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New ICTs and new needs: teacher training and the accessibility of ICTs in higher education

Nowe technologie informacyjno-komunikacyjne i nowe potrzeby: kształcenie nauczycieli i obecność tych technologii w szkolnictwie wyższym

Abstract

The incorporation of ICTs in the educational field results in new alternatives, new habits, and new needs. In the case of teachers, their ability to work and integrate technological devices or tools to make them more accessible in the future becomes highly relevant. In recent years, technical possibilities such as Massive Open Online Courses (MOOC), Open Educational Resources (OERs), gamification, video streaming platforms, or transversal managers such as Google Classroom have been emerging. Possibilities that involve different scenarios of the teaching-learning process were especially enhanced during the pandemic caused by SARS-CoV-2. This results in a necessary and continuous reflection on the preparation of teachers in the didactic application of ICTs in the short, medium, and long term. All this is placed in the context of higher education, a stage always linked to technological innovation and one which promotes research in the field of education. For this reason, in the present work, it is exposed in different sections how the technological change has been gaining pace resulting in a conceptual development around ICTs in the classroom. At the same time, it analyses how teacher training in higher education is a problem of the present and future, which is why it acquires a key relevance.

Key words: ICT, higher education, digital competence, Spain.

Streszczenie

Włączenie nowych technologii informacyjnych (ICT) w obszar edukacji powoduje powstanie nowych alternatyw, nowych nawyków i nowych potrzeb. W przypadku nauczycieli ich zdolność do pracy i wykorzystywania urządzeń lub narzędzi technologicznych, które będą bardziej obecne w przyszłości, staje się istotna. W ostatnich latach pojawiły się takie możliwości, jak: grupowe otwarte kursy online (MOOC), otwarte zasoby edukacyjne (OER), gamifikacja, platformy do streamingu wideo oraz Google Classroom. Ich zastosowanie w procesie nauczania-uczenia się ujawniło się szczególnie mocno podczas pandemii spowodowanej przez SARS-CoV-2. Skutkuje to wymagającą i ciągłą refleksją nad

przygotowaniem nauczyciela do jego pracy dydaktycznej dzisiaj i w przyszłości. Wszystko to dzieje się w kontekście szkolnictwa wyższego, etapu zawsze związanego z innowacjami technologicznymi i promującego badania w dziedzinie edukacji. Z tego powodu w niniejszym artykule w różnych jego częściach pokazano, jakie zaszły zmiany technologiczne i konceptualne dotyczące rozwoju i zastosowania ICT w klasie szkolnej. Jednocześnie analizuje się, dlaczego kształcenie nauczycieli w szkolnictwie wyższym jest problemem teraźniejszości i przyszłości.

Słowa kluczowe: nowe technologie informacyjne (ICT), szkolnictwo wyższe, kompetencje cyfrowe, Hiszpania.

New approaches and technological approaches

It is still difficult to think about the role that technology will have on a day-to--day basis. In recent times, especially in the face of SARS-CoV-2, the presence of technology has become naturalised to such a degree that it is already difficult to spend a day without it[1]. Access, in earlier times, to devices such as radio or television allows us to consider how fast the revolution is still in force today. Probably it is the smartphone that has revolutionised everythingmore than anything else, Its proliferation during the last decade can be considered a disruptive event in the history of humanity. Despite constant presence of, television, radio, or computer, it is hard not to affirm that this device has influenced many daily activities.

There are habits whose execution is significantly different from how they were carried out in previous years. These differences can be seen from simple gestures such as checking the time, now from the smartphone instead of the wristwatch, to managing companies from remote locations and asynchronously. The fact is that so many changes could be listed that it would amaze recent generations whose growth has been nurtured by digital or technological experiences[2]. The constant technological development is causing global variations , from the most essential such as accessing information[3] to favoring the integration of people with disabilities in diverse contexts. In the case of Information and Communication Technologies (ICTs), the introduction of them has become the axis of changes that go beyond the production of devices that serve as tools.

One of the groups of society in which the impact of ICTs has generated a greater impact is the new generations. This is especially true of those born in the last decade of the 20th century, who have seen how ICTs have been progressively incorporated

[1] Lee, Y.; Malcein, L. & Kim, S. (2021). Information and communications technology (ICT) usage during COVID-19: motivating factors and implications. *International Journal of Environmental Research and Public Health*, 18(7). doi: 10.3390/ijerph18073571

[2] Moreno, N.; Marin, A.; Cano, V.; Sanabria, J.; Jaramillo, A. & Ossa, J. (2021). Parental mediations and internet use by colombian children and adolescents. *INTERDISCLIPLINARIA*, 38(2), 275-290. doi: 10.16888/interd.2021.38.2.18

[3] Ricoy, M. & Martinez, S. (2021). Digital newspapers' perspectives about adolescents' Smartphone use. *Sustainability*, 13(9). doi: 10.3390/su13095316

into society, and those born in the 21st century whose relationship with them can be considered innate[4]. Both cases exemplify how technology has been acquiring a more significant role in human customs, beyond audiovisual consumption. This new profile implies the birth of a new paradigm, something that goes beyond devices or technology as support devices but as fundamental elements of personal development. For this reason, the data provided by the National Institute of Statistics[5] is as follows: 69.5% of children in Spain between the ages of 10 and 15 already have a smartphone (Figure 1).

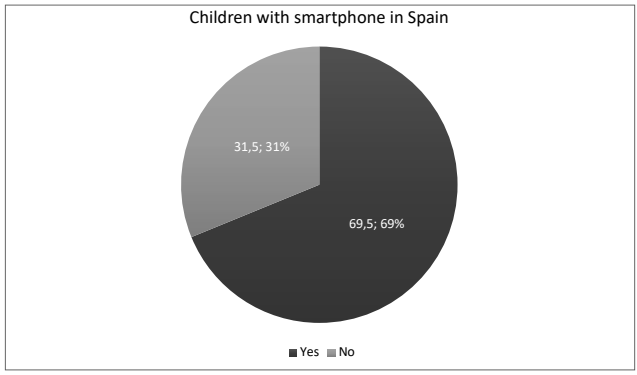

Figure 1. Percentage of children in Spain having smartphones

A contrast can be noticed here in comparison to previous generations , those who observe and live with a complete perspective on how ICTs have emerged as pillars of contemporary life. This irruption has entailed, to a lesser or greater degree, changes in their habits that involve a new learning and adaptation process. Given the pace of life and speed of technological innovations, these issues are not usually taken into account except in the most obvious situations. An example of this, in the Spanish context, was that many older people had difficulties in requesting a vaccination appointment for SARS-CoV-2 since such a request was generally to be made through the Internet[6]. This fact indicates to what degree ICTs can have repercussions not only in social or economic contexts but also in medical ones.

[4] Nunez, P.; Larranaga, K.; Rangel, C. & Ortega, F. (2021). Critical analysis of the risks in the use of the internet and social networks in childhood and adolescence. *Frontiers in Psychology*, 12. doi: 10.3389/fpsyg.2021.683384

[5] Instituto Nacional de Estadística (2021). *Encuesta sobre equipamiento y uso de tecnologías de información y comunicación en los hogares*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176741&menu=ultiDatos&idp=125473557669

[6] Luca, M.; Mustea, L.; Taran, A.; Stefea, P. & Vatavu, S. (2021). Challenges on radical health redesign to reconfigure the level of e-health adoption in EU countries. *Frontiers in Public Health*, 9. doi: 10.3389/fpubh.2021.728287

The transfer of ICTs has affected different areas, among which is education. During the last years in Spain, there has been a notable commitment to the incorporation of these media, especially during the first decade of the 21st century. The promulgation of the Organic Law of Education 2/2006 was the confirmation of the intention of the Spanish government to incorporate ICTs in educational contexts. Its application could be verified in two ways: the theoretical one was the legislative adaptation of the law to competency-based learning and the incorporation of the Digital Competence (CD), and that was implemented through the provision of material to educational centers. Regarding the former , it should be noted since it involved a differentiated approach in the Spanish educational system and, in addition, it considered technology for the first time as a key factor of student development. On the other hand, the provision of equipment and material was supported by resources such as digital whiteboards and projectors, which are still in use in educational practice.

This educational policy was developed and supported by other initiatives more locally focused. The provision of technological materials had a generalbut different application since other projects were also carried out that tried to encourage the LOE approach, such as the Medusa Project in the Canary Islands, Averroes in Andalusia, the Premia Program in the Basque Country, the Ramón y Cajal Program in Aragon, Plumier in Murcia, the Siega Project in Galicia, EducaMadrid in Madrid or the Argo Program in Catalonia[7]. In the case of Aragon, the School 2.0 Project wasimplemented, specifically in providing the centers with devices such as computers and digital whiteboards for educational practice. All of that the projects (have) tried to incorporate ICTs into educational centers where students were already beginning to interact actively with devices such as mobile phones with original access to the Internet or online video platforms.

New technological contexts also have led to its subsequent revision and redefinition. During the last two decades, there has been a constant conceptual search for the integration of ICTs into education. This has led to the birth and development of new approaches that concern the integration of ICTs in the teaching-learning processes, ranging from the most basic incorporation to those that establish them as personal development tools[8]. Some ideas have been defined according to the integration of these media into everyday life and, of course, to environments increasingly closer to the educational field, i.e. an environment that, as briefly described in previous paragraphs, has undergone significant alterations from the conception of the most recent generations to the material and legislative endowments . This reflects as well

[7] Area, M. (2008). Una breve historia de las políticas de incoporación de las tecnologías digitales al sistema escolar en España. *Quaderns digitals: Revista de Nuevas Tecnologías y Sociedad*, 51.

[8] Batanero, C.; De Marcos, L.; Rivera, L.; Holvikivi, J.; Hilera, J. & Tortosa, S. (2021). Improving accesibility in online education: comparative analysis of attitudes of blind and deaf students toward and adapted learning platforn. *IEEE ACCESS*, 9. doi: 10.1109/ACCESS.2021.3095041

as confirms a continuous interest in the subject, and the fact that the relationship between education and ICTs is something alive, yet the final definition of which being[9].

The first incorporations to the educational system of the ICTs did not involve major conceptual revolutions. The approach, as the programs derived from LOE (2006) well reflect, was to integrate them into the teaching-learning process as one more resource. That is why during the first years, and even today, its usefulness is as a resource rather than as a transversal learning path. This can be seen in the case of digital whiteboards, expensive supportive tools whose applicability is usually reduced to actions very similar to that of the digital whiteboard : filling in words in sentences, displaying an image or video (it can be replaced by a projector or a computer), drawing with colours, pointing or others. The reality is that this type of media, even today, continues to play an insignificant role that is not very different from leaving a smartphone to a child to entertain himself/herself, that is incorporating technology but without a clear pedagogical purpose behind it.

Progressively, a base was developed in the integration of ICTs, especially directing their incorporation to something more than a mere punctual resource . The consideration of ICTs as a channeling medium for learning has finally begun to take hold. That is why tools such as Technologies for Learning and Communication (TAC) began to gain strength, especially when they enhanced teaching supported by ICTs but not only aimed at how they should be used[10]. The impact was that education did not only have to be oriented towards teaching how to use ICTs, in addition to it already being used as basic tools, but they had to be the axis of learning. This meant that it was good to teach students how to use new technologies but not routinely and mechanically. They should be channeled so that learning is as comprehensive as possible.

Over the years, new approaches have appeared, more focused on the incorporation of ICTs in the processes and the integral development of students, such as Technology Empowerment and Participation (TEP)[11]. New comprehensive applications of ICTs that are very different from those from the beginning of the 21st century,. In this sense, it should be noted how in recent years these media have led to a personal-social revolution that has to be incorporated into school practices due to its potentiality. The possibilities that ICTs offer in terms of personal and social development, oriented towards empowerment, are remarkably different from the basic use of devices such as computers linked to a projector. These are new times,

[9] Maaranen, K. & Kynaslahti, H. (2021). 'It sounded like fun, that we would get to go to the univeristy'. Puils teaching ICT to peers: a case of study of Finnish Media Agents. *Technology Pedagogy and Education*, 30(2), 257-269. doi: 10.1080/1475939X.2021.1876756

[10] Lozano, R. (2011). De las TIC a las TAC: tecnologías del aprendizaje y del conocimiento. *Anuario ThinkEPI,* 1, 45-47.

[11] Carbonell, I. (2020). A new educational reality: TIC-TAC-TEP and neuroemotional Wifi curriculum planning. *DIALOGICA*, 17(3), 73-90.

there are new possibilities and interpersonal relationships have changed remarkably thanks to the birth and development of devices such as smartphones[12].

There are more recent approaches, such as Relationship, Information and Communication Technologies (TRIC) that affect how ICTs become more meaningful than their being mere tools. In the case of education, its incorporation is in progress, exponentially increased by the pandemic caused by SARS-CoV-2, and the future is expected to lead even more directly towards its integration. They not only have to be taken into consideration for their social ubiquity but for their associated possibilities. It is necessary that they be present to avoid a total disconnection with reality. This entails a constant rethinking, especially in the face of a technology industry that every decade is associated with the creation of new habits, within which all educational variables must be taken into account, from students, increasingly accustomed to having their own technological means from an early age, to teachers whose initial training is far from technological realities [13]. On top of that we must add one key factor: educational institutions, a fundamental element whose attitude towards ICTs will be decisive.

Teacher training in higher education: times of change

Teachers are one of the axes of the educational process. Despite more global, political, or contextual conditions, the reality is that their work is essential for the development of didactic practice. The rise of ICTs, also noticeable outside the classroom , is leading to notable rethinking in relation to how teacher's activities should be performed. During the still unfinished pandemic caused by SARS-CoV-2, it has become clear that it is critical. The mandatory transition to solely digital media, such as laptops and even smartphones, caused by the impossibility of face-to-face teaching has required a significant change in teachers' professional practice[14]. Although this methodology is already integrated within some higher education institutions, it is necessary to analyse the new needs and possibilities that exist today.

Before delving into the teacher and his/her role in the 21st-century education, it is necessary to reflect on the role of higher education itself. Without going into

[12] Shukla, A.; Kushwah, P.; Jain, E. & Sharma, S. (2021). Role of ICT in emancipation of digital entrepeneurship among new generation women. *Journal of Enterprising Communities-People and Places in the Global Economy*, 15(1), 137-154. doi: 10.1108/JEC-04-2020-0071

[13] Jo, H.; Hwang, Y. & Dronina, Y. (2021). Mediating effects os Smartphone utilization between attitude and willingness to use home-based healthcare ICT among older adultrs. *Healthcare Informatics Research*, 27(2), 137-145. doi: 10.4258/hir.2021.27.2.137

[14] Perez, B. & Berbegal, J. (2020). The adaptability of the flipped classroom method: a case of study of its application during the covid-19 crisis. *REDU-Revista de Docencia Universitaria*, 18(2), 49-66. doi: 10.4995/redu.2020.14419

detail, since it would occupy too much space, it is necessary to focus on the teacher's relevance at the beginning of the third decade of the century. The importance of e teacher training remains unquestionable. It is remarkable how different institutions have altered their pragmatism towards non-contact environments. This fact is a key since it should not be forgotten that higher education must be implemented in future labor practices in a society where it cannot be unidirectional. The incorporation of ICTs has been the subject of study in recent years, especially in Spain[15], and it occurs before the integration of methodologies such as b-learning or m-learning[16].

In the context of change and readjustment, teachers acquire a fundamental role. From the first technological incorporations in the classroom, such as projectors or computers, their use has already represented a disruption with respect to methodologies and models developed during previous decades. In recent times, new conceptions have emerged, such as those cited in previous paragraphs: TIC, TAC, TEP, or TRIC. The key to all this, in addition to the incorporation of technology into educational contexts, lies in how the teaching profile undergoes a continuous change. From those more traditional approaches in which teachers were the only source of information, tools have been made available that allow asynchronous learning and almost indefinite access to sources. This implies new needs, especially when the integration of ICTs is considered a process whose end is not yet in sight and whose repercussions in the classroom progressively depend on different factors[17]. In this sense, key issues should be highlighted, such as the digital divide, which can be seen inside and outside the classroom.

The clearest example of the new direction has been the pandemic and the teaching developed during this time. The impossibility of face-to-face teaching has led to educational actions only developed through digital media, with video conferencing being the most common practice. This has meant an acceleration and rethinking that has filtered ICTs as well as teaching as new educational focuses of attention[18]. Regarding ICTs, during this period they have shown that technological development maintains these teaching-learning processes, although not in the same way as in face-to-face cases, and this has also occurred in higher education. On the other hand, teachers have shown not only a clear interest, despite the limitations

[15] Cruz, M.; Pozo, M.; Juca, J. & Sanchez, L. (2020). The integration of ICT in the higher education curriculum in the last decade (period 2009-2019). *Revista Ciencias Pedagógicas e Innovación*, 8(1), 55-61. doi: 10.26423/rcpi.v8i1.368

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[17] Nunez, Q.; Gomez, S.; Ganete, A. & Goncalves, D. (2021). Professional culture and ICT teacher education in times of crisis: the perception of teachers. *Revista Electrónica Interuniversitaria de Formación del Profesorado*, 24(2), 153-165. doi: 10.6018/reifop.470831

[18] Kim, J.; Pak, S. & Cho, Y. (The role of teachers' social networks in ICT-based instruction. *ASIA-Pacific Education Researcher*. doi: 10.1007/s40299-020-00547-5

of going from face-to-face teaching to having to use devices, but their roles have varied notably. Now they have to take into consideration their own relationship with ICTs, the creative capacity associated with technological means, the capacities to communicate information, and the "action" during the process, all of which is what is called 4.0 training[19].

New contexts imply new changes and new adaptations. Returning to the perspective of higher education, although without losing the teacher as the axis, it is essential to think about the present and the future. As has already been implied, it is undeniable that ICTs are going to be present to a greater extent, especially in these turbulent times. Their role in higher education, which has already varied in recent years through methodologies such as flipped learning or gamification, will grow, all this bearing in mind that the incorporation of ICTs has repercussions not only on students, with a lesser or greater predisposition to them, but also on teachers who have to be technically and mentally trained to apply them properly. In times when face-to-face and non-face-to--face are going to be akin approaches, it is vital that teachers are prepared for such a challenge, knowing what is the most appropriate for the teaching-learning process. For this reason, the following paragraphs will name some tools and methodologies supported by ICTs that should serve as a teaching channel for future practices.

The tools that can cause the greatest impact in the didactic process can be associated with Massive Open Online Courses (MOOC) and Google Classroom, two transversal tools. Regarding MOOCs, this medium is already used by some educational institutions as the only way of teaching and also as a complement to face-to-face teaching[20]. It is a resource on the rise in recent years thanks to the potential it offers: ubiquity, information management, and asynchronism. Its format is similar to online courses, a strategy increasingly applied in Spain, but offering interactivity between who manages the said course and who learns. Something similar happens with Google Classroom, although in this case it is associated more with a document manager. in the fact that it is integrated with Google favors the interrelation of technological devices, which is why it is usually a resource for channeling information or dealing with specific issues.

The subgroups that arise from applications like the previous ones are Open Educational Resources (OERs) or gamification. The OERs[21] have a direct relationship with information management, especially nowadays when students have

[19] Sysoieva, S. & Osadcha, K. (2020). Formation of the tutor ICT-competence in the procces of future teachers' profesional training. *Information Technologies and Learning Tools*, 80(6), 207-221. doi: 10.33407/itlt.v80i6.4182

[20] Lorente, A.; Despujol, I. & Castaneda, L. (2021). MOOC as a leveling strategy in higher Education: the case of the Polytechnic University of Valencia. *Campus Virtuales*, 10(2), 9-25.

[21] Alberola, I.; Iglesias, M. & Lozano, I. (2021). Teachers' beliefs about the rol of digital educational resources in educational practice: a qualitative study. *Education Sciences*, 11(5). doi: 10.3390/educsci11050239

to develop their critical capacity. This case is perfect to expose the complexity of current technology: large quantities, the need for channeling, and the urgency of didactics. In the case of gamification, with cases like Kahoot, it is understood more as a learning tool clearly supported by ICTs. His approach involves a shift to those primary approaches to the use of ICTs, and in this case, their use has more to do with concepts such as TAC or TEP.

If rising technologies are being considered, it is necessary to bear in mind Artificial Intelligence (AI). This type of media, whose growth can be seen in devices already as easily available as virtual assistants or in smartphones themselves, is one of the topics in which more interest is being placed in educational terms[22]. Despite the fact that it is a technology that has not yet been fully developed, its first advances, especially during the last decade, suggest that its integration in educational environments can be somewhat disruptive in teaching-learning processes. This type of media would allow a debate on the role of the physical teacher, the person, and establish a reflection on what the role of AI could be within educational centers. It can be sensed that its possibilities are significant[23], such as correcting exams or serving as an individual tutor, but in the case of higher education, what is clear is that teachers will have to be considered before the application of AI in the classroom[24].

The so-called Big Data is also on the rise. It is a technology that is being incorporated into different daily environments and whose implementation in the educational system is a matter of time[25]. As with AI, its role must be deeply analysed since it can range from helping to solve a specific didactic error to establishing analysis or metrics of students and even teachers. Something must have this technology when it is being highly analyzed in recent years[26], according to its own development, and its applications are progressively expanding through more or less educational centers or institutions . New media, new resources, and, again, possible new needs, especially when dealing with technologies that are developed when teachers are practicing and not in their previous learning process in universities[27].

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[22] Yu, S. (2021). Application of artificial intelligence in physical education. *International Journal of Electrical Enineering Education*. doi: 10.1177/0020720921996604

[23] Ma, W. (2021). Aritificial intelligence-based real-time communication and ai-multimedia services in higher education. *Journal of Multiple-Valued Logic and Soft Computing*, 36(1-3), 231-248.

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[27] Bian, F. & Wang, X. (2021). The effects of big data on the management of higher education in China its countermeasures. International Journal of Electrical Engineering Education. doi: 10.1177/00207209211002076

These examples, briefly described, reflect how the educational process is very much alive thanks to ICTs. For this reason, it is essential to consider teacher training, In Spain, there have been different conceptions of teaching needs, encompassed within the so-called Digital Teaching Competence[28], which have been grouped into five areas: information and information literacy, communication and collaboration, content creation digital, security and troubleshooting.

Discussion and conclusions

The present research work has been oriented to carry out a theoretical analysis that raises on the question of teacher training in times of ICTs. It is undeniable how their integration into society implies their adaptation to educational contexts, which entails new habits and new needs[29]. Within this context of change, increased by SARS-CoV-2 and its repercussions, it is vital to keep teacher training in mind as a present and future need. In the case of higher education, a stage characterised by the application and analysis of technology in didactic practices, it cannot be oblivious to a process of change whose end is not yet in sight and whose deficiencies are growing. Spain is one of the countries in which the most approximations are raised about CDD, there are legislative and conceptual approaches that take them into account. Faced with new scenarios in which social networks have become the axis of society, with the new guidelines that this implies[30], the perspective of professionals immersed in curricular obligations cannot be lost. The more so that Artificial Intelligence and Big Data are increasingly present, generating new contexts and roles[31].

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