



Critical and prospective analysis of online education in pandemic and post-pandemic contexts: Digital tools and resources to support teaching in synchronous and asynchronous learning modalities

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Summary. *Humanity, prior to the COVID-19 pandemic, was already in the process of a gradual cultural transition between modernity and postmodernity. The rapid pace of scientific and technological advances has led humans towards a progressive adaptation, as they develop new ways to confront and to solve their problems. In the exceptional context of the pandemic, people and institutions have faced a sudden need to readapt their ways of life and their means of communication. In education, the need to migrate from traditional classrooms to online systems was urgent, and the shift required digital tools and resources to support teaching. This theoretical article aims to analyze the disruption in the educational context and to detail the adaptations that may contribute to the effectiveness of educational processes. Moreover, it discusses the pedagogical, methodological, didactic, and evaluative aspects of the change in education. The article also proposes some guidelines for learning on both synchronous and asynchronous platforms. The trends associated with these changes are analyzed in order to offer a perspective on education in the post-pandemic world.*

Keywords: *education; technological disruption; pandemic; online learning; digital resources*

Análisis crítico y prospectivo de la educación en línea en contextos pandémicos y pospandémicos: herramientas y recursos digitales para apoyar la enseñanza en modalidades de aprendizaje sincrónico y asincrónico

Resumen. *La humanidad, previo a la pandemia del COVID-19, experimentaba una gradual transición cultural entre la modernidad y la postmodernidad. La profundización del avance científico y tecnológico, condujo al hombre hacia una progresiva adaptación, desarrollando nuevas formas de enfrentar y resolver sus problemas. En este contexto excepcional, las personas y las instituciones enfrentan la necesidad de readaptar bruscamente esos modos de vida y sus formas de comunicación. En educación, la necesidad de migrar desde aulas tradicionales hacia sistemas de modalidad en línea, requiere herramientas y recursos digitales de apoyo a la docencia. Este artículo teórico tiene como objetivo analizar críticamente esta disrupción, detallando adaptaciones pedagógicas, metodológicas, didácticas y evaluativas que aporten a la eficacia de estos procesos educativos. Se consideran orientaciones para el aprendizaje en plataformas sincrónicas y asincrónicas. Son analizadas las tendencias asociadas a estos cambios, aportando una prospectiva sobre la educación en contextos de post-pandemia.*

Palabras clave: *educación; disrupción tecnológica; pandemia; aprendizaje en línea; recursos digitales*

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Introduction

Starting with the formulation of Information Theory (Shannon & Weaver, 1949) to the emergence and the spread of new Information and Communication Technologies in the decades that followed the middle of the last century, society and culture experienced a growth process that changed the ways people and institutions managed information and communicated. This process was relatively slow, involving gradual adaptation to new ways of facing and solving problems, reflecting the scientific and technological progress characteristic of the last stages of modernity.

Different theories and meta-narratives have tried to explain this phenomenon of cultural, social, scientific and technological changes: (i) theories about the postmodern human condition, of postmodern science and technology as intelligence (e.g. Foucault, 1976; Toulmin, 1981; Lipovetsky, 1983; Lyotard, 1984; Ferré, 1985); (ii) theories about new forms of thought related to techno sciences, telematics, cybernetics and the new forms of organization of the globalized world (e.g. Wiener, 1948; McLuhan, 1962; Featherstone, 1989; Seidman, 1994; Atkinson, 2002; Derrida, 2006); (iii) a range of other theories associated with or derived from this cultural transition, such as Systems Theory (Bertalanffy, 1968); Epistemological Anarchism (Feyerabend, 1975); Chaos Theory (May, 1976); Decision Making Theory (Simon, 1978); the notion of Technological Revolution (Dertouzos, 1997); the Theory of the End of History (Fukuyama, 1998); the Theory of Connectivism (Siemens, 2005); the Theory of Transhumanism (Kurzweil, 2005); the Theory of Coassociation (Prensky, 2011), among others. Many of these theories call for a reformulation of educational paradigms because they suggest the emergence of new ways of teaching and learning when educational processes are mediated or complemented by digital environments.

On March 11, 2020, the World Health Organization (WHO) declared that COVID-19 was a global pandemic (Cucinotta & Vanelli, 2020; Yi et al., 2020). Given that this occurred in an excessively complex context wherein the future was already in question because of the process of technological disruption, many demands and new needs for humanity have emerged. With the abrupt and unexpected spread of the Coronavirus, countries, organizations and individuals were under urgent pressure to adapt to the exceptional and catastrophic situation. Measures included lockdowns and social distancing, and all kinds of non-essential activities were brought to a halt. This, of course, severely affected daily life (Ordorika, 2020). Digital media have filled some of the gaps, attempting to respond to human demands in this unprecedented context where the use of technologies has proven essential for the continuity of everyday activities such as telecommuting, learning, practicing sports, communication, fighting boredom and shopping (García-Peñalvo, 2020).

The spread of technology use, which had been constant but relatively gradual, experienced a window

of opportunity unprecedented in the history of humanity. These circumstances have revealed a feeling of vulnerability that society was not aware of until now (Villaescusa, 2020). The urgent need for a migration from traditional classrooms to teaching and learning systems implemented entirely in the form of online education (e-learning) was keenly felt (Argudo & Tenecela, 2020).

This emerging requirement evinced the digital divides, the gaps and inequalities in access to technology. It also threw social inequalities into sharp relief, with some unable to accompany family members, which has generated a more worrying social gap, if possible, than the digital one (Sangrà et al., 2020). This state of affairs has brought with it a rapid adaptation of computer systems, the expansion of connectivity and information support capacities, and a demand for efficient computer equipment and digital connections. In the educational field, the challenge has been to ensure the continuity of student learning, due to the fact that over 1.38 billion of learners are affected by the pandemic (UNESCO, 2020). This theoretical article aims to analyze the disruption caused by COVID-19 in the educational setting and detail the adaptations that may contribute to the effectiveness of educational processes. The article also presents some guidelines for platform-based online learning. Finally, the trends associated with these changes are described, providing a perspective on education in the post-pandemic context.

The context of cultural transition and technological disruption

We are currently in the midst of a technological disruption, characterized by the rapid development of very advanced technologies that will drastically change the face of the world in the next two decades. Amongst these disruptive technologies are developments such as big data, with its massive information processing capabilities, and artificial intelligence, as it is being applied to natural language processing, artificial vision and augmented reality. Also of importance are other applications such as robotization, which is being applied in production, services and domestic life; the Internet of Things (IoT), related to 3D printing (Consumer 3D) and 4D printing; the digital marketplace based on the blockchain, with applications such as Bitcoin and ICOs (Initial Coin Offerings), Token and other cryptocurrencies; autonomous vehicles, used in industry and transport; home automation (smart homes), Internet for me (systems that learn about and facilitate peoples' lives, smart clocks, heart rate control, disease control, among other applications); developments in the security of the Internet of things, facing the challenges associated with manipulating information or computer attacks on interconnected things (Ransomware of Things - RoT); Smart Cities (smart traffic lights, traffic management, services, security); nanotechnology and biotechnology, combining physical and biological materials; digital health (tele-

medicine, e-health, medical informatics), among many other disruptive technologies that require us to innovate and manage change.

Online distance education in the context of the pandemic

During the pandemic, as a result of the suspension of face-to-face classes and the reliance on remote work, digitalization problems (Almazán, 2020) and access barriers (Mailizar et al., 2020) have become more evident. The challenges involve the question of how best to support families in distance learning or learning from home and how to ensure the effectiveness of virtual environments to favor learning (Failache et al., 2020). All this is complicated by the fact that teachers are not pedagogically or emotionally prepared (Ramos-Huenteo et al., 2020) to face this online scenario. These contexts require new competences, skills and uses, practices that shorten distances and break down barriers through online connections, shaping a new space in which there are no clear borders (Hurtado, 2020), where we are allowed the gift of ubiquity and the opportunity to develop *another me*.

Online education is justified under three sets of conditions: (i) territorial dispersion; (ii) the need to educate very large groups of students; and, (iii) as a way to meet educational needs in exceptional situations (disasters, pandemics, wars and others), in which students and teachers have difficulties in traveling or cannot attend schools or universities.

Online education consists of a set of teaching and learning modalities that are carried out remotely, based on forms of communication mediated by synchronous and asynchronous technologies. Bates (2019) points out that students studying online are in a different learning environment or context than students learning in a classroom, and the teaching design needs to be adapted to the learning environment. It requires adaptations to a progressive, flexible, and distributed concept of the curriculum, as opposed to traditional teaching systems, which tend to be linear, more rigid, and spatially situated.

For these virtual education systems to operate effectively, it is advisable to apply the principles of reverse pedagogy or the “Flipped Classroom”, an approach in which students have access to sources of information and knowledge before the synchronous sessions. This allows them to arrive prepared, and it promotes autonomy, self-regulation, and collaboration in learning (Salam & Farooq, 2020). Evidence suggests that the main factors contributing to the flipped classroom’s positive effect are the opportunities it provides for structured, active learning and problem solving (Strelan et al. 2020). This type of distance education can be implemented in both *synchronous and asynchronous modes*, the two of which should operate in a complementary manner. On one hand, *synchronous online education* implies connecting teachers and students at the same time. They communicate independently of

where they are, and this kind of education involves the application of a distributed curriculum. It can be personalized, although the tendency is for synchronous sessions to be conducted in groups. Participants can connect via video-conferencing and chat systems at the same time, and sessions can be recorded and saved for future reference. It is a time-dependent modality, since teachers and students must set aside programmed time slots for communication. On the other hand, *asynchronous online education* implies that teaching and learning activities are carried out independently of time and place. Teachers and students are physically in different locations, and they communicate through digital platforms. They are generally organized around a Virtual Learning Community (VLC) which shares information (access and representation) and should make it possible to manage knowledge (creation and transfer). Communication takes place in digital environments that have been technologically and pedagogically designed for this purpose. Teachers, students and virtual tutors all have access to these platforms and use them for a) sharing content; b) carrying out theoretical and practical activities with digital resources; c) developing skills for the 21st century; and d) developing learning competencies and reaching achievements.

There are other learning modalities supported by Information and Communication Technologies (ICT), such as blended learning or *b-learning* (Lakhali et al. 2020), mobile learning or *m-learning* (Romero-Rodríguez et al., 2020), simulated virtual learning, immersive technologies in education (Badilla et al., 2017), educational robotics. These are just some of the other tools and applications for teaching (Campos et al., 2020) that can be used as a complement to classroom learning in post-pandemic or traditional learning conditions.

Knowledge Management in Virtual Learning Communities

In a VLC, it is recommended that educational processes be carried out in *learning modules*. One example of how a learning module could be designed in a graduate course can be seen in Figure 1. The sample module here includes: i) activities in digital environments; ii) collaboration in discussion forums; iii) participation in virtual pedagogical portfolios; iv) availability of digital teaching and learning tools and resources, such as a) educational software; b) multimedia resources (e.g. videos, audio recordings, animations, comics); c) documentary centers (e.g. online catalogs, digital books); d) simulators and trainers; and e) augmented reality spaces, between others tools.

It is essential in a VLC to distinguish between administering information and information representation. According to Careaga and Avendaño (2017), the term *information management* refers to gaining access to information or processed data, which constitutes a first approximation to the sources. This requires the application of basic intellectual capacities to select the

SESIÓN II: MÓDULOS TEÓRICO - PRÁCTICOS

Estos módulos corresponden a:

RESULTADO DE APRENDIZAJE 1:

Desarrolla actividades teórico-prácticas, que den cuenta de la importancia de las TIC para la innovación pedagógica en diversos contextos educativos.

Teórico 2:

- Introducción a las TIC en educación. Las TIC y su impacto social y cultural

Práctico 2:

- Foro en EV@ Indagación acerca de experiencias e innovaciones sobre uso de TIC en la enseñanza de la matemática.



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- VIDEO: TIC, cambio social y cultural e impacto en educación
 - PRESENTACIÓN: TIC, cambio social y cultural e impacto en educación
 - VIDEOCONFERENCIA TEÓRICA 1: PROGRAMADA 20 ABRIL 08:10 hrs.
 - VIDEO DE LA SESIÓN TEÓRICA 1: 20 DE ABRIL 2020

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- VIDEOCONFERENCIA PRÁCTICA 1_
 - FORO INDAGACIÓN EXPERIENCIAS
 - VIDEO EXPLICATIVO PRÁCTICO "INDAGACIÓN EXPERIENCIAS"
 - FORO DE TRABAJO DOCUMENTO 1: TIC en contextos de cambio social y cultural
 - GRABACIÓN DISPONIBLE CLASE LUNES 20 ABRIL

Figure 1. An example of modularization in a CVA in an ICT graduate course

(Source: Own elaboration).

relevant information according to the purpose for which the information is to be managed. The term *information representation* refers to users' act of reprocessing this selected information to order to demonstrate their grasp of a new theoretical or practical construct, based on a reworking of the sources consulted. It is critical that learning be designed to avoid the pitfall of mere information consumption, where students become trapped in a circuit that iterates between access and representation. Metaphorically in education, this would correspond to the *Sparknotes* syndrome (or the *Rincón del Vago* syndrome in Spanish), in computer jargon, copy and paste. The *epistemological* frontier lies between the consumption of information and the generation of new ideas that comes via managing knowledge. The new ideas emanate from intellectual elaborations, based on theory and/or experience, which allow students to form their own constructs and move beyond the references to the available sources of information. An intellectual construct of one's own can express a new idea which, when conceived, then needs

to be transferred via a process that links *individual intellectual capital* with the formation of *collaborative social capital*. A new idea can be as simple as a child's drawing naive strokes on a piece of paper and the explanation of the drawing in his or her mother tongue, and it can be as complex as the formulation of an equation by a scientist using mathematical language. The essential element is the mediation of language to represent theoretical or practical intellectual constructs. All language constitutes a form of representation of the *world of ideas* (immanent and abstract) or the world of things (objective and concrete). Without the *mediation of language*, there is no knowledge (Careaga, 2020). Language, in an epistemological sense, is any symbolic means that allows for an abstract representation of reality and is used to transfer knowledge. Examples can include not just one's mother tongue, but also mathematics, geometry, music, sign language, drawing, art in general as an aesthetic representation and other symbolic systems. In this sense, online education cannot remain exclusively situated in the administration

of information, since it would be trapped in the “rear-view mirror” school methodology denounced by McLuhan (1962), remaining in the dimension of the known. VLCs should function as networks of knowledge managers, crossing over into the dimension of what is yet to *be known*.

Collaborative didactics in digital learning contexts

Didactics is a pedagogical discipline. It is concerned with the development of methods and techniques that are applied to aid learning. In academic and research educational environments, it is considered a science of learning. According to the standard concept, teachers are responsible for didactical design, generally before the learning process. The collaborative construction of didactics, on the other hand, is a pedagogical approach that is associated with autonomy, self-regulation, and collaborative learning. It connects teachers and students, both playing active roles in the learning process. In online education, the pedagogical use of digital tools and teaching resources facilitates the design of learning contexts in which it is possible to promote collaborative learning. In such contexts, didactics is energized and filled with contents and theoretical-practical learning actions co-managed by the members of a VLC, all of whom contribute to information management and promoting knowledge management.

When working collaboratively, teachers and students teach and learn together. They contribute to creating a horizontal pedagogical relationship, which goes beyond the rationalist-academic limits of the traditional front-facing class. In virtual learning contexts, when students learn to construct teaching collaboratively, their learning becomes more meaningful and entertaining, and it can give them greater intellectual, cognitive, and emotional satisfaction.

Multimedia technologies enrich learning content and facilitate understanding. The Internet, meanwhile, facilitates students' access to educational resources and services, regardless of where they are physically located, and it stimulates collaboration between educational actors and allows for remote exchanges. Coll (2015) emphasized that the combined use of multimedia technologies and the Internet makes learning possible in practically any setting, whether the school, university, home, workplace or leisure spaces.

Online learning assessment

When the methods of teaching and learning change, it is also prudent to change the modalities of evaluation. Standardization in the application of tests, questionnaires, rubrics or assessment guidelines of practical steps is not enough, even if these forms of assessment are applied in digital formats. One of the relevant changes in assessment is an end to the automatic conflation of evaluation and scoring. Another consideration is to avoid restricting evaluations to the measurement of learned content or of practical steps set out by teachers.

To assess online learning, it is convenient desirable to apply more participatory, horizontal, and innovative assessment modalities. For instance, the following six different kinds of assessment are useful: 1) authentic and formative assessment, 2) project and process assessment, 3) evaluation of intellectual constructs based on knowledge management, 4) evaluation of competencies, skills, and/or learning achievements, 5) feedback as an assessment modality, and 6) evaluation of virtual performance.

Firstly, *authentic and formative assessment* leaves behind the verticality and exogenous sense of classical assessment. It is based on a constructivist approach to learning (Vygotsky, 1978) that values the interaction between those who teach and learn together. The social factors involved in teaching and learning take on greater importance here. Everyone participates in the process, turning evaluation into a more endogenous assessment, one that focuses on personal and collective evidence and takes into account the experiences that emerge along with learning (Mueller, 2014). It is carried out by teachers and students at the beginning, during and at the end of the learning modules. The students implement this form of assessment on an individual basis by considering and evaluating their own learning processes. They also use a collaborative approach, as each student observes and evaluates what his or her classmates have learned. The higher the level of agreement between these two kinds of assessment, the higher the level of authenticity of the evaluation. There are a number of techniques and instruments that are suited to authentic assessment in multimedia environments. It is recommendable to use a combination of observation guidelines, situational tests that make it possible to observe competencies and skills in context, field notebooks, virtual pedagogical portfolios, semantic or conceptual maps, synthesis diagrams, results from matrices, performance check guidelines in digital environments and/or laboratories, essays, monographs, and presentations or public lectures (in videoconferences, in the case of the e-learning modality), among other methods.

Secondly, *project and process assessment* involves evaluating the project design proposals formulated by the students. This assessment is done bearing in mind the theoretical and practical aspects necessary to carry out each task. Simulation or implementation processes are considered, depending on the conditions and the context in which the work is done. This evaluation can be combined with authentic evaluation, taking into account the students' individual, collaborative and social performances.

Thirdly, *evaluation of theoretical and/or practical intellectual constructs, based on knowledge management* is an assessment approach that examines the students' capacity to be managers of their learning and the administration of information. In other words, it measures the degree to which they can access and represent information, processes which form the initial basis for managing knowledge. The ultimate manifestation of

this modality consists of assessing the capacity to transfer the knowledge generated to rest of the Virtual Learning Community.

Fourthly, *evaluation of competencies, skills, and/or learning achievements* requires a contextualized evaluation of performance. This assessment should be both quantitative and qualitative and should be based on observations and/or measurements of performance in different contexts. If the contexts are modified and the competencies, skills or learning achievements are maintained, it means that what being is assessed is consistent.

Fifthly, *feedback as an assessment modality* is an approach that students' learning progress as a gradual progress toward achievement. In virtual environments, feedback interactions are horizontal and reciprocal, whether they are between teachers and students or among students.

Sixthly, there is *evaluation of virtual performance*. This includes, for example, automated statistics on user performance that are delivered by the platforms: number of times that students access, read, participate and contribute in the various designed environments such as forums, resource centers, document centers, digital portfolios and others. Also, it is possible to evaluate observable digital performance, e.g. the use of operating systems, application and educational software and simulators, to name a few.

Quality of online learning

The perception of quality is complex. The concept refers to set of characteristics of a product or service (education) that determine the degree of satisfaction of the needs that said product or service provides to the consumer (user, student, family, guardian) or client. This definition needs to be adapted to be applied in educational contexts, considering quality standards that can be grouped into four dimensions, all of them essential to providing effective virtual educational (Couffignal, 1965). According to Careaga and Avenaño (2017) these dimensions are: a) pedagogical, b) technological, c) theoretical and d) management.

The pedagogical dimension incorporates factors related to innovations in curriculum when ICTs are integrated into teaching practices. It includes educational theories, curricular approaches associated with innovative notions related to the cyber curriculum, pedagogical principles that guide the incorporation of virtual environments, methodological strategies associated with the use of technologies, innovative modalities of collaborative construction of didactics, pedagogical practices and their innovative modalities of evaluation and monitoring. Additionally, it deals with definitions of pedagogical standards as references for the accreditation of the quality of ICT applications in teaching practices (Ministerio de Educación de Chile, 2016).

The technological dimension includes aspects related to the architecture that contains the basic com-

ponents of any technological system, the definition of the philosophy of technological solutions, the virtual platforms that are developed, communication, and definitions of hardware and software. An awareness of this dimension makes it possible to ensure the quality, interoperability, scalability, and conceptual self-containment of technological solutions applied to e-learning modalities.

The theoretical dimension includes the systems of conceptions that provide foundations for the pedagogical use of ICT, expressed as fundamental and conceptual issues. It serves as the guiding axis of the pedagogical and technological dimensions. It includes the conceptual framework, the anthropological-philosophical foundations and the epistemological approach.

Lastly, the management dimension analyzes the modeling of aspects related to economic, curricular and technological sustainability on which the other dimensions depend. It is associated with administrative, financial, material and technological resources.

Suggestions of tools and digital resources to support teaching

According to the World Economic Forum (2020), even before the pandemic there was rapid growth in the adoption of educational technology, with global Ed-Tech investments reaching US\$18.66 billion. Due to the impact on education that the closure of schools and universities has had, multiple organizations have published educational applications, platforms and resources that can contribute to facilitating student learning and to providing social attention and interaction during this period (see table 1). They are classified according to the needs of distance learning, and most of them offer functionalities in multiple categories, languages and educational levels.

Conclusions

This theoretical article will prove useful in expanding the understanding of the effects of the lockdown of the population due to the COVID-19 pandemic, which posed two crucial problems to traditional education. Firstly, neither the education system overall, nor individual educational institutions, nor the teachers and students were sufficiently prepared to face this abrupt and challenging change. Secondly, the dynamics of the crisis revealed great digital divides when it comes to access to the equipment, connectivity and the skills needed to innovate in teaching and learning. We are still in a phase of cultural transition, in which not everyone has the skills or the willingness to migrate rapidly from face-to-face contexts and situated curriculum to virtual contexts and distributed curriculum.

It is essential to assume a proactive, open, and flexible attitude to change in order to establish online education systems, since technologies are anthropological and constitute a form of human identity

Table 1. Digital tools and resources to support teaching and learning

Source	URL
UNESCO. (2020). Distance learning solutions.	https://en.unesco.org/covid19/educationresponse/solutions
European Commission. (2020b). Coronavirus: online learning resources	https://ec.europa.eu/education/resources-and-tools/coronavirus-online-learning-resources_en
OECD. (2020). Supporting the continuation of teaching and learning during the COVID-19 Pandemic Annotated resources for online learning.	http://www.oecd.org/education/Supporting-the-continuation-of-teaching-and-learning-during-the-COVID-19-pandemic.pdf
Southern New Hampshire University. (2020). Overnight Online Teaching Resources.	https://colab.laspau.org/es/articulos/ensenanza-en-linea-de-la-noche-a-lamanana-southern-new-hampshire-university-comparte-su-experiencia/
Elsevier. (2020). Resources and tips to successfully study and train (from home) in times of coronavirus.	https://www.elsevier.com/es-es/connect/coronavirus/recursos-y-consejos-para-estudiar-y-formar-desde-casa-con-exito-en-tiempos-del-coronavirus
EduTEKA. (N/D). Digital resources.	http://eduteka.icesi.edu.co/recursos/
Universidad Católica de la Santísima Concepción. (2020). Bateria de Recursos Didácticos Digitales y de Comunicación.	https://colab.laspau.org/wp-content/uploads/2020/03/SUGERENCIAS_EST%C3%81NDARES_CALIDAD_ELEARNINGUIEGC_MCAREAGA_CFUENTESV20202020.pdf
Plan Ceibal. (2020). Plan Ceibal durante la suspensión de clases en centros educativos.	https://www.ceibal.edu.uy/es
Educarchile. (2020). Herramientas TIC para construir.	https://www.educarchile.cl/herramientas-tic
Pearson. (2020). Pearson Uses Global Reach to Provide Learning Tools, Expertise for those Affected by Pandemic.	https://www.pearson.com/news-and-research/announcements/2020/03/pearson-uses-global-reach-to-provide-learning-tools-expertise-f.html
The MIT Press	https://covid-19.mitpress.mit.edu/
NASA at Home	https://www.nasa.gov/specials/nasaathome/index.html
Harvard University. Free Online Courses	https://online-learning.harvard.edu/catalog/free

(Source: Own elaboration)

(Stiegler, 1994). Moreover, the digital world is made up of artificial spaces created by human beings, to be inhabited by people. Throughout this article, we have referred to classic and contemporary authors to inform our critical analysis of this disruption, detailing pedagogical, methodological, didactic and evaluative proposals that can contribute to the effectiveness of these educational processes. The current scenario has led us to prepare ourselves to prefigure new paradigms that need new anthropological-philosophical and epistemological visions. It is imperative to rethink education, beginning with experimentation with new forms of teaching and learning. We must share the challenges involved in learning, understanding and carrying out new roles that our current educational systems have yet to sufficiently absorb or appreciate. Far from correcting entrenched inequalities, the coronavirus showed the worst side of education, one that, possibly, was meant to be kept hidden. Distance education, during the past months, has lifted the veil from what we all knew but were not willing to admit in the 21st century. Not all teachers or students have real access to the technological gadgets to they need to perform their roles successfully.

In an exceptional context like 2020 it is crucial for educators to understand how to act more effectively, how to rethink education and find new ways of teach-

ing and learning, not only to improve their students' academic achievement, but also empower them by developing effective learning experiences. We agree with Hodges et al. (2020), who argue that what we have been doing during this confinement is not online education. Teachers and students are merely trying to use certain technologies to overcome the current social distancing mandate produced by the pandemic. True online education requires an epistemological reconceptualization, using access to information, digital tools and resources to support teaching in synchronous and asynchronous learning modalities. In this way, we can harness the potential of online learning for managing knowledge and creating and transferring theoretical and practical intellectual constructs through cyberspace.

As final considerations, it is important that we face our current challenges by sharing personal and institutional concerns without fear of failure, with maximum agility, with a sort of positive ambition, managing useful answers that favor the common good. The above idea makes sense considering that educational institutions were forced to migrate from traditional classrooms to online systems.

It is crucial that the members of the educational community are not afraid or unwilling to take on these new risks together in order to manage the changes effectively. It is not only the responsibility of educational authorities to solve online education emerging problems, but it is also a responsibility shared with teachers, students, administrators, assistants and families.

The trends associated with these changes provide some perspective on education in the post-pandemic context. It is worth noting that multiple organizations have made recommendations as to how school reopening should proceed. For example, they have referred to how to prevent infections (ISGlobal, Barcelona Global Health Institute, 2020), or they have stressed good hygiene practices such as maintaining social distance and checking for symptoms (UNICEF, 2020). Meanwhile, the new Digital Education Action Plan proposed by the European Union will be a key instrument for the recovery of the next generation. It seeks to support education and training institutions and citizens in their efforts to adapt to the digital transition and help ensure a fair and inclusive recovery (European Commission, 2020).

We are all necessary and we must heed the call to collaborate in the construction of a new notion of society, sharing a new mixed educational paradigm that can face the post-pandemic context and meet the new demands and requirements of the 21st century.

Conflict of interest statement

The authors declare there are no conflict of interest

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References

- Almazán, A. (2020). Covid-19: ¿Punto Sin Retorno de la Digitalización de la Educación? *Revista Internacional De Educación Para La Justicia Social*, 9(3e). <https://revistas.uam.es/riejs/article/view/12089>
- Argudo, M. & Tenecela, M. (2020). Educación con tecnología en una pandemia: breve análisis. *Revista Científic*, 5(17), 292-310.
- Atkinson, D. (2002). Toward a sociocognitive approach to second language acquisition. *The Modern Language Journal*, 86(4), 525-545. <https://doi.org/10.1111/1540-4781.00159>
- Badilla, M. G., Vera, A. & Lytras, M. (2017). Pre-service teachers' skills and perceptions about the use of virtual learning environments to improve teaching and learning. *Behaviour & Information Technology*, 36(6), 575-588. <https://doi.org/10.1080/0144929X.2016.1266388>
- Bates, A. (2019). *Teaching in a Digital Age: Guidelines for Designing and Learning*. Tony Bates Associates Limited. <https://opentextbc.ca/teachinginadigitalage/>
- Bertalanffy, K. (1968). *General System theory: Foundations, Development, Applications*. George Braziller.
- Campos, N., Nogal, M., Caliz, C. & Juan, A.A. (2020). Simulation-based education involving online and on-campus models in different European universities. *International Journal of Educational Technology in Higher Education*, 17(1), 1-15. <https://doi.org/10.1186/s41239-020-0181-y>
- Careaga, M. (2020). *Aproximaciones a la Epistemología para Universitarios. Breves acercamientos a mentes brillantes*. Ril Editores.
- Careaga, M. & Avendaño, V. (2017). *Currículum Cibernético y Gestión del Conocimiento. Fundamentos y Modelos de Referencia*. RIL Editores y Editorial UCSC.
- Coll, C. (2015). *La Gestión del Aprendizaje en las Comunidades de Aprendizaje en línea*. <https://es.slideshare.net/grintie/coll-2015-la-gestin-del-aprendizaje-en-las-comunidades-de-aprendizaje-en-linea>
- European Commission. (2020, June 18). *Public consultation launched on the new Digital Education Action Plan*. https://ec.europa.eu/education/news/public-consultation-new-digital-education-action-plan_es
- Couffignal, L. (1965). *La Cibernética en la Enseñanza*. Grijalbo.
- Cucinotta, D. & Vanelli, M. (2020). WHO declares COVID-19 a pandemic. *Acta Biomed*, 91(1), 157-160. <https://doi.org/10.23750/abm.v91i1.9397>
- Derrida, J. (2006). *Aprender por fin a vivir*. Amorrortu editores.
- Dertouzos, M. (1997). *What will be: How the new world of information will change our lives*. HarperOne.
- Failache, E., Katzkowicz, N., & Machado, A. (2020). La educación en tiempos de pandemia y el día después: El caso de Uruguay. *Revista Internacional de Educación para la Justicia Social*, 9(3e). <https://revistas.uam.es/riejs/article/view/12185>
- Featherstone, M. (1989). Towards a sociology of post-modern culture. *Some Structure and Culture*, 164-182. De Gruyter.
- Ferré, F. (1985). *Philosophy of technology*. The university of Georgia Press.
- Feyerabend, P. (1975). *Against Method: Outline of an Anarchist Theory of Knowledge*. Verso Books.
- Foucault, M. (1976). *Defender la Sociedad*. Editorial. Fondo de Cultura Económica.
- Fukuyama, F. (1998). *The end of history and the last man*. Penguin.
- García-Peñalvo, F. J. (2020). *El sistema universitario ante la COVID-19: Corto, medio y largo plazo*. <https://bit.ly/2YPUeXU>
- Hodges, C., Moore, S., Lojce, B., Trust, T. & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review*, 27. <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- Hurtado, F. (2020). Educación, Sociedad e Ideología: La Trilogía Imperante del Siglo XXI. *Revista Arbitrada del Centro de Investigación y Estudios Gerenciales*, 42,138-149.
- ISGlobal, Barcelona Global Health Institute. (2020). *Cómo se debería desarrollar la vuelta a la escuela*. <https://www.isglobal.org/-/covid-19-como-se-deberia-desarrollar-la-vuelta-a-la-escuela>
- Kurzweil, R. (2005). *The singularity is near: when humans transcend biology*. Viking.
- Lakhal, S., Mukamurera, J., Bédard, M., Heilporn, G. & Chauvet, M. (2020). Features fostering academic and social integration in blended synchronous courses in graduate programs. *International Journal of Educational Technology in Higher Education*, 17(5). <https://doi.org/10.1186/s41239-020-0180-z>
- Lipovetsky, G. (1983). *L'Ère du vide: essais sur l'individualisme contemporain*. Editions Gallimard.
- Lyotard, J.F. (1984). *La condición postmoderna: informe sobre el saber*. Cátedra.
- Mailizar, A., Almanthari, S. & Bruce, C (2020). Secondary school mathematics teachers' views on e-learning implementation barriers during the COVID-19 pandemic: The case of Indonesia. *Eurasia Journal of Mathematics, Science and Technology Education*, 16, 7-20. <https://doi.org/10.29333/ejmste/8240>
- May, R. (1976). Simple mathematical models with very complicated dynamics. *Nature*, 261(5560), 459-467.
- McLuhan, M. (1962). *The Gutenberg galaxy: The making of typographic man*. University of Toronto Press.
- Ministerio de Educación de Chile. (2016). *Estándares para la Formación Inicial Docente*. <https://www.cpeip.cl/estandares-orientadores-para-la-formacion-inicial-docente/>

- Mueller, J. (2014). *Authentic assessment toolbox*. North Central College, Naperville, IL. <http://jfmuelлер.faculty.noctrl.edu/toolbox/whydoit.htm>
- Ordorika, I. (2020). Pandemia y educación superior. *Revista de la Educación Superior*, 49(194), 1-8. <https://doi.org/10.36857/resu.2020.194.1120>
- Prensky, M. (2011). *Enseñar a nativos digitales*. SM.
- Ramos-Huenteo, V., García, H., Olea, C., Lobos, K. & Sáez, F. (2020) Percepción docente respecto al trabajo pedagógico durante la COVID-19. *CienciAmérica* 9(2),334-353. <http://dx.doi.org/10.33210/ca.v9i2.325>
- Romero-Rodríguez, J., Aznar-Díaz, I., Hinojo-Lucena, F. & Cáceres-Reche, M. (2020). Models of good teaching practices for mobile learning in higher education. *Palgrave Communications*, 6(1), 1-7. <https://doi.org/10.1057/s41599-020-0468-6>
- Salam, M. & Farooq, M. (2020). Does sociability quality of web-based collaborative learning information system influence students' satisfaction and system usage? *International Journal of Educational Technology in Higher Education*, 17(26), 1-39. <https://doi.org/10.1186/s41239-020-00189-z>
- Sangrà, A. (Coord.), Badia, A., Cabrera, N., Espasa, A., Fernández-Ferrer, M., Guàrdia, L., Guasch, T., Guitert, M., Maina, M., Raffaghelli, J. E., Romero, M. & Romeu, T. (2020). *Decálogo para la mejora de la docencia online. Propuestas para educar en contextos presenciales discontinuos*. Editorial UOC. http://openaccess.uoc.edu/webapps/o2/bitstream/10609/122307/1/9788491807766_no_venal.pdf
- Seidman, S. (1994). Queer-ing sociology, sociologizing queer theory: An introduction. *Sociological Theory*, 12(2), 166-177.
- Shannon, C. & Weaver, W. (1949). *The mathematical theory of communication*. University of Illinois Press.
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology & Distance Learning*. http://www.itdl.org/Journal/Jan_05/article01.htm
- Simon, H. (1978). *Rational decision-making in business organizations*. Carnegie-Mellon University, Pittsburgh, Pennsylvania, USA.
- Stiegler, B. (1994). *La Technique et le temps*. Tome 1: La faute d'Épiméthée.
- Strelan, P., Osborn, A. & Palmer, E. (2020). The flipped classroom: A meta-analysis of effects on student performance across disciplines and education levels. *Educational Research Review*, 30, 100314. <https://doi.org/10.1016/j.edurev.2020.100314>
- Toulmin, S. (1981). The Tyranny of Principles. *The Hastings Center Report*, 11(6), 31-39. <https://doi.org/10.2307/3560542>
- UNESCO. (2020). *1.37 billion students now home as COVID-19 school closures expand, ministers scale up multimedia approaches to ensure learning continuity*. <https://en.unesco.org/news/137-billion-students-now-home-covid-19-school-closures-expand-ministers-scale-multimedia>
- UNICEF. (2020). *Safe School Return campaign*. <https://www.unicef.cn/en/covid-19/safe-school-return>
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Villaescusa, M. (2020, March 30). Todos somos vulnerables, todos somos necesarios. Boletín de APOCLAM, Edición especial Juntos por la orientación. <https://colectivorienta.wordpress.com/2020/03/30/todos-somos-vulnerables-todos-somos-necesarios/>
- Wiener, N. (1948/1985). *Cibernética o el control y comunicación en animales y máquinas*. Reseña de la obra. Tusquets.
- William, S. (1996). *The Control Handbook*. CRC Press.
- World Economic Forum. (2020). *The COVID-19 pandemic has changed education forever. This is how*. <https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/>
- Yi, Y., Lagniton, P., Ye, S., Li, E., & Xu, R. H. (2020). Covid-19: what has been learned and to be learned about the novel coronavirus disease. *International Journal of Biological Sciences*, 16(10), 1753-1766. <https://doi.org/10.7150/ijbs.45134>

