
- Modeling & Demonstration: observing appropriate digital citizenship behaviours from adults;
- Feedback & Analysis: discussing and sharing reflections and experiences with peers and adults, receiving constructive feedback on the effective use of technologies in school and society.

Figure 3 - Four-Stage Technology Learning Framework for Teaching Digital Citizenship (by Ribble, 2008)

Teachers, as citizens, must, first and foremost, possess the digital skills in order to participate actively in the digital society. At the same time, they play the role of guidance and direction for their students, providing learning opportunities starting, as we have seen, from modelling & demonstration. They must, therefore, be able to show their expertise to their students but also transmit their critical and creative use of it. In their role as teachers, they must also be able to facilitate learning through digital technologies. For these reasons, the DigCompEdu (2017) identified six macro areas of competence needed by teachers, broken down into further specific competences (Figure 4). The six areas are:
- Professional engagement: using digital technologies to communicate, collaborate with colleagues and for personal development;
- Digital resources: identifying, creating and sharing digital resources;
- Teaching and learning: managing the use of digital technologies for teaching and learning;
- Assessment: reinforcing assessments through digital technologies;
- Empowering learners: using digital technologies for inclusion and active involvement of learners;
- Facilitating learners' digital competence: facilitating learners' creative and responsible use of digital technologies for sharing, communication, content creation and problem-solving activities.

Figure 4 – Synthesis of the DIGCOMPEDU framework (by Redecker, 2017)

According to some research carried out in Italy in the past years, the introduction of technologies in the educational field has aroused and still arouses many doubts among teachers. As we have seen in the previous paragraphs, on average, teachers fall into the category of digital immigrants and, as such, have an approach to the digital world, in life and in teaching, that presents differences compared to the digital natives, their students. As described in Legrottaglie and Ligorio's study (2014), teachers generally give a positive connotation to the use of computers in school but, in fact, there is a major divergence between what teachers think of technology in the educational context and its actual

potential in educational practice. Moreover, there emerges an approach to technology in teaching that focuses on information and logistical aspects rather than on new models of learning. The negative arguments put forward by teachers focus mainly on the risk of isolating students, the uncertainty of sources and the failure to stimulate students' ability to reason. These elements are joined by a number of internal factors such as readiness to change, perceived self-efficacy and beliefs about one's own adequacy in using technologies and interest (Benigno et al., 2014). Specifically, teachers' Information and Communication Technology (ICT) self-efficacy is defined as their perceived ability to use ICT for teaching and learning, identifying TPACK (Technological, Pedagogical and Content Knowledge) as the prerequisite for integrating technology into teaching (Scherer, Siddiq, Teo, 2015; Scherer & Siddiq, 2015; Siddiq, Scherer, & Tondeur, 2016; Hew, Lan, Tang, Jia, & Lo, 2019), as it allows teachers to design content-specific teaching strategies (Scherer, Tondeur, & Siddiq, 2017; Scherer, Tondeur, Siddiq, & Baran, 2018; Moreira-Fontán, García-Señorán, Conde-Rodríguez, González, 2019; Petko, 2020). Furthermore, the international literature has widely highlighted how low self-efficacy can reflect negatively on the adoption of new teaching tools and methodologies, as it affects the motivation and interest of the individual (Chifari et al., 2000; Fouad and Smith, 1996). Very often the emotional aspects of teachers are also underestimated (Chen, 2016), conversely, emotions are contagious, and students are affected by teachers' emotions (Becker, Goetz, Morger, Ranellucci, 2014; Sutton & Wheatley, 2003). The application of new technologies in the classroom has been associated with teachers' anxious and apprehensive states (Joo et al., 2016), while perceived ease of computer use is positively correlated with enjoyment of use (Teo & Noyes, 2011). From what has been described above, it is clear that it is necessary to think about a training intervention for teachers that takes into account not only the content aspects of new technologies and their use but also more psychological aspects related to the sense of self-efficacy, motivation and resistance to change.

5. A proposal for a psycho-educational intervention on digital citizenship for teachers

In order to consciously and proactively use technology, teachers need knowledge, skills and psychological reactions (Kirschner, 2015; Sweller, 2020). As far as knowledge and skills are concerned, we refer to the TPACK framework (Koehler & Mishra, 2009), already mentioned in the previous section, considered as acted competence (Willermark, 2018) and the relationship between the different elements that compose it (pedagogical knowledge-PK, content knowledge-CK, pedagogical content knowledge-PCK, knowledge of context and technological knowledge-TK) is seen as transformative, i.e. the influence of CK, PK, and TK on TPACK is completely mediated by TPK, TCK, and PCK (Schmid, Brianza, and Petko, 2020). To knowledge and skills, it is important to add psychological reactions, analysed on three different levels: affective responses, sensations and perceptions; attitudes (curiosity, rejection, acceptance); opinions and beliefs (Tucci and Antonietti, 2009). Psychological reactions play an important role in the integration of technology in general and by teachers (Cheng & Xie, 2018; Tondeur, van Braak, Ertmer, Ottenbreit-Leftwich, 2017). In addition, Scherer and Teo (2019) attribute psychological reactions a significant role in predicting teachers' intention to use technology. Among the opinions and beliefs that influence the approach to technology, we mainly refer to the teacher's pedagogical belief system that comprises a broad and complex belief structure related to teaching and learning (Ertmer and Ottenbreit-Leftwich 2010; Hermans et al., 2008) that are rather stable and difficult to change as they are built over time, over many years of experience and supported by broad consensus (Ertmer, 2005).

The proposal of psycho-educational intervention aims to work on these three aspects: knowledge, skills, and psychological reactions, through a training course consisting in several meetings during which teaching will be carried out based on the method of experiential learning (Reggio, 2009), where the direct experience of teachers approaching new technologies is the cornerstone of the didactics, followed by a process of metacognition. In this way, as well as directly experiencing new ways of "doing teaching", teachers can gradually acquire a new mental representation of the digital world.

Each training session includes three fundamental steps:

1) theoretical framework on digital competences defined by DigiComp2:

- Information and data literacy

- Communication and collaboration

- Digital content creation

- Security

- Problem solving;

2) Classroom activities on the competence covered in the session.

3) elements of Mindfulness.

On this last aspect, the international literature has highlighted the benefits of Mindfulness practice on several cognitive and psychological aspects in teachers: reduction of burnout, increase of teaching effectiveness, reduction of attentional bias (Flook, Goldberg, Pinger, Bonus, Davidson, 2013; Kilpatrick et al., 2011; Lutz, Slatger, Dunne, Davidson, 2008).

6. Conclusions

The social, economic, and political changes we are witnessing are more and more accelerating and significantly influenced by technology. In particular, AI provides immense opportunities for the development of a fair and inclusive society and, in our field, for inclusive education that is accessible to all, although it can also generate major risks with respect to its misapplication. The current issue is not getting information but getting the right information at the right time to make the right decisions (Farmer, 2010). It is becoming increasingly important to ensure that the current human component is valued as a facilitator in this era of transition in the pedagogical sphere, and, therefore, ongoing training for students and teachers on digital issues becomes of primary importance. On the one hand, students need education regarding the responsible and ethical use of the e-world; on the other hand, teachers, who are adults and mostly digital immigrants, find themselves having to teach their students a new way of relating to the world of information, be it social, economic or political. It is a priority to start with the teachers, providing new tools and methodologies. Our proposal for intervention works in this area, providing knowledge, tools and a proactive and critical approach to the digital world. The path defined works on three levels: theoretical, experiential and emotional, with the aim of generating a change in the way of seeing, using and teaching the digital sphere. The training project is currently being tested on a sample of teachers, in order to verify its effectiveness and subsequently include it in the teachers' permanent training program.

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