The technology acceptance model in the Collaborative learning of Web 2.0, Web 3.0 and Web 4.0: Higher Education case study

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Abstract: - At present, Web 2.0 or Semantic Web is increasingly used to refer to a new state of the Web, while other terms are used such as Ontologies, Web Ontologies, Web Ontology Languages, Social Networks and Social Web, as well as social software. However, many of them are confused with each other and in some cases are taken as the same. These terms are highly linked to Web 2.0, the main objective of the study is to identify how many studies have been carried out on Web 2.0, Web 3.0 and Web 4.0. The methodology used to guide the process of the state of the art is the method of systematic review of the qualitative specialized literature; for this reason, we have chosen to use the guidelines presented for the systematic review of the articles of which 75 were selected from the different scientific journals of great world relevance. The final objective of the academic article is to improve the objective measures used in the various studies of Web 2, Web 3 and Web 4.0. The general conclusion of this study of systematic review of the studies found, is that although Web 4.0 has confirmed to be a very consistent technological resource, it still has limitations that manage to be perceived by other academics as opportunities for future research.

Keywords: collaborative networks, educational institutions, web 2.0 technologies, web 3.0, web 4.0, teaching,
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1. Introduction

Recent years have been characterised by technological advances highlighted by the birth of the World Wide Web (WWW) and the development of Web 2.0-based technologies, such as social networking sites, social bookmarking and micro-blogging tools; this has resulted in many opportunities for manufacturing organisations, but also significant challenges, especially in terms of collaboration between employees and projects, and today's companies need to improve communication channels between geographically dispersed and co-located employees and external partners [1] (Aparici, R., & García, D. (2018).

Innovation in technology is happening at a dizzying rate. Hassle-free, open-source applications and services established on the Internet and designed to boost teaching and learning have now been made available to the general public at limited or no cost. These online social networking applications known as Web 2.0 allow people to meet, create, share and broadcast information, thus giving rise to development [2] Barak, Miri (2018).

Web 2.0 is a platform that allows users to participate directly, in real time, and contribute to the topic under discussion. One of the many features of Web 2.0 technologies is the vast collection of information, such as images, text, data and search indexes. The content available from this platform can be used in various ways, levelling out forms for the development of new pedagogies.

Web 2.0 applications include web-based software and services that enable people to create, share, communicate and collaborate on the web, regardless of geographic, time or technological skill limitations [3] Bosch et al.

Web 2.0, Web 3.0 and Web 4.0 are part of an extremely important advance in education, presenting opportunities for students to improve the quality of their autonomous and collaborative learning, as well as the development of new technological and social skills and competences [4] Buchanan, (2018).

2. Planning Review

The process of planning is: a) a systematic review process was developed, in which the search chain was used to define the field of study about Web 2.0, Web 3.0 and Web 4.0 that have been advanced in the universities, then, b) the research questions were expressed to get the study of the state of the art; and c) the period of systematic search was defined between 2018 and 2020.

2.1. Search in Scientific Journals

In this phase, the following were added: a) articles published in recognized scientific journals taking into account the impact factor, both in Spanish and in English, using scientific databases related to ICTs:

- Scopus (http://www.scopus.com)

- IEEE Xplore (http://ieeexplore.ieee.org)

- Elsevier (https://www.elsevier.com)

- Springer Link (https://link.springer.com)

- Google Scholar

The search strings were generated from the combination of keywords using the AND operator. They were defined as follows (web 2.0 or web 3.0 or web 4.0 and education), for the first search.

The following criteria were proposed for our systematic review

Inclusion criterion 1: Is to filter the articles by the area of Computer Science, a pilot test was carried out, with the intention of improving the search strategy and discarding scientific articles that did not contain sufficient information in relation to proposals for Web 2.0, Web 3.0, Web 4.0 in universities.

Inclusion criterion 2: Articles from recognised specialist journals by date from 2018 to 2020 with the aim of achieving a more up-to-date literature on the subject under review and because the use of ICT in educational projects has been markedly developed in the last three years.

Inclusion criterion 3: Priority will be given to articles, no more than 5 years old, and for references concepts or definitions may be considered older articles by reviewing the impact factor of the indexed journal. That is, the title, abstract, list of key words, conclusions of each article were read to determine whether or not the article met the selection criteria determined.

Inclusion criterion 4: Related articles will be defined that have technical methods and approaches to compare and determine coverage among models of adoption or acceptance of information and communication technology focused on university education, educational institutions, etc. For this, a template was created to obtain the most relevant articles for the systematic review.

2.2. Review of the results

Around 2900 articles were found related to the variables associated with the models of ICT adoption in universities, from which 75 relevant studies were selected, since they contain relevant information to answer the questions asked at the beginning of the research (see Table 1).

Table 1 Systematic Review of Scientific Articles

Source	Generic Search Chain	N° Result Base	N° Results 1st. Iteration (Criterion 1 and 2)	N° Results excluded by object of study	N° Resultados incluidos por objeto de estudio 2da. Iteración (3)	N° Relevant unselected results	N° Relevant selected results 3rd. Iteration (4)
Scopus	**(web 2.0 or web 3.0 or web 4.0 and education)**	1295 articles	articles 2018 (43) 2019 (38) 2020 (30)	36 articles	26 articles 2018 (9) 2019 (10) 2020 (7)	20 articles	11 articles 2018 (3) 2019 (5) 2020 (3)
IEEE Xplore	**(web 2.0 or web 3.0 or web 4.0 and education)**	435 articles	136 Articles 2018 (25) 2019 (27) 2020 (36)	85 articles	23 articles 2018 (7) 2019 (4) 2020 (12)	17 articles	1 articles 2018 (1) 2019 (0) 2020 (0)
Elsevier Science Direct	(web 2.0 or web 3.0 AND web 4.0 AND education)	540 articles	120 articles 2018 (10) 2019 (31) 2020 (20)	29 articles	17 articles 2018 (3) 2019 (8) 2020 (6)	15 articles	12 articles 2018 (5) 2019 (2) 2020 (5)
Springer Link	**(web 2.0 or web 3.0 or web 4.0 and education)**	1289 articles	225 articles 2018 (35) 2019 (55) 2020 (41)	148 articles	36 articles 2018 (12) 2019 (14) 2020 (10)	62 articles	28 articles 2018 (17) 2016 (8) 2020 (3)
Google Scholar	**(web 2.0 or web 3.0 or web 4.0 and education)**	189000 articles	86000 articles in pdf format	16546 articles	129 articles 2018 (70) 2019 (30) 2020 (29)	56 articles	23 articles 2018 (9) 2019 (6) 2020 (8)
Total		192559	86391	16844	231	170	75

The criteria for the inclusion of primary studies were essentially oriented in the studies of the following particularities: title, summary, introduction, review of planning, review of process, review of results, outcomes and discussion, conclusions of each research, where it was examined to what extent the projects Web 2.0, Web 3.0 and Web 4.0 in education were evaluated.

In order to establish the effectiveness of the scientific articles, a thorough content analysis was required, taking into account variables such as the level of description of the proposed model, its relationship with the domain of technology acceptance or adoption, and its applicability.

The records of the selected primary studies were distributed in a table with the aim of defining the specific variables of interest and in which the following information was taken into account: code, title, source, country, year, authors, key words, references (if secondary studies exist), main ideas, type of model to be proposed and its real applicability.

Table 2. Template used to store the information of the articles

Title in English	Cyberloafing in IT classrooms: exploring the role of the psycho-social environment in the classroom, attitude to computers and computing courses, motivation and learning strategies					
Title in Spanish	Cyberloafing en las aulas de TI: exploración del papel del entorno psicosocial en el aula, actitud hacia las computadoras y cursos de informática, motivación y estrategias de aprendizaje					
DOI	• 10.1007/s12528-018-9184-2					
Source	Springer Science+Business Media, LLC, part of Springer Nature 2018					
Sample	607 students					
Country	Turquía					
Year	2018	**Volume**	**Pages**	23	**Impact factor**	Q1
Authors	Ramazan Yılmaz Halil Yurdugül					
Website	Springer		**Journal**		Springer Link	
Key Words	Cyberloafing, Psycho-social environment, Attitudes, Motivation, Learning strategies, Information technologies classrooms					
Metodology	Correlational method					
Conclusions: Finally, it is shown that the cyberattack behaviors of students are influenced by their perceptions, attitudes and psychosocial learning strategies. However, the results show that students' cyberattack behaviors are not influenced by their motivation for courses.						
Type of model proposed ICT (Information and Communication Technologies)						
Application for which the model is used Software Engineering						
Bibliography. Yılmaz, R., Yurdugül, H. Cyberloafing in TI classroom: exploring the role of the psychosocial environment in the classroom, attitude towards computers and computer courses, motivation and learning strategies. J Comput High Educ 30, 530–552 (2018). https://doi.org/10.1007/s12528-018-9184-2						

The bibliographic references of the selected articles allowed us to investigate a number of research results; we explored specialized databases resulting in 900 consulted articles we kept 75 for analysis of the systematic review.

They were selected using the four inclusion criteria mentioned above; for example, we have a full card of the articles reviewed shown in Table 2.

3. Results and Discussion

This section presents the most important results of the systematic review related to Web 2.0, Web 3.0 and Web 4.0 in education within educational institutions of the 75 articles found.

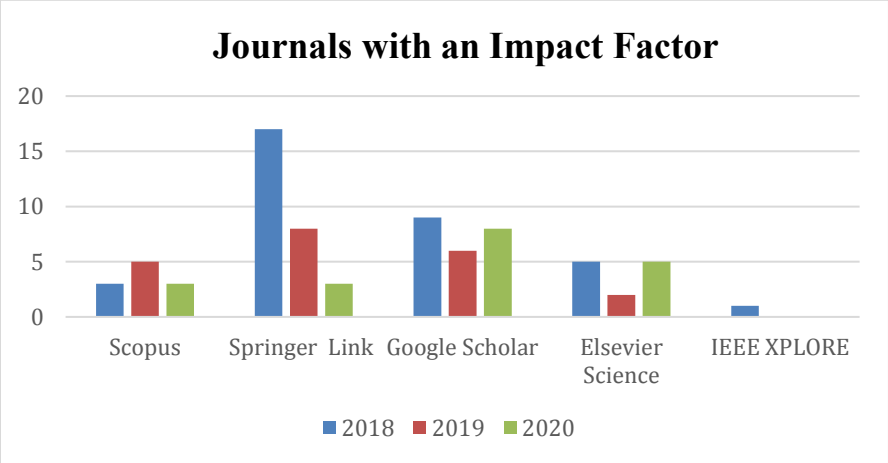
The figure shows the summary of the number of publications per year and per indexed scientific journal, the most relevant database was taken from Scopus with 11 impact studies, followed by Google Scholar with 23 studies, then with 1 IEEE Xplore research, another important database is from Springer Link with 28 academic articles; which represent 98% of the studies found from the systematic review of the literature on Web 2.0, Web 3.0 and Web 4.0 technologies.

With respect to the years in 2018, 35 researches have been taken, in 2019 21 articles were found, in 2020 19 relevant articles have been collected.

Figure 1. Summary of Web 2.0, Web 3.0 and Web 4.0 studies in education and their variants by specialised database.

Table 3 Results of the Journals with Impact Factor

Year	Scopus	Springer Link	Google Scholar	Elsevier Science	IEEE XPLORE
2018	3	17	9	5	1
2019	5	8	6	2	0
2020	3	3	8	5	0
Total	11	28	23	12	1
		TOTAL SUM	75		



The Figure shows the distribution of the 75 articles by type of study, the studies found define the following authors: [5] Calva, José Luis, (2017) who tries to understand the quality and impact of content in collaborative investment platforms, through empirical analysis; [6] Carlisle, D.L., (2018), describes application-level caching in web applications through an empirical study; [8] Jiménez-Saavedra, (2018), develops a process model, a critical review of blended-based computer education; [9] Juan Carlos Chancusig Chisag and Javier Arturo Gamboa Cruzado, (2020), whose main aim of the article is to analyse evidence-based pedagogical approaches related to the use of Web 2 technologies. 0, Web 3.0 in virtual higher education environments; [10] López-Gil, M. & Bernal-Bravo, C. (2019), provide a review of the theoretical bases and research on the uses of Web 2.0 applications (blogs, wikis, collaborative documents and conceptual mapping, video sharing applications, microblogging, social networking sites and social bookmarking for collaborative learning); [11] Brazilian Ministry of Foreign Affairs. (2018), uses multi-channel online learning resources (OLR) in learning activities that benefit extensively from traditional learning based on collaborative learning that emphasises widespread learning anywhere, anytime; [7] R. Chacón (2014), in this reflection, we discuss the connectivist conception of learning in Web 2.0 environments, which points to the pedagogy of what are known as CMOOCs (massively open online courses); [12] Moscoso, R. V. (2018), explains the integration of Web 2.0 technologies in face recognition to help produce, store and share content in a higher education course, empirically explains the forms of effective collaboration skills training for students based on the use of Web TC; [13] Sarrab, M., Al-Shihi, H., Al-Manthari, B. et al. Toward. (2018), explain what the usability of mobile applications is: a literature review and the rationale for a new mode of usability in education, [14] Batova Marina Mikhailovna, Baranova Irina Vyacheslavovna. (2019), the report proposed a model of the intellectual space, reflecting the mechanisms of knowledge representation on the processes of innovative modernisation. Knowledge was systematised in thematic areas such as mathematical modelling, innovation and project management, and organisational design. In order to systematize knowledge in the field of project management, a database of foreign and Russian information systems on the market has been created, which are used to solve problems of However, the software products included in the knowledge base do not fully reflect the design. The knowledge

base contains information on the technological and organisational details of innovative modernisation, as well as the details of investment capital formation. The analysis showed that a significant drawback of the software systems included in the database is the low level of detail of the economic and mathematical models that form the basis of the software product.

Table 4. Articles by type of study

Kind of study	N° of studies (75)
Laboratory Study	1
Field investigation	74
TOTAL	**75**

Table 4 shows the distribution of the 75 academic articles in the 5 scientific journals

in a total of 74 in the different universities of higher education, thus validating the studies found worldwide.

Table 5. Studies found in the different countries of the world

Country	N° of studies
Spain	18
México	10
Colombia	6
United States	5
Australia	4
China	3
Ecuador	3
Brazil	2
British	2
Argentina	2
Germany	2
Australia- China	1
Costa Rica	1
France	1
India	1
Indonesia	1
Irak	1
Irán	1
Malasia	1
Norway	1
New Zeland	1
Omán	1
Perú	1
Poland	1
Portugal	1
Republic of Korea	1
Street New York	1
Sweden	1
Turkey	1
TOTAL	**75**

mentioned above, they have published 1 article on laboratory studies and field research

Table 5 shows the distribution of the 75 articles per country where the countries with more academic articles prevail, such as Spain, Mexico, Colombia, United States, Australia, China, Ecuador being the precursors of the studies carried out to improve the teaching and learning process.

4. Conclusions

- In the last two decades we have witnessed the spontaneous emergence of a culture of participation on a global scale which, although still very superficial and scarcely significant when it comes to varying the structures of communicational power of previous stages, has served to intuit the potential of cognitive intelligence and the power of communication between equals, where they are made public from everyday aspects to political, educational or social manifestations.

- Throughout this work, an attempt has been made to know and analyse the digital competences of the university students of the Degrees in Education of the University of Cadiz. These skills will be in constant transformation as will the technologies themselves and the needs and educational possibilities that derive from them. The presence of technologies has transformed every socio-educational area, in the sources and agents of knowledge and the ways of understanding, building and disseminating knowledge. This panorama requires the development of certain skills in students to face the dizzying and deep challenges posed by the possibilities of Web 2.0, 3.0 and 4.0 applications, interacting reciprocally with their educational practices to develop, evolve and improve educational processes.

- Currently, students' demands respond to communication needs using tools such as

mobile phones, which have an increasing number of applications. If we teachers are familiar with them, we can make them useful and not just limited to children's games. For this reason, there is a lack of synchronisation between what the student needs and what the teacher provides. If we want to develop skills so that students can develop effectively in the time that teachers have to live, we cannot turn our backs on the new technologies used in education and the construction of new learning.

- The research presented contributes to the development of learning using Web 2.0, Web 3.0 and Web 4.0 technologies and its main objective is to improve the effectiveness of education, by designing personalized activities and expanding the selection of ICT tools to support universities in the teaching-learning process in universities.

- A systematic review was carried out in the main scientific journals with an impact factor such as Scopus, IEEE Access, Springer, Elsevier Science Direct, Google Scholar from 2018 to 2020 of published works on technologies 2.0, 3.0 and 4.0, finding a total of 75 studies carried out. In the different countries of the world, each one shows the scientific advances they have developed and the contributions they have made to science.

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