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SAGE Open
October-December 2023: 1–13
© The Author(s) 2023
DOI: 10.1177/21582440231204677
journals.sagepub.com/home/sgo
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Literature Review on Emerging Educational Practices Mediated by Digital Technologies in Higher Education, Based on Academic Papers

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Abstract

Compared to the abundant generic research on technologies and education, few studies focus on the scope of whether the technologies used meet the expectations set forth in international reports and to what extent technology contributes to transforming educational practice. Our objective was to identify and analyze the characteristics of educational practices that are being developed in higher education and to assess the value that technology brings to educational practice. We conducted a systematic review of academic papers published in scientific journals: a corpus of 1,207 articles from six journals included in indexed databases (JCR and SJR), selected using Google Scholar Metrics. According to the various records screened, the study we present is based on 49 articles, published between 2018 and 2019. We conclude that beyond their reproducible, enriching, or transformative nature, most of the articles analyzed address the improvement of students' performance, engagement, or self-perception, in which they positively value the experience of learning mediated by digital technology, although they do not have an impact on the transformative value.

Keywords

digital technology, digital pedagogy, transformation, higher education

Introduction

For the last two decades, relevant authors in the field of education have periodically drawn our attention to the gap between the expectations we place on digital technologies to improve learning and teaching, and the reality of their incorporation into our classrooms. Back in 2001, Cuban, in the conclusions of his study on the use of technology in schools and universities located in the US technology development hub of Silicon Valley, wondered how it was possible that, after two decades and billions of dollars being invested in buying computers, wiring schools and providing technical support, most teachers used computers at home and only a minority actively used them for teaching. Moreover, they tended to use the powerful technologies made available to them to continue their usual teaching practices rather than transform them (Cuban, 2001).

In our immediate environment, significant budgetary investments had not yet been made in those years and our infrastructures were not as powerful. Nowadays, however, universities have an efficient virtual campus to support face-to-face classes (usually based on Moodle), which includes a wide range of modules for developing classroom and online activities (workshop, glossary, forum, wiki, etc.), capable of integrating other applications such as video conferencing systems or digital portfolio tools. In addition, university facilities are equipped with a quality Internet connection (wifi and ethernet). All in all, the feeling is the same as Cuban highlighted 20 years ago: technologies are little used to transform teaching and learning processes, or to transform information into knowledge.

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It is very likely that an important part of these high expectations of the transformative power of digital technologies is the result of the strong impact of, on the one hand, the discourses disseminated by the increasingly powerful industry of the so-called EdTech sector and, on the other, the reports that gather the opinion of experts in the academic field, which are promoted and published by various companies and organizations with a view to revealing the trends and predictions in the use of digital technologies at different levels and in different educational contexts. It is noteworthy that these reports include *EduTrends* by the de Monterrey (2021) in Mexico; *Horizon*, provided by the *New Media Consortium* and now taken over by Educause (2021) in the USA; *Innovating Pedagogies* by the Open University in the UK (Open University Innovation Reports, 2021); or *Top Tools for Learning* by Hart (2021) and the Centre for Learning & Performance Technologies, among others. In general, these reports present a horizon of sophisticated technologies that universities are expected to adapt their teaching in the short, medium, or long term: such as mixed or extended reality, gamification, learning analytics or adaptive learning developments.

Authors, such as Watters (2017) and Grussendorf (2018), have strongly criticized these predictions for their lack of reflection, forward-looking errors and, above all, their lack of consideration of the diversity of contexts in which these technologies are used.

This critical stance has had the support of a substantial part of the academic community, which has led the *Horizon Reports* deciding the "Fail or Scale" section, which re-examines the previous forecasts and analyses the technologies that were adopted or had an impact on the educational practices of universities.

In clear opposition to this type of discourse, which tends to place importance on digital technology, even over and above the didactic methodologies that they try to support, other authors confirm that what is important are the pedagogical approaches, the vision of what it means to teach and learn (Adell & Castañeda, 2012; Goodyear et al., 2021; Mishra & Koehler, 2006; Reeves & Lin, 2020; Veletsianos, 2010).

These are works that tell us about emerging technologies or pedagogies to refer to the continuous refinement and development of educational practices based on digital technologies, where the emerging qualifier is not interpreted as "new," "new practices" or "new technologies," but rather as "new" in relation to dominant practices, that is, new ways of using digital technologies to innovate educational practices.

For our part, we agree that these latter perspectives force us to reconsider the supposed innovative and transformative effect that is often automatically attributed to the incorporation and use of digital technologies in educational practices.

The possibilities offered by technologies to support teaching and learning processes do not depend so much on the characteristics of the technologies selected as on the use made of them in the design and development of educational practices that incorporate them (Coll et al., 2008). It is the specific uses that teachers and students make of these technologies, when organizing their joint activity around learning content and activities, which end up determining, their greater or lesser impact on educational practices and, their greater or lesser capacity to transform teaching and improve learning. Hence, when we set out to incorporate technologies into our educational practices, we must start by asking ourselves about the added value that technologies can bring to the learning processes that we endeavor to promote.

It is about incorporating technologies to encourage students to receive meaningful learning and with greater personal value, and at the same time, to increase the possibilities for teachers to monitor students' learning in greater detail in order to help them progress in it (Coll, 2004; Onrubia, 2005).

However, as we pointed out at the beginning of this introduction, these expectations about the potential of digital technologies clash with what we perceive to be happening in university classrooms.

The literature in the field shows a large amount of empirical research and reviews that focus mainly on "the things of technologies and devices" (Reeves & Lin, 2020): works focused on experimental or quasi-experimental studies on the effects of technologies. In contrast, there is little research and, above all, reviews focusing on teachers' uses of digital technologies. Even when this latter aspect is the primary focus, most are based on applying questionnaires to teachers to explore teachers' reported uses (e.g., Kimmons & Hall, 2018), but very few analyze the types of use they actually make of them in their everyday teaching. A clear exception is the work of Kirkwood and Price (2014), who analyzed how digital technologies are incorporated into educational practices in the university context. Based on the review of many scientific articles published in the period from 2005 to 2010, these authors conclude that, in at least 50% of the cases, digital technologies have been used with little or no change in the teaching method (e.g., opening a new channel of communication with participants).

Based on this, we decided, as a research team, to apply for a funded research project to investigate the uses of digital technologies made by the teaching staff in various faculties at our own university through in-depth interviews, as reported by Lindín (2021). We also decided to broaden our research focus to explore the uses made in

other universities from a systematic review of articles published in scientific journals. The results of this second objective form the basis of this paper. We present herewith a detailed systematic review of empirical studies on educational experiences or proposals mediated by digital technologies, which have been published between 2018 and 2019 in a set of six journals that focus on digital technologies applied to higher education. With this review we set about reviewing the following questions: (a) what type of didactic methodologies are identified in the educational proposals, (b) what type of technologies or digital environments are used to develop these educational proposals, and (c) what value does the use of digital technologies bring to the educational proposal.

Methodology

We carried out a systematic literature review. According to Crompton et al. (2017), it involves a process of identification, selection and synthesis of primary research studies to provide a complete and current picture of the subject of study. In our case, it will be emerging practices in higher education mediated by digital technologies. We have followed the methodological guidelines proposed by various authors (McMillan & Schumacher, 2010; Okoli & Schabram, 2010) and the quality standards of the PRISMA statement, to ensure the internal consistency of the review (Page et al., 2021).

Phases of the Review

Phase 1. Journal Identification. We have selected the top publications of Google Scholar as our main source of information, since it offered us greater precision when searching for journals focused on our thematic area of interest, in contrast to the broader categories used by the Web of Science or Scopus. We have chosen two lists of journals corresponding to the subcategories Educational Technology and Higher Education (within the Social Sciences category).

In the list of each category, we selected the three journals with the highest impact index in Google Scholar Metrics, which correspond mostly to Q1 of JCR and fully to Q1 of SJR. The bibliometric data provided by Google Scholar Metrics is generated by Google Scholar, which is the most comprehensive and least biased scientific and academic data source currently available, as reported in Delgado and Repiso (2013). As a second inclusion criterion, we have determined that they be journals to which the analysts, authors of this paper, have access to the full content. Thus, in the initial research, for the years 2018 and 2019, we have obtained 1,207 articles (Table 1).

Phase 2. Records Screened: Title, Abstract & Keywords. We obtained the first selection of articles through searching for terms in the title, abstract or keywords, differentiated according to the category of the list to which the journal belongs. Thus, for journals in the Higher Education category, we used the search words [Technology OR Digital] and for journals in the Educational Technology category we used the combination ["Higher Education" OR University OR College]. In addition, we established as an exclusion criterion that the articles were not reviews of empirical studies, but exclusively primary sources. This first selection excluded 945 articles, leaving 262 for analysis (Table 1).

Phase 3. Records Screened: Full Text. From the previous selection of articles, we made a first reading of the full texts. This first reading allowed us to identify some articles that did not meet our search parameters, which led us to establish three new exclusion criteria: articles not related to higher education, articles not related to the use

Table 1. Results of the Initial Research (Magazines, Published Articles, and Selected).

	2018			2019			Total		
	Number of articles			Number of articles			Number of articles		
	P	S		P	S		P	S	
	F	F	%	F	F	%	F	F	%
Computers and Education	188	61	32.45	229	57	24.89	417	118	28.3
British Journal of Educational Technology	201	19	9.45	140	59	42.14	341	78	22.87
Internet and Higher Education	22	14	63.64	23	14	60.87	45	28	62.22
Higher Education	67	5	7.46	66	11	16.67	133	16	12.03
Research in Higher Education	49	2	4.08	36	3	8.33	85	5	5.88
Assessment and Evaluation in Higher Education	89	5	5.62	97	12	12.37	186	17	9.14
Total	616	106	17.21	591	156	26.4	1207	262	21.71

Note. P = published; S = selected; F = frequency.

of digital technologies, and articles that were not focused on a methodological proposal mediated by digital technologies. The application of these criteria excluded 200 articles, leaving 62 for analysis.

Our next step was to define an initial protocol based on three dimensions that would allow us to classify the articles: (a) the type of didactic or pedagogical methodology implemented, (b) the type of technologies or digital environments used to develop said didactic or pedagogical methodology, and (c) the educational value that the proposed use of technologies or digital environments contribute to the didactic or pedagogical methodology. We also proposed a first proposal of categories to specify each dimension, together with operational criteria to apply them.

Then we proceeded to individually analyze a first group of 10 randomly selected articles. Following their review, the analysts met to identify and resolve the problems detected and to agree on protocol specifications and the definition of the categories. The total number of selected articles was then distributed into three pairs. The members of each pair coded the articles independently to compare the results of the analyses and agreed on a shared coding. If the pair of analysts did not reach an agreement, they went to a third party who acted as a judge. The opinion of the third-party judge was necessary in 12 of the cases, which represents 6% of the total number of articles analyzed. This contrast between pairs and the judge also helped us to refine the protocol and the category system for each dimension.

Phase 4. Assessed for Eligibility. The application of the resulting protocol led us to make the decision to establish a new exclusion criterion, consisting of not analyzing the works when educational practice was not sufficiently specified. Using this criterion, 13 articles were excluded, leaving 49 for analysis.

Category System and Protocol

The category system finally used for each of the dimensions, together with a brief explanation of each of them, is outlined in Tables 2 to 4.

The three categories of this third dimension (Table 4) represent three different degrees of usability of the functionalities of digital technologies to enhance students' learning processes or the teacher's teaching process. This gradient ranges from the lowest level, which virtually involves no change in the use of digital technologies for learning or teaching, to the highest level, where the potential of digital technologies is harnessed to implement improved and innovative ways of teaching and learning that would be impossible without them.

Table 2. Dimension 1: Type of Teaching Proposal or Methodology.

Categories	Description
1. Inquiry-based methodologies	Place the learner as the protagonist of the learning process.
2. Competency-based learning	Teaching the learner to mobilize and articulate a set of knowledge, skills and resources at the service of competent performance or execution in a given type of situation.
3. Flexible or personalized learning	Providing the learner with different possibilities so that he/she can make decisions about what to learn, where and how to do it.
4. Gamification	Use of techniques, elements and dynamics of games and recreational activities in teaching and learning activities.
5. Hybrid learning	Combination of face-to-face and online activities.
6. Experiential learning	Learning by doing with special emphasis on the creation of products based on digital technologies.
7. Drilling and practice	Resolution of exercises and simple activities based on repetition to reinforce the acquisition of conceptual or procedural content.
8. Mixed	Combination of two or more types of the above methodologies.
9. Others	Methodologies that cannot be included in any of the above categories

Source. Adapted from EduTrends 2017 (Observatorio de Innovación Educativa, 2017).

As operational criteria for the application of the categories, we agreed on didactic methodologies in the first dimension to prioritize the category to which the authors attributed innovation in educational practice or to use the category "mixed" in the case where several methodologies were clearly combined. For the second dimension, digital technologies were decided on as we considered that the categories were not exclusive, so that analysts could classify the same article with two or more categories of digital technologies.

Figure 1 shows the flow of the decisions taken on the relevance of the articles initially selected (solid rectangles), the exclusion criteria and the number of articles affected (dotted rectangles), the number of articles selected for the next phase (circles), up to the final selection of the 49 articles that were analyzed in-depth.

Sample

The 49 articles included in the analysis for the period under consideration (2018–2019) are distributed across journals and years as shown in Table 5.

Table 3. Dimension 2: Type of Technology or Digital Environment.

Categories (systems or tools for:)	Description
1. Adaptive or individualized systems	Technology determines the needs of learners in the digital environment and provides the teacher or learner with pathways, material, or resources according to these needs.
2. Social networks	Technological environments specifically designed for communication between people who share an interest, a profession, a background…, used as part of the learning process.
3. Collaborative environments	Technological environments specifically designed for communication and/or collaboration between students and/or the teacher.
4. Mobile and/or ubiquitous tools	Technologies that facilitate learning at any time and place.
5. Open courses	Environments specifically created to work with very large groups of learners such as MOOCs.
6. Personal learning environments	Customizable desktop systems or set of tools selected by the learner to create his or her own virtual or blended (face-to-face) environment.
7. Extended reality	Environments or activities based on augmented reality, virtual reality or artificial intelligence.
8. Learning management systems	LMS, CMS or LCMS that manages users, resources, materials, teaching and learning and assessment tasks.
9. Other	Technologies or digital environment that cannot be included in any of the above categories.

Source. Adapted from NMC Horizon Reports 2005 to 2020 (Educause, 2021).

Table 4. Dimension 3: Value Brought by Using Technology in Educational Practice.

Categories	Description
Reproducible use	Digital technologies do not bring added value to teaching or learning. They are used to reproduce what could be done without them (e.g., a word processor without using any of its functionalities, as one would use pencil and paper to complete a writing task; a digital whiteboard as if it were a traditional whiteboard).
Enriching use	Digital technologies do not change the ways of teaching and learning, but they can make them better, faster, more dynamic, more fun, and more effective (e.g., calculators, which speed up the operations and allow learners to concentrate on solving complex problems; self-correction drilling and practice programs, or digital books with similar structures to paper-based books and with little use of multimedia resources).
Transformative use	Digital technologies magnify the possibilities for teacher adjustment of learning aids for students and/or facilitate learners to construct knowledge and attribute meaning to learning content and tasks in innovative ways. Digital technologies drive new ways of teaching and learning that would not be possible or would be very difficult without them (e.g., tools or applications that support interaction, communication and collaboration processes between learners or between teacher and learners; visualization or stimulation tools that allow combining and integrating very different representation formats; tools or applications that enable the teacher to continuously obtain information and follow the learner's learning process and to provide dynamic, responsive and contingent aid to that process).

Source. Adapted from Coll et al. (2008) and Puentedura (2014).

Results

Didactic Methodologies

The teaching-learning methodologies are presented in Table 6. Methodologies are combined in three articles: inquiry and competencies in two articles and inquiry and personalized learning in one article. The article classified in "Others" corresponds to a proposal for the use of videoconferences to impart contents.

Technologies or Digital Environments

In each learning technology, the experiences analyzed use one or more technologies (Table 7). No research has been found on educational practices that works with other technologies such as Robotics, Blockchain, Affective Computing, 3D Print, Natural User Interfaces or Wearable Technology. Instead, technologies not initially included (Others) have been found: the use of games, the use of YouTube videos, a video portfolio, and specific interactive video-conferencing platforms.

Contributions of the Use of Technology

Overall, the value that the use of technology brings to educational practice (Table 8) is moderate; the use is merely reproducible in six articles, enriching in 20 and is transformative in 22 of them.

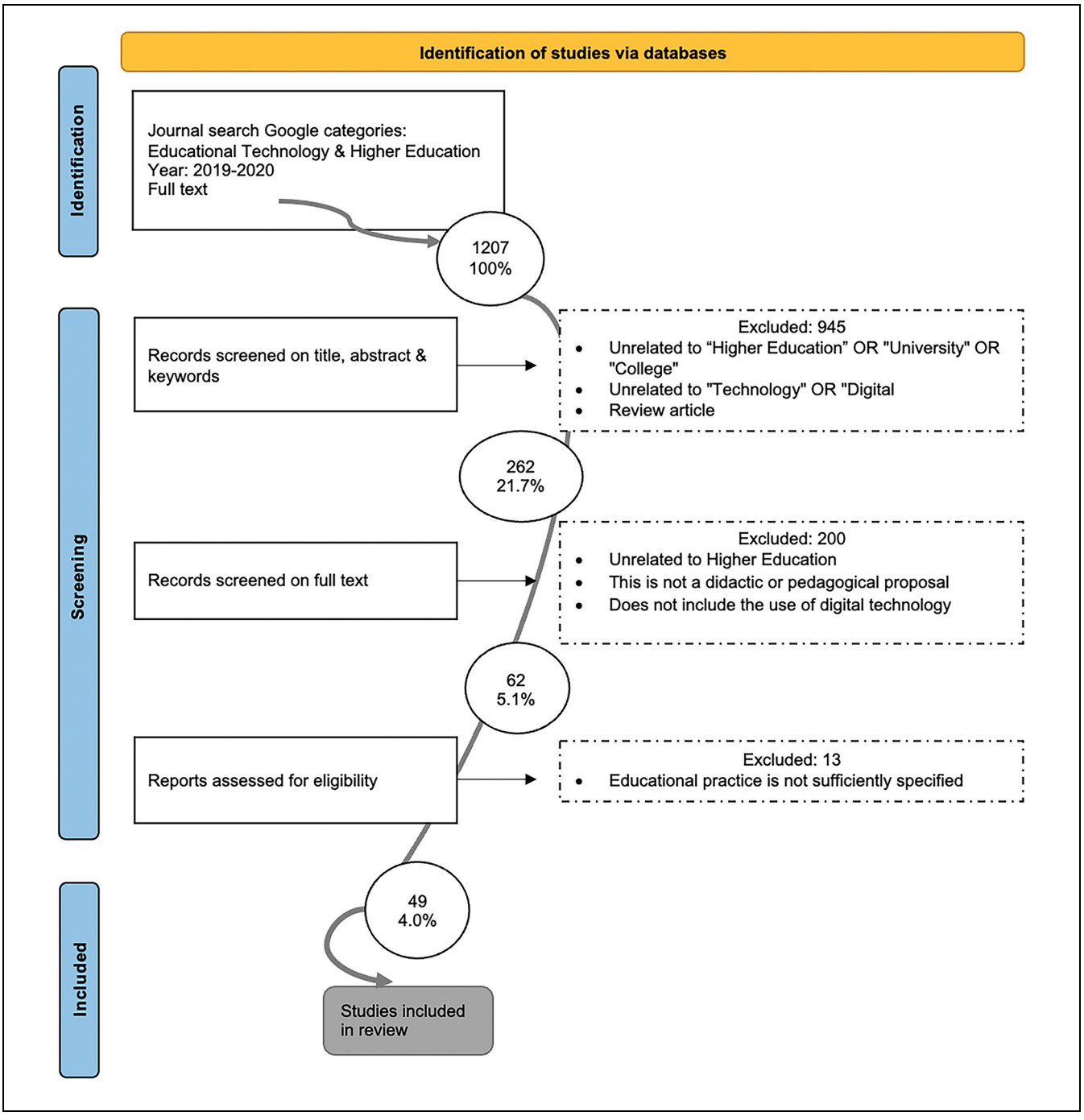

Figure 1. Flow diagram phases of a systematic review adapted from Page et al. (2021).

Inquiry-based methodologies are the most frequently chosen to study teaching/learning practices. They appear in 17 articles, with the following typologies: PBL or variants (4), problem-solving (3), case studies (2), learning community (2), peer assessment (2), debates (1), flipped class (1) or a combination of several (2).

One or more technologies are used in each case to support these methodologies. The most used is collaborative environments (9) or LMS (5) and to a lesser extent, mobile (2) and social networks (2). Learning analytics appears in one article. The value of technology in these methodologies is mainly transformative (10), followed by enriching (5) and reproducible (2).

The transformative value appears especially in studies using collaborative environments. These are environments that integrate a variety of tools and are used so

Table 5. Articles Analyzed by Journal and Year.

	2018	2019	Total
Computers and Education	13	12	25
British Journal of Educational Technology	6	9	15
Internet and Higher Education	2	3	5
Higher Education	1	0	1
Research in Higher Education	0	0	0
Assessment and Evaluation in Higher Education	0	3	3
Total	22	27	49

Table 6. Presence of Type of Didactic Proposal or Methodology.

	F	%
1. Inquiry-based methodologies	17	34.70%
2. Competency-based learning	5	10.20%
3. Flexible or personalized learning	2	4.10%
4. Gamification	7	14.30%
5. Hybrid learning	10	20.40%
6. Experiential learning	0	0%
7. Drilling and practice	4	8.20%
8. Mixed	3	6.10%
9. Others	1	2.00%

Note. F = frequency.

Table 7. Presence of Type of Technology or Digital Environment.

	F	%
1. Adaptive or individualized systems	1	2%
2. Social networks	5	10.2%
3. Collaborative environments	15	30.6%
4. Mobile and/or ubiquitous tools	16	32.7%
5. Open courses	1	2%
6. Personal learning environments	1	2%
7. Extended reality	1	2%
8. Learning management systems	21	42.9%
9. Others	4	8.2%

Note. F = frequency.

Table 8. Contributions of Technology.

	F	%
1. Reproducible use	6	12.2%
2. Enriching use	20	40.8%
3. Transformative use	22	44.9%
4. No data	1	2%

Note. F = frequency.

that students must bring different skills into play (communicating, searching and applying information, reaching agreements, managing teams and time, work planning, coproducing knowledge…). The learning environments, which are difficult to emulate without technology, are versatile in fostering: group construction of knowledge, project management processes (Noguera et al., 2018; Seman et al., 2018), metacognitive processes or social presence (Molinillo et al., 2018), as well as processes of collaboration, participation, negotiation and engagement through collaborative writing tools (Levrai & Bolster, 2019; C. Lin & Reigeluth, 2019). It is also evident that through these technological platforms, tutors can monitor participation in a more in-depth manner in order to achieve the appropriate and necessary levels to enable collaborative learning (Cacciamani et al., 2019). For their part, social networks generate spaces for the development of virtual learning communities, improving social connection, relationships, stress and student satisfaction (Thai et al., 2019). Learning analytics add value to educational practice when the teacher encourages the use of the reports they write up for students to self-regulate their participation and learning process (B. Chen et al., 2018). Geolocation and photography mobile applications enable students to be engaged in authentic activities fostering socially shared and connected learning to community activism (Bell et al., 2019).

The enriching value occurs when the technology provides an environment that favors the processes pursued, but its presence may not be strictly necessary, or the use made of it does not require it. A Moodle environment favors the processes of participation before and after in a flipped classroom, although it is the activities in the face-to-face classroom that prove most useful for metacognition and subsequent self-regulation (Wang, 2019). Mobile technology support enriches the transformation of physical classroom spaces that better connect to a face-to-face environment (Yeoman & Wilson, 2019). Mobile and LMS favor audio feedback in a wholly virtual environment (Rasi & Vuojärvi, 2018), and assist learners to reflect on their learning process, although feedback could be provided by any other means.

The value is reproducible when the technology used does not contribute to the improvement of the practice or is even perceived by the participants or the researchers of the study as problematic for its educational use, such as the use of Facebook in peer-assessment (Demir, 2018), or a virtual collaborative environment that is shown to be less useful than face-to-face for the production of quality products (Barak & Usher, 2019). These studies show that technology alone does not transform educational practices; what transforms them is the type of pedagogical use that is made of it.

In five of the articles, the methodology focuses on competency-based learning, in which, with varying emphasis, the following transversal competencies are worked on: learning ability and responsibility (5),

teamwork (4), creative capacity and entrepreneurial skills (5) and communication skills (5).

The most common technology is the LMS (3), followed by mobile devices (2). LMSs provide an environment that facilitates interaction and asynchronous communication, while the ubiquitous nature of mobile devices increases the effectiveness of accessing information and content at any time and from anywhere.

The incorporation of technology enriches learning (3) or transforms it (2). The enriching value occurs through effective access to SMS content (Li & Deng, 2018), as well as by regulation strategies that incorporate reflection by learners (Splichal et al., 2018; van Den Bos & Tan, 2019).

The transformative value occurs when the technological development of specific functionalities enhance communication and motivation among students (Parsazadeh et al., 2018) or affect digital strategies for understanding and evaluating learning (Y.-J. Lin & Wang, 2018).

Only two articles present proposals focusing on flexible or personalized learning to support the construction of one's own learning trajectory.

We note the trend toward the accumulation of technologies: together with the mobile phone, collaborative environments, LMS and PLN to facilitate access to content and communication; or social networks (Facebook) to have multiple sources of information and set up spaces for reflection on one's own learning.

The value of technology in both articles is enriching as it provides ease of interaction and access to content and contributes to regulation. It helps to overcome communication barriers (Rees Lewis et al., 2018) and provides specific audio-visual content for the development of specific tasks in the flipped classroom (Ng, 2018).

Gamification is used as a teaching methodology in seven of the articles through using different strategies: badges and rewards, role-playing games and games that provide feedback and assess learning. Gamification is used to increase students' motivation and participation in activities (5), improve memory retention (1) or enhance self-regulation processes (2). Active learning requires student participation and therefore the presence of methodologies that encourage it; gamification, thanks to its playful component could respond to this need.

We observe two trends when choosing gamification to support technology. On the one hand, ad hoc applications (for mobile phones in two articles and for computers in two others); and, on the other hand, environments that incorporate gamified strategies (badges, points and classification tables). Thus, in three of the articles, environments such as Moodle (2) or Canvas Network Platform are used in a massive course (1).

The value of technology in gamification is mainly reproducible (3), followed equally by enriching (2) and transformative (2). A value that is more enhanced in the case of app-specific design (two transformers, one enricher and one reproducer), than in the case of already gamified environments (two players and one enricher). We infer that when designing an application, strategies can be articulated that are not contemplated in commercial gamified environments.

The reproducible value of technology is when it is used to automate the delivery of badges and rewards in exchange for completing activities, but without taking into account their content, as the teacher could give them without the need for technology (Huang & Hew, 2018; Ortega-Arranz et al., 2019; Park et al., 2019). In the enriching value category, in addition to automating gamification processes, technologies also provide other elements, such as the personalization of learning itineraries through activities of varying difficulty and rewards based on the quality of the content produced (Tsay et al., 2018). This is also undertaken through role-playing games that recreate scenarios linked to reality (Fu et al., 2019).

The transformative value occurs when technology creates an environment that is difficult to emulate without its presence and its use manages to have an impact on relevant processes. In this case, these are games that recreate a rich visual environment necessary for learning the discipline (Wilkinson et al., 2020), that assess learning or that offer automated and adaptive feedback, fostering decision-making and self-regulation processes (Cutumisu et al., 2019).

Hybrid learning is used in 10 articles as a didactic methodology that combines face-to-face learning and online actions, with different objectives related to the positive impact that work integrated by both types of environments can represent: analyze and influence digital tasks prior to the classroom (four articles incorporate the flipped classroom); observing knowledge construction strategies (2) engagement and involvement (2) and increasing student performance and satisfaction (2).

The technologies chosen as support, bearing in mind that they often use more than one, are mainly LMS (6) and systems or tools for mobile and/or ubiquitous learning (4), or their combination (3). To a lesser extent, collaborative environments (2) and social networks (1) are used.

The value of technology is distributed between enriching (5) and transformative (4), with one case not defined due to a lack of information. While the general strategy is to use the hybrid session to augment, enhance or prepare classroom activity, it often only brings more dynamism or efficiency.

The enriching value appears in articles where technology positively influences the achievement of objectives, without transforming the training sequence. The distribution of the learning process outside the face-to-face classroom in digital environments serves to improve performance, through the selection of videos (Lee & Choi,

2019); build knowledge collaboratively, through annotations in documents (Yang et al., 2018); foster reflective thinking and participation (M. A. Chen et al., 2019); boost self-regulation of learning (Apps et al., 2019), and encourage online feedback, with a variable result, through questionnaires (Förster et al., 2018).

The transformative value appears in articles that illustrate the use of technologies for the controlled monitoring of teachers and the provision of contingent aid (collaboration and content) in the creation of online content (Kazanidis et al., 2019); incorporate technology to redesign training initiatives during the process, as a result of community building, which is combined with access to content and feedback (Awidi et al., 2019; Murillo-Zamorano et al., 2019), or WhatsApp to establish relationships of trust between tutor-tutored that did not occur in face-to-face sessions (Rambe & Mkono, 2019).

The four articles that present a proposal for drilling and practice focus pedagogical action on the resolution of activities fragmented into consecutive tasks of a process.

The technologies on which they are based are systems or tools for mobile and/or ubiquitous learning (3) and LMS (3); both coincide in the two cases. In one of the cases, LMS is combined with virtual laboratories and in the other case, mobile and/or ubiquitous learning technologies are used. The use of technology is reproducible (1), enriching (2) and transformative (1).

In the case of reproducible use, synchronous/asynchronous learning mimics the strategies of face-to-face strategies (Xiangming & Song, 2018). As regards enriching use, feedback received during the flipped classroom enhances participation and task development (Chong, 2019; Elmaadaway, 2018). The transformative use occurs when technology allows for virtual lab exercises as training and a complement to face-to-face sessions, which is impossible to do outside the digital environment (Viegas et al., 2018).

We verified the mixed technology in three articles, where inquiry methodologies are combined with competency-based learning (2) or with flexible or personalized learning (1).

The choice of technologies coincides in the use of specific software, together with communication tools (LMS, Facebook, Skype, Facebook, YouTube), or with student monitoring systems. A third article uses a collaborative web environment for the training of concepts.

The enriching value occurs when the technology allows access to content repositories and receives feedback (Yeh et al., 2019). The transformative value is based on the incorporation of software for sequential task-based work; together with social communication platforms that manage to facilitate contact between students, teachers and professionals in the sector (Rodriguez et al., 2018), or when the recording of activities on the screen configures spaces for reflection on their own learning, combined with different forms of feedback (Altıok et al., 2019).

Discussion

Compared to the abundant generic research on technologies and education, few studies emphasize whether the technologies used meet the high expectations set forth in international reports (de Monterrey, 2021; Hart, 2021; Open University Innovation Reports, 2021) and to what extent technology contributes to transforming educational practice.

We note that the technologies employed by teacher researchers and the educational practices in which they are used can be considered to be emerging (Adell & Castañeda, 2012; Veletsianos, 2010).

However, not all the uses have the same capacity to transform and improve teaching and learning processes. According to Coll et al. (2008), the uses that provide the greatest added value are those that allow the potential of technologies to be harnessed to advocate new ways of learning and teaching. Thus, in other words, it is about using technologies to encourage students to construct even richer and more complex meanings about content and teaching situations, thereby attributing greater meaning and personal value to them. At the same time, increasing the amount and types of support teachers can provide to students and thus customize it to their needs on a contingent basis (Coll, 2004; Onrubia, 2005). It is no longer a question of using technologies to do the same thing better, faster, more dynamically, more fun, or more efficiently, but to do things differently, to put into action learning and teaching processes that would not be possible without the help of technology.

Conclusions

We aimed to identify and analyze the characteristics of educational practices mediated by digital technologies that are being developed in higher education, and, from there, to analyze the value that the use of technology contributes, in each case, to educational practice.

The methodological approach adopted based on the systematic review of research articles on educational technology in higher education over 2 years, has allowed us to approach the object of study, from which we highlight the following results.

In most cases, they are technologies that already have a long track record. In order of frequency, these are LMS, mobile learning, collaborative environments, and social networks to a lesser extent. On the other hand, technologies proposed by the Horizon reports (Educause, 2021), such as those strategies like maker, blockchain, the

Internet of things… have no presence in the educational practices we have analyzed and adaptive technologies such as learning analytics have a residual presence.

Regarding teaching and learning methodologies, the results reveal a use of student-centered methodologies, highlighting in order of frequency, inquiry-based methodologies, hybrid learning, gamification, competency-based learning, and personalized learning (residual). Special mention deserves the practices that use traditional drilling (although with the support of technologies). This fact responds to a growing interest of the teaching community to fit teaching into the learning theories that dominate the current educational paradigm (constructivism, social constructivism…).

We appreciate a certain relationship between the methodology and the functions it fulfils. Firstly, inquiry methodologies help to promote processes such as work planning, search, analysis and application of information, reflection, debate, and co-production of knowledge, in line with meaningful, constructivist learning and learning by doing. Secondly, gamification, thanks to its playful component, is used to enhance student participation in the framework of active learning. Thirdly, competency-based learning affects the acquisition of transversal skills (such as learning and responsibility skills, teamwork, creative and entrepreneurial skills, and communication skills). Fourthly, that hybrid learning enhances the positive characteristics of both environments (digital/face-to-face) to foster student engagement, performance, and satisfaction.

Overall, the value of technology brings to educational practices is in equal parts transformative (focused primarily on inquiry methodologies) and enriching (focused primarily on inquiry methodologies and hybrid learning). Only in few cases is it reproducible, and it is especially focused on gamification and inquiry methodologies. A more enriching value is observed in the use of technologies such as LMS, which provide an environment rich in documentation and interaction, and enhances educational practice. Collaborative environments and social networks, on the contrary, can transform educational practices, thanks to their characteristics of social connection, which contribute to the development of learning communities and promote spaces for reflection, in which planning, consensus and search of information are inseparable.

Likewise, mobile technologies, depending on their use, can provide a more enriching or transformative value. Enriching, since they enhance communication, group learning and self-regulation, streamline and simplify feedback and the various forms of shared evaluation, and thus bring greater dynamism to the learning process. Transformative, since online collaboration and exchange allow decisions to be made through teamwork in real time, integrating expert advice and peer assessment; evaluate the validity of digital content, and establish personal links that transform the quantity and quality of teacher support. In this case, the game becomes a strategy to enhance and consolidate learning.

Our review highlights two aspects. On the one hand, the already-mentioned international reports traditionally promote the incorporation of the latest technology (as a novelty) with little pedagogical involvement and without adaptation to the context (Grussendorf, 2018; Watters, 2017). It could be mistakenly inferred that the mere incorporation of the latest technology implies significant improvements in the teaching-learning process.

On the other hand, we find that most of the articles analyzed, beyond illustrating the use of technology for reproducible, enriching or transformative value, use it with the aim of improving students' performance or engagement, or students' self-perception of themselves, in that they assume that the learning experience mediated by technology is positive (Kimmons & Hall, 2018). Nevertheless, in no case is there any reflection of the potential of technologies to transform students' ways of learning or teachers' way of teaching.

We must point out that the systematic review is not without limitations, as it could be subject to bias, since we only considered publications from journals, and of high academic impact. This criterion guaranteed the quality of the experiences analyzed and allowed us to make a systematized selection, but at the same time it did not incorporate practices disseminated across other fields.

From our point of view, the expectations placed on the potential of digital technologies to innovate teaching and learning processes are fully justified. Digital technologies make it possible to set up online spaces that ease the development of activities synchronously or asynchronously, regardless of where they take place. They also enable and configure online or face-to-face workspaces that integrate different semiotic systems (letters and written texts, still or moving images, oral language, sounds, numerical data, graphics, etc.) capable of extending to unsuspected limits the capacities of teachers and learners to (re)represent, process, transmit and share information and knowledge (Coll et al., 2008).

In short, we understand that teachers should project technopedagogical designs aimed at making the most of the potential of digital technologies to produce important changes in the ways of learning and teaching instead of just small improvements (in student performance or engagement). Furthermore, in this way, the future of research in the field of educational technology (and its publications) would have an impact on the value that the incorporation of technology brings to educational practice, thus focusing its objective on fostering its transformative nature.

Acknowledgments

Not applicable.

Contributions

All authors have made substantial contributions to the conception and design of the work; the acquisition and analysis of data; the analysis and interpretation of data; have drafted the work and substantively revised it. All authors have read and approved the submitted version and to have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by: Institute of Research in Education (IRE) [Grant Number 2019-01], Department of Teaching and Learning and Educational Organization (DOE), Esbrina (Subjectivities, Visualities and Contemporary Learning Environments) research group, and Learning, Media & Social Interactions (LMI) research group. All from Universitat de Barcelona.

Ethics Statement

Not applicable.

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Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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