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Learning ecologies
in the digital age

Ecologías de aprendizaje
en la era digital



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JCR 2018 (2019-20): Q1. Impact Factor: 3.338. 5 Year Impact Factor 3.785. Immediacy Index: 1.750; Eigenfactor Score: 0.00076; Communication: Q1 (10th position from 243, top Iberoamerican journal); Education: Q1 (9th position from 88), the first Spanish and Iberoamerican journal
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SCIMAGO JOURNAL RANK: SJR 2018 (2019-20): 0.851: Q1 in Cultural Studies: The top 10% journal. Q1 in Communication: The 10% top journal. Q1 in Education: The 10% top journal



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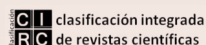
GOOGLE SCHOLAR

2019/20: Top 100 de Google: 1st position (from 100) in the Spanish ranking of all research journals areas. H5: 38. Mean H5: 50. In 2019-09-23: H: 69; H5: 62 (30.912 accumulated citations)
H5 Index (2013-2017), according EC3 Reports, 2018 (UGR): 1st position in Education (out of 165; H5: 38); 1st position in Communication (out of 51; H5: 38)



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Level INT2 (2019)

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SUBMISSION GUIDELINES

GENERAL INFORMATION

“Comunicar”, Media Education Research Journal is published by Grupo Comunicar Ediciones (VAT: G21116603). This established non-profit professional group, founded in 1988 in Spain, specialises in the field of media education. The journal has been in print continuously since 1994, published every three months.

Contents are peer reviewed, in accordance with publication standards established in the APA 7 (American Psychological Association) manual. Compliance with these requirements facilitates indexation in the main databases of international journals in this field, which increases the dissemination of published papers and therefore raises the profile of the authors and their centres.

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Subject Matter: Fundamentally, research papers related to communication and education, and especially the intersection between the two fields: media education, educational media and resources, educational technology, IT and electronic resources, audiovisual, technologies... Reports, studies and experiments relating to these subjects are also accepted.

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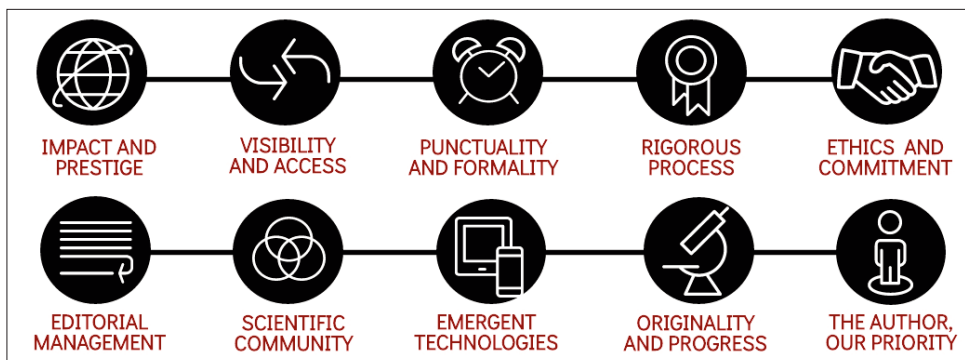
University of Zaragoza/Aragon-Radio, 2015

TOP PRIZE IN COMMUNICATION

Carlos III University, Madrid, 2007



QUALITY CRITERIA



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- Number of research works received: 160. Number of research works accepted: 10.
- Percent of manuscripts accepted: 6.25%; Percent of manuscript rejected: 93.75%.
- Received manuscripts internationalisation: 31 countries.
- Numbers of Reviews: 214 (update: www.comunicarjournal.com).
- Scientific Reviewers internationalisation: 20 countries.
- Country of origin: 4 countries (Spain, Mexico, Australia & Peru).
- International databases in COMUNICAR 62: 727 (2020-01) (update: www.comunicarjournal.com).



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Special

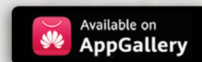
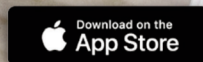
Topic Issue

Learning ecologies in the digital age

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Digital learning ecologies and professional development of university professors

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ABSTRACT

This study analyses the extent to which university faculty use the technological resources that make up their Learning Ecologies to promote their professional development as educators. The interest of this research lies on the growing impact of Learning Ecologies as a framework to examine the multiple learning opportunities provided by a complex digital landscape. Global data referred to the use of technological resources grouped in three dimensions (information access, search and management resources, creation and content editing resources, and interaction and communication resources) has been identified. In addition, the influence of different variables such as gender, age, years of teaching experience and the field of knowledge were also examined. The study was conducted using a survey-based quantitative methodology. The sample consisted of 1,652 faculty belonging to 50 Spanish universities. To respond to the objectives of the study, descriptive and inferential analyses (ANOVA) were carried out. On the one hand, a moderate use of technological resources for professional development was noted while on the other hand, significant differences were observed on all variables analyzed. The results suggest a need to promote, both at the individual and institutional levels, more enriched Learning Ecologies, in such a way that each professor can harness the learning opportunities afforded by the networked society.

RESUMEN

En este estudio se analiza en qué medida el profesorado universitario utiliza los recursos tecnológicos que configuran sus Ecologías de Aprendizaje para propiciar su desarrollo profesional como docentes. El interés de esta investigación radica en el creciente impacto del constructo de las Ecologías de Aprendizaje como marco para examinar e interpretar las múltiples oportunidades de aprendizaje que ofrece el complejo panorama digital actual. Además de identificar los datos globales referidos al uso de los recursos tecnológicos agrupados en tres dimensiones (recursos de acceso, búsqueda y gestión de la información, recursos de creación y edición de contenido, y recursos de interacción y comunicación), también se examina la influencia de diferentes variables como el género, la edad, los años de experiencia docente y la rama de conocimiento. La metodología empleada ha sido de corte cuantitativo a través de encuesta. La muestra está compuesta por 1.652 profesores pertenecientes a 50 universidades españolas. Para dar respuesta al objetivo del estudio se llevaron a cabo análisis descriptivos e inferenciales (ANOVA). Se constata un empleo moderado de los recursos tecnológicos para el desarrollo profesional y, además, se observan diferencias significativas en función de las variables analizadas. Los resultados alertan de la necesidad de fomentar, tanto a nivel individual como institucional, Ecologías de Aprendizaje más enriquecidas, de manera que cada docente pueda aprovechar mejor las posibilidades de aprendizaje que ofrece la sociedad en red.

KEYWORDS | PALABRAS CLAVE

Continuing education, teacher education, professional development, university teachers, higher education, learning ecologies, technological resources, informal learning.

Formación permanente, formación del profesorado, desarrollo profesional, profesorado universitario, educación superior, ecologías de aprendizaje, recursos tecnológicos, aprendizaje informal.

1. Introduction and state of the art

The unrelenting explosion and expansion of knowledge, along with its obsolescence, generate great instability both at an individual and institutional levels, demanding the need for lifelong learning as a basic requirement for personal and professional development. But, in addition, learning has undergone a metamorphosis (González-Sanmamed, Sangrà, Souto-Seijo, & Estévez, 2018) as new formats have been fostered, time and space have been extended, and informal and non-formal models of knowledge acquisition have been strengthened. Thus, learning is characterized as ubiquitous (Díez-Gutiérrez & Díaz-Nafría, 2018), invisible (Cobo & Moravec, 2011), connected (Siemens, 2007) or rhizomatic (Cormier, 2008).

In this attempt to answer questions about what, how, when and where learning takes place in a networked society, the concept of Learning Ecologies (LE) emerges as a perspective to analyze and arbitrate proposals that account for the open, dynamic and complex mechanisms from which knowledge is constructed and shared.

Several authors have upheld the relevance of LE as a construct that enables the appreciation and promotion of the broad and diverse learning opportunities offered by the current context (Looi, 2001; Barron, 2006; Jackson, 2013; Sangrà, González-Sanmamed, & Guitert, 2013; Maina & García, 2016). Specifically, Jackson (2013: 7) states that LE “understand the processes and variety of contexts and interactions that provide individuals with opportunities and resources to learn, to develop and to achieve”.

The recent review by Sangrà, Raffaghelli and Guitert-Catasús (2019) reveals the interest aroused by this concept and the studies being conducted with various groups to reveal how they benefit from, and also how they could promote, their LE.

In particular, analyses have been developed to explore in-service teachers' LE and their links with learning processes and teachers' professional development (Sangrà, Guitert, Pérez-Mateo, & Ernest, 2011; Sangrà, González-Sanmamed, & Guitert, 2013; González-Sanmamed, Santos, & Muñoz-Carril, 2016; Ranieri, Giampaolo, & Bruni, 2019; Van-den-Beemt & Diepstraten, 2016).

The confluence of both lines of reflection and inquiry is promising, especially when considering the assumption of professional development as a process of continuous learning, in which each teacher tries to improve their own training, taking advantage of the resources available through various mechanisms and contexts.

The demand for a teaching staff that is up to date, with the skills and knowledge that guarantee their adequate performance, and with the commitment required for the task of training future generations, takes on special relevance in the field of higher education. The professional development of university professors is a key factor in guaranteeing quality higher education (Darling-Hammond & Richardson, 2009; Inamorato, Gausas, Mackeviciute, Jotautyte, & Martinaitis, 2019).

Various studies have identified the characteristics, conditions and models of professional development for university faculty, and have also assessed the improvements these provide (Gast, Schildkamp & Van-der-Veen, 2017; Van Waes, De-Maeyer, Moolenaar, Van-Petegem, & Van-den-Bossche, 2018; Jaramillo-Baquerizo, Valcke, & Vanderlinde, 2019). The expansion of technology is generating new formats for professional development (Parsons & al., 2019) by facilitating learning anytime, anywhere (Trust, Krutka, & Carpenter, 2016). Specifically, university professors have begun to create opportunities for their own professional development using different resources such as video tutorials or social networks (Brill & Park, 2011; Seaman & Tinti-Kane, 2013).

These and other studies highlight the relevance of technological resources in the learning and professional development processes of university professors. The importance of resources has been recognized by various authors (Barron, 2006; Jackson, 2013; González-Sanmamed, Muñoz-Carril, & Santos-Caamaño, 2019) as one of the components of LE which, together with contexts, actions and relationships, represent the pillars upon which individuals can articulate, manage and promote their own LE.

As He and Li (2019) noted, learning is becoming increasingly self-directed and informal with the support of technology, hence the need to explore the resources used by faculty to foster their professional development from an integrative vision provided by LE.

On the one hand, we have to assume the importance and control of educators to direct their own learning according to their needs, interests and potentialities, determining aspects of professional development (Muijs, Day, Harris, & Lindsay, 2004), but we also have to take into account how resources influence or may influence the development of the other components of LE (fostering actions, stimulating relationships, generating contexts, etc.) that will contribute to the development of personalized learning and professional development modalities (Yurkofsky, Blum-Smith, & Brennan, 2019).

2. Materials and methods

This study is part of a wider project that analyses the LE of university professors and their impact on learning processes and professional development related to teaching. Specifically, the purpose of this study was to identify the technological tools that make up the LE of university professors, and to assess the extent to which they are used to promote their professional development. The following hypotheses were put forward:

1) Gender is associated with significant differences in the use of technological resources for the professional development of university professors from the LE perspective.

2) Age is a significant factor in the use of technological tools for the professional development of university professors.

3) Experience generates significant differences in the use of technological tools for the professional development of university professors from the LE viewpoint.

4) The professor's field of knowledge leads to significant differences in the use of technological tools for the professional development of university professors within the LE framework.

A descriptive methodology with a cross-sectional design was applied using a survey-based method. The data were collected through a questionnaire designed ad hoc from a systematic review of the literature on LE. To establish the validity of the content, the initial instrument was submitted to expert judgement. Nine professionals with training on the study subject (LE) and educational research methodology participated in the validation process, all of them with more than 12 years of professional experience at the university level. Based on their assessments, the first version was reworked and then a pilot test was conducted on 210 subjects to determine the reliability of the questionnaire. After verifying adequate psychometric levels and reviewing some grammatical aspects, the final version was created in digital format (Google Forms) and administered online. The application was open for 5 months. Different institutional managers collaborated and distributed the instrument by e-mail. A presentation was included explaining the objective of the study, framed within its research project, and providing anonymity and confidentiality guarantees. All questions had to be answered and the average response time was around 12 minutes.

The complete questionnaire included seven scales. The first four evaluated constructs within the personal dimension of LE and the next three delved into the experiential dimension of the Ecologies (González-Sanmamed, Muñoz-Carril, & Santos-Caamaño, 2019). To carry out this study, one of the scales included in the experiential dimension was used, namely the Resource Scale. Its design was based on the typology of digital tools proposed by Adell and Castañeda (2010), Castañeda and Adell (2013), Kop (2011), as well as Dabbagh and Kitsantas (2012).

The Resource Scale is comprised of 24 items (Table 1), with a Likert scale from 1 (not at all) to 5 (extremely), distributed into three factors. The first of these, with 10 items, includes the "resources for access, search and information management"; the second factor includes the "resources for creating

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and editing content”, with eight items; and finally, the third factor, made up of six items, groups the “interaction and communication resources”. Once the questionnaire had been administered and the criteria of reliability had been met once again, the Cronbach alpha coefficient was calculated, both globally ($\alpha=.90$) and for each of the dimensions making up the questionnaire: resources for access, search and management of information ($\alpha=.82$), content creation and editing resources ($\alpha=.75$), as well as interaction and communication resources ($\alpha=.75$).

Table 1. Descriptive statistics according to the type of resources used by faculty for learning and professional development

	Not at all		Slightly		Moderately		Very		Extremely		M	DT
	n	%	n	%	n	%	n	%	n	%		
Resources for access, search and information management												
Video tutorials (YouTube, Vimeo, etc.)	241	14.6	335	20.3	449	27.2	412	24.9	215	13.0	3.01	1.24
Social Markers (Delicious, Diigo, etc.)	1279	77.4	194	11.7	115	7.0	38	2.3	26	1.6	1.38	0.83
Repositories of virtual learning objects (Minerva, Investigo, etc.)	948	57.4	258	15.6	243	14.7	133	8.1	70	4.2	1.86	1.18
Digital tools for notetaking (Onenote, Evernote, etc.)	855	51.8	266	16.1	269	16.3	148	9.0	114	6.9	2.03	1.28
Digital task managers (Evernote, Trello, WunderList, Google Tasks, etc.)	876	53.0	276	16.7	216	13.1	158	9.6	126	7.6	2.02	1.31
Digital calendars (Google calendar, iCal, etc.)	395	23.9	226	13.7	251	15.2	303	18.3	477	28.9	3.14	1.55
Digital project management (MS Project, Basecamp, Gantt PV, etc.)	1088	65.9	253	15.3	175	10.6	92	5.6	44	2.7	1.63	1.04
Cloud storage (Dropbox, Drive, Box, Onedrive)	97	5.9	142	8.6	268	16.2	387	23.4	758	45.9	3.94	1.22
Applications to save and read later (Pocket, Instapaper, etc.)	1092	66.1	241	14.6	149	9.0	110	6.7	60	3.6	1.67	1.11
Mail, planner, contact and task management software	113	6.8	103	6.2	153	9.3	366	22.2	917	55.5	4.13	1.22
Resources to create and edit content												
Blogs, Wikis, websites...for online writing	330	20.0	280	16.9	387	23.4	424	25.7	231	14.0	2.96	1.33
Audio editing tools (Podcasts)	824	49.9	368	22.3	248	15.0	163	9.9	49	3.0	1.93	1.14
Networks focused on document-based information (Slideshare, Glogster, etc.)	692	41.9	355	21.5	299	18.1	228	13.8	78	4.7	2.17	1.24
Networks focused on grouping and discussing content (Tumblr, Pinterest, ScoopIt)	947	57.3	331	20.0	214	13.0	125	7.6	35	2.1	1.77	1.06
Generic networks (Facebook, Google+)	594	36.0	339	20.5	286	17.3	282	17.1	151	9.1	2.42	1.36
Office automation (MS-Office, Adobe PDF, Zoho, LibreOffice, etc.)	109	6.6	76	4.6	189	11.4	379	22.9	899	54.4	4.13	1.19
Multimedia: creation in audio, video and image formats (Photoshop, Gimp, Powtoon, Audacity, iMovie, etc.)	499	29.6	358	21.7	340	20.6	254	15.4	211	12.8	2.6	1.38
Virtual classroom (Moodle, Blackboard, etc.)	201	12.2	126	7.6	227	13.7	400	24.2	698	42.3	3.76	1.38
Resources for interaction and communication												
Microblogging networks (Twitter, etc.)	856	51.8	282	17.1	236	14.3	170	10.3	108	6.5	2.02	1.28
Image-centric networks (Instagram, Flickr, etc.)	1028	62.2	265	16.0	164	9.9	124	7.5	71	4.3	1.75	1.16
Professional networks (LinkedIn, etc.)	603	36.5	368	22.3	301	18.2	239	14.5	141	8.5	2.36	1.32
Mobile messaging (Whatsapp, etc.)	421	25.5	302	18.3	292	17.7	342	20.7	295	17.9	2.8	1.45
Email	37	2.2	56	3.4	156	10.0	430	26.0	963	58.3	4.34	1.94
Videoconference (Skype, etc.)	282	17.1	297	18.0	416	25.2	424	25.7	233	14.1	3.01	1.29

Non-probability, convenience sampling was used. The sample was comprised of 1,652 university professors belonging to 50 Spanish universities, 50.5% male and 49.5% female. In terms of age, 23.8% were under 40 years of age; 33.1% were between 41 and 50 years of age, and 43.2% were over 51 years

of age. 33.4% had less than 10 years of teaching experience; 26.3% had between 11 and 20 years, and 40.3% had more than 20 years of experience. The distribution by field of knowledge was the following: 28% belonged to the Social-Judicial field, 21.4% to the field of Engineering and Architecture, 25.2% to Health Sciences, 13.8% to Arts and Humanities and, finally, 11.1% to the field of Sciences. Data was analyzed with the IBM SPSS (v.25) software.

3. Analysis and results

In Table 1, through the descriptive statistics of each item, organized into the three dimensions considered, it is possible to appreciate the tools that are used to a greater or lesser degree.

Table 2. Means, standard deviations, asymmetry, kurtosis and correlation matrix

	1	2	3
1. Resources for access, search and information management	–		
2. Resources for content creation and management	.70**	–	
3. Resources for interaction and communication	.60**	.64**	–
M	2.48	2.72	2.73
SD	0.75	0.76	0.83
Asymmetry	0.49	0.19	0.28
Kurtosis	-0.01	-0.34	-0.39

**p<.001

Table 2 provides the means, standard deviations, asymmetry, kurtosis, as well as the Pearson correlation coefficients for the dependent variables used in this study. The normal distribution of the variables was analyzed based on the criteria adopted by Finney and DiStefano (2006), who indicate maximum values of two and seven for asymmetry and kurtosis, respectively. It can be concluded that the variables included in this study exhibit normal distributions.

Table 3. Descriptive statistics (mean and standard deviation) pertaining to the different age groups in terms of their use of digital resources

	Under 40 years old (1)		Between 41 and 50 Years old (2)		Over 51 years old (3)	
	M	SD	M	SD	M	SD
Resources for access, search and information management	2.60	0.74	2.57	0.75	2.34	0.74
Resources for content creation and editing	2.79	0.76	2.81	0.74	2.61	0.76
Resources for interaction and communication	2.83	0.91	2.78	0.83	2.63	0.78

Note. Scheffé test: information access, search and management resources 1-3, 2-3; content creation and editing resources 1-3, 2-3. Games-Howell test: interaction and communication resources 1-3, 2-3. Age (1=Under 40; 2=Between 41 and 50; 3=Over 51).

In terms of correlations, there is a significant and positive relationship between the use of resources for access, search and management of information and resources for content creation and management ($r=.70$; $p<.001$); furthermore, there is also the relationship between the use of resources for content creation and management and resources for interaction and communication ($r=.64$; $p<.001$), and finally the one between the use of resources for creation and management and resources for interaction and communication ($r=.60$; $p<.001$).

Analyses of variance (ANOVA) were conducted to find out if there were statistically significant differences in the use of resource typologies according to gender, age, years of experience and field of knowledge. Subsequently, Scheffé's post-hoc contrast tests were used, and in order to know the size of the effect, the partial eta-square coefficient was used (η_p^2); the interpretation of the latter is based on the criterion established by Cohen (1988), indicating that an effect is small when $\eta_p^2=.01$ ($d=.20$), medium when $\eta_p^2=.059$ ($d=.50$) and large if $\eta_p^2=.138$ ($d=.80$).

First, taking gender as an independent variable, and the three types of resources as dependent variables, the ANOVA results show that there are statistically significant differences with a small effect size in the use of information access, search and management resources [$F_{(1,1650)}=3.962$, $p<.05$; $\eta_p^2=.002$], as well as in the use of resources to create and edit content [$F_{(1,1650)}=38.917$, $p<.001$; $\eta_p^2=.02$], and finally in

the use of interaction and communication resources [$F_{(1.1650)}=33.584$, $p<.001$; $\eta_p^2=.02$] according to gender, with female participants using the three types of resources at a greater degree.

Table 4. Descriptive Statistics (mean and standard deviation) corresponding to different groups of professors according to their teaching experience, in the use of digital resources

	Less than 10 years (1)		Between 11 and 20 years (2)		More than 21 years (3)	
	M	SD	M	SD	M	SD
Resources for access, search and information management	2.63	0.74	2.53	0.77	2.32	0.72
Resources for content creation and editing	2.83	0.76	2.77	0.75	2.60	0.75
Resources for interaction and communication	2.87	0.88	2.73	0.82	2.60	0.78

Note. Scheffé test: information access, search and management resources 1-3, 2-3; content creation and editing resources 1-3, 2-3. Games-Howell test: interaction and communication resources 1-3, 2-3, 1-2. Years of Experience (1=Less than 10 years; 2=Between 11 and 20 years; 3=More than 21 years).

Second, an ANOVA was performed considering age as an independent variable (1=under 40 years; 2=between 41 and 50 years; and 3=over 50 years) and the use of the three types of resources as dependent variables. In the case of interaction and communication resources, the robust Brown-Forsythe (F^*) tests were used, followed by Games-Howell post-hoc tests, not assuming equal variances. The results show statistically significant differences with a small effect size on the use of information access, search and management resources [$F_{(2.1649)}=20.689$, $p<.001$; $\eta_p^2=.02$], in the use of resources to create and edit content [$F_{(2.1649)}=12.243$, $p<.001$; $\eta_p^2=.01$] and in the use of interaction and communication resources [$F^*_{(2.1313)}=9.032$, $p<.001$; $\eta_p^2=.01$] depending on age.

Specifically, there are differences in the use of the three types of resources considered between professors who are under 40 and those who are over 51, and between those who are between 41 and 50 and those who are over 51.

Results show the same trend: greater use of digital resources for professional development by the youngest group of professors, followed by the group between 41 and 50 years of age, and a distinctly lower use by the group over 51 years of age (Table 3).

Table 5. Descriptive statistics (mean and standard deviation) relating to the different fields of knowledge in the use of digital resources

	Social-Judicial (1)		Engineering and Architecture (2)		Health Sciences (3)		Arts and Humanities (4)		Sciences (5)	
	M	SD	M	SD	M	SD	M	SD	M	SD
Resources for access, search and information management	2.53	0.81	2.48	0.71	2.51	0.72	2.5	0.75	2.27	0.73
Resources for content creation and editing	2.78	0.79	2.59	0.70	2.78	0.74	2.81	0.84	2.55	0.70
Resources for interaction and communication	2.91	0.83	2.51	0.80	2.81	0.78	2.79	0.86	2.41	0.81

Note. Scheffé test: interaction and communication resources 1-2, 1-5, 2-3, 2-4, 3-5, 4-5. Games-Howell test: information access, search and management resources 1-5, 2-5, 3-5, 4-5; content creation and editing resources 1-2, 1-5, 2-3, 2-4, 3-5, 4-5. Field of Knowledge (1=Social-Judicial; 2=Engineering and Architecture; 3=Health Sciences; 4=Arts and Humanities, 5=Sciences).

Third, an ANOVA was performed taking the years of experience as an independent variable (1=less than 10 years, 2=between 11 and 20 years, 3=more than 21 years) and the use of the three types of digital resources as dependent variables. In the case of interaction and communication resources, the robust Brown-Forsythe (F^*) tests were used, followed by Games-Howell post-hoc tests, given that the assumption of variance homogeneity was not met. The results indicated that there are statistically significant differences (with a small effect size) in the use of access, search and management resources [$F_{(2.1649)}=26.774$, $p<.001$; $\eta_p^2=.03$], as well as in the use of resources for creating and editing

content [$F_{(2,1649)} = 15.39, p < .001; \eta_p^2 = .02$], and in the use of interaction and communication resources [$F_{(2,1516)}^* = 15.86, p < .001; \eta_p^2 = .02$], depending on the years of experience. Although the effect is small in all three cases, there are differences in the use of access, search and information management resources between professors with less than 10 years of experience and those with more than 21 years of experience, and between the group with between 11 and 20 years of experience and the group with more than 21 years of experience. The trend in all three cases is that the use of digital resources to foster professional development decreases as teaching experience increases.

Finally, a final ANOVA was carried out taking the field of knowledge as an independent variable (1=Social-Judicial, 2=Engineering-Architecture, 3=Health Sciences, 4=Arts-Humanities, 5=Sciences), and the use of interaction and communication resources as a dependent variable. At the same time, the other two dependent variables (information access, search and management resources, as well as the use of interaction and communication resources) were taken into account. At the same time, since the other two dependent variables (information access, search and management resources, and content creation and editing resources) did not meet the homoscedasticity assumption, the robust Brown-Forsythe (F^*) tests were used, followed by post-hoc Games-Howell tests. The results show statistically significant differences with a small effect size on the use of information access, search and management resources [$F_{(4,1384)}^* = 4.29, p < .01; \eta_p^2 = .01$], in the use of content creation and editing resources [$F_{(4,1336)}^* = 7.29, p < .001; \eta_p^2 = .017$], and in the use of interaction and communication resources [$F_{(4,1647)} = 19.92, p < .001; \eta_p^2 = .046$] based on years of experience (Table 5).

Although the size of the effect was small, significant differences were found in the use of access, search and information management resources between the teaching staff in the science field and those in the other fields, with this group displaying the lowest rates of use of this type of resources. In this case, the teaching staff of the Social-Judicial area exhibits the highest use values. In terms of the use of resources of content creation and editing, the Arts and Humanities group exhibits the highest usage indexes, followed by the Health Sciences faculty and those in the Social-Judicial field; the groups that use these resources to a lesser extent are those in Engineering and Architecture, and Science. As for interaction and communication resources, the faculty of the Social-Judicial field stands out with the highest rates of use of this type of tools, followed by the Health Sciences and the Arts and Humanities groups, with the Engineering and Architecture as well as the Science faculties using these resources the least.

Table 5 also shows that the trend towards the use of resources for creation and editing, and for interaction and communication is greater than the use of resources for access, search and management of information in all the fields of knowledge. The scarce use of digital tools by Science teaching staff as compared to professors in the rest of the fields of knowledge stands out.

4. Discussion and conclusions

First of all, it should be noted that this study is part of an emerging line of research that still needs to be conceptually strengthened and empirically explored. In addition, it could be regarded as pioneering, since the scarce work available on professional development processes within the framework of LE has been performed with educators at non-university levels.

A global analysis of the results enables a glimpse into the most used resources for professional development: email, office automation, mail managers, planner, virtual classroom, cloud storage, digital calendars, and video tutorials. These are all tools used daily in teaching and, perhaps, the most accessible and manageable tools to promote update and continuous improvement processes. Each professor includes some of the tools in his/her Learning Ecology through diverse experiences, interactions and contexts along his/her life journey, turning them into resources for professional development to the extent to which they are activated consciously and autonomously to foster localized and personalized learning. In fact, research carried out on digital competence (Durán, Prendes, & Gutiérrez, 2019) or studies on TPACK (Jaipal & al., 2018) in higher education teaching staff confirm the need to strengthen the integration of technology at the university level, and to reinforce the technological training of faculty. Responsibility lies with each professor, and also with the institutions themselves, to facilitate access to and promote the use of technological resources that enable the configuration of an enriched ecology from which each

professor could guide his or her own professional development. The analyses carried out indicate that all the hypotheses raised have been met. With regard to gender, it must be noted that this is a controversial variable given the discrepancies in the results of previous research concerning its impact on the use of technology and on teaching professional development. In order to assess the data in this study, which reveals that females account for the majority use of the three types of resources for their professional development, it is important to point out that female university professors are more interested in carrying out self-actualization training activities than male professors (Caballero, 2013). However, it would also be advisable to study the influence of other variables such as the perception of self-efficacy, anxiety, attitude or intrinsic motivation towards the use of technology (Drent & Meelissen, 2008).

With regard to results in terms of the fields of knowledge, it is worth noting that Science professors, followed by Engineering and Architecture professors, are the ones who use digital resources the least to develop professionally. These data can be evaluated in light of the study carried out by Cabero, Llorente and Marín (2010). In addition, the scarce use of Interaction and Communication resources among Science as well as Engineering and Architecture professors may suggest a preference for individual rather than cooperative work (Caballero, 2013).

In general, the results obtained reflect a discrete use of technological resources for professional development, revealing some significant limitations in the configuration of university professors' LE. The implications of these results have to be assessed from a three-fold perspective: they warn of the need to increase the range of resources available for teacher training, warn of the desirability of broadening the formats for professors' professional development, and encourage the establishment of mechanisms that contribute to reinforcing LE in order to make them more prosperous.

The impact of these implications is twofold. On the one hand, at the professional level, each professor must be aware of the components that make up his or her LE, since this would mean taking control of their learning process according to individual needs, interests and opportunities (Maina & García, 2016). On the other hand, at an institutional level, the recognition of the importance of LE for professors' optimal and fruitful professional development would be the starting point for improving the training offering by universities through the design of continuous faculty training plans with more personalized, open and flexible itineraries.

Finally, although the study has focused on the analysis of digital resources, recognized as essential components of the experiential dimension of LE (González-Sanmamed, Muñoz-Carril, & Santos-Caamaño, 2019), it is essential to take into account their interdependence with the other components of LE (Relationships, Contexts and Actions). Thus, resources can facilitate collaboration between professors, evidencing their potential to avoid isolation and to promote success in professional development, for example, through social networks or learning communities (Lozano, Iglesias, & Martínez, 2014). On the other hand, resources not only favor, but also expand learning contexts, in a continuum ranging from most formal to informal settings (Sangrá & al., 2011). Finally, digital resources reduce spatial-temporal limitations, offering new and timely ways to carry out training actions in today's complex scenario.

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Personalised learning networks in the university blended learning context

Redes de aprendizaje personalizadas en contextos universitarios de aprendizaje semipresencial

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ABSTRACT

In researching student learning experience in Higher Education, a dearth of studies has investigated cognitive, social, and material dimensions simultaneously with the same population. From an ecological perspective of learning, this study examined the interrelatedness amongst key elements in these dimensions of 365 undergraduates' personalised learning networks. Data were collected from questionnaires, learning analytics, and course marks to measure these elements in the blended learning experience and academic performance. Students reported qualitatively different cognitive engagement between an understanding and a reproducing learning orientation towards learning, which when combined with their choices of collaboration, generated five qualitatively different patterns of collaboration. The results revealed that students had an understanding learning orientation and chose to collaborate with students of similar learning orientation tended to have more successful blended learning experience. Their personalised learning networks were characterized by self-reported adoption of deep approaches to face-to-face and online learning; positive perceptions of the integration between online environment and the course design; the way they collaborated and positioned themselves in their collaborative networks; and they were more engaged with online learning activities in the course. The study had significant implications to inform theory development in learning ecology research and to guide curriculum design, teaching, and learning.

RESUMEN

En la Educación Superior, pocos estudios han investigado simultáneamente las dimensiones cognitivas, sociales y materiales de una misma población. Desde una perspectiva ecológica del aprendizaje, este estudio examina la interrelación entre elementos clave a partir de estas dimensiones en las redes personalizadas de 365 estudiantes. Los datos procedentes de cuestionarios, análisis de aprendizaje y calificaciones del curso permiten considerar estos aspectos en la experiencia de aprendizaje y en el rendimiento académico. Los participantes registraron niveles cualitativamente dispares en el nivel de implicación en el curso, oscilando de un enfoque orientado a la comprensión a enfoques basados en la reproducción de contenidos, lo que, junto a sus opciones de colaboración, generó cinco patrones distintos. Los resultados revelaron que una orientación más comprensiva y una cooperación con estudiantes de orientaciones similares tiende a asociarse con mejores rendimientos en el aprendizaje semipresencial. Sus redes personalizadas se caracterizaron por enfoques más profundos hacia el aprendizaje presencial y virtual; percepciones positivas hacia la integración de ambos contextos; el diseño del curso, por la forma y modo de colaboración; y por una mayor implicación en las actividades en línea. El estudio tuvo implicaciones significativas de aplicación en el desarrollo teórico de la investigación en la ecología del aprendizaje, así como en la forma de guiar el diseño del currículum, la práctica docente y el aprendizaje.

KEYWORDS | PALABRAS CLAVE

Ecological perspective, personalised learning network, interrelatedness, cognitive dimension, social dimension, material dimension, blended learning experience, university students.

Perspectiva ecológica, red de aprendizaje personalizada, interrelación, dimensión cognitiva, dimensión social, dimensión material, experiencia de aprendizaje semipresencial, estudiantes universitarios.

1. Introduction

In contemporary Higher Education, students are increasingly given choices in their learning processes: the subjects they choose to study, the lectures they prefer to attend or view online, the approaches they favor when learning in a seminar, the ways in which they learn online, their partners for laboratory work, or their preference to study in a physical library or log onto an online database. Consequently, modern experiences of learning at the university level should be understood in terms of contemporaneous decisions made by students when they engage in different dimensions in their learning. In this study, we argue that each choice made by students can be considered as an element in relation to a personalised learning network, which can have different levels of success. The purpose of the study is to explain why some personalised learning networks are relatively more or less successful. Adopting an ecological perspective on student experience of learning, which looks for associations across multiple dimensions, this study examines: 1) Qualitative differences in first-year science students' personalised learning networks created by their decisions involving approaches to, and perceptions of learning, their choices of collaboration with others, and the extent of engagement with learning technologies in and outside of class in a human biology subject designed as a blended course; 2) How these choices are related to their academic performance in the course.

1.1. An ecological perspective on learning

The term “ecology” is used to describe the dynamic interactions between organisms and their environments in which a diversity of factors is intricately intertwined (Ellis & Goodyear, 2019). When the ecological metaphor is applied to learning, Barron (2006: 195) defines a learning ecology as: “the set of contexts found in physical or virtual spaces that provide opportunities for learning. Each context is comprised of a unique configuration of activities, material resources, relationships, and the interactions that emerge from them.” Likewise, Jackson (2013: 2) describes an individual's learning ecology as one that: “Comprises their process and set of contexts and interactions that provides them with opportunities and resources for learning, development and achievement. Each context comprises a unique configuration of purposes, activities, material resources, relationships and the interactions and mediated learning that emerge from them”. These two definitions share some similarities that learning is seen as a dynamic system from an ecological perspective, and such an ecosystem of learning is constituted by the interdependencies between learners and their intertwining with people and multifarious material resources (Ellis & Goodyear, 2019). To date, only limited research has adopted ecological perspectives in the study of learning. Of these limited studies, the majority has been conducted in school settings (Barron, 2004; Barron, Wise, & Martin, 2013). One of the limitations of these studies has been the use of a single method—either the survey or the observational method—failing to provide a more comprehensive picture of students' learning ecologies than could be obtained by using multiple methods. This study fills these gaps as it investigates ecologies of university students' learning experience by adopting complementary methods drawing on different data sources. From the definition that learning ecologies are seen as the interdependencies between learners and their intertwining with people and things, we considered three dimensions in students' learning experience, namely cognitive, social, and material. While the cognitive dimension is primarily concerned with learners' internal states, which are interdependent on other learners and non-human elements in learning, the latter two focus on the social and material dimensions respectively.

For analytical purposes, we selected the key elements in each dimension: including approaches to, and perceptions of, learning (cognitive dimension); with whom and how to collaborate (social dimension); and engagement with learning technologies both in and outside formal classes (material dimension). Investigation of the interplay of these elements across the dimensions will be able to reveal features of relatively more or less successful personalised learning networks, providing important actionable knowledge for educators to improve student learning experience. In successful personalised learning networks, we hypothesise that the elements are aligned and coherent, which tend to support student understanding of subject matter and assist them achieving desirable learning outcomes. In impoverished networks, students may miss key elements in learning, or the elements are likely to be fragmented and unaligned. Such experiences will impede understanding and be related to poorer academic performance.

Investigating variations across multiple dimensions of student experience will provide holistic evidence that reveals structural features of successful personalised learning networks for the purposes of learning improvement. The rationale of adopting an ecological perspective includes the following:

- It acknowledges that the reality that university student learning experiences are made up of multiple elements in many dimensions and the interplay between them, which are dynamic, hard to separate, and intricately intertwined. Hence, it is only through investigation of the interrelatedness amongst them that one can explain why some students are more successful than others.
- It allows for a synergy of complementary research methodologies so that the complexity of modern learning experiences across class and online contexts can be effectively revealed.
- It accommodates a combination of different data sources, including self-report and observational data in order for triangulation of research results.

Informed by this rationale, the study draws on methodologies in three areas: 1) Student approaches to learning (Pintrich, 2004; Prosser & Trigwell, 2017); 2) Social network research (De-Nooy, Mrvar, & Batagelj, 2011; Wasserman & Faust, 1994); 3) Materiality in learning

From the definition that learning ecologies are seen as the interdependencies between learners and their intertwining with people and things, we considered three dimensions in students' learning experience, namely cognitive, social, and material.

(Fenwick, 2015; Fenwick & Landri, 2012). A combined use of these methods is illuminating because: 1) Their explicit and implicit intent to reveal qualitative variations when used to investigate student learning; 2) Their capacity to examine student learning experience at the individual and group levels across face-to-face and online contexts; and 3) they are consistent with an ecologically informed, social scientific way to understanding student learning experience adopted in this study.

1.2. Student approaches to learning (SAL) research

SAL research is used in this study to identify key cognitive elements in student learning experience to explain qualitatively different academic performance in Higher Education (Kember, 2015). Seminal studies have shown that how students go about learning (their approaches) and how they perceive learning (their perceptions) relate to their learning performance (Entwistle & Ramsden, 2015).

Applying the framework in blended learning context, research has demonstrated logical associations amongst approaches to face-to-face and online learning and perceptions of blended learning environment: students who perceive that face-to-face and online learning are well integrated tend to adopt deep approaches to learning and to using online learning technologies, which in turn are positively associated with better academic achievement (Ellis, Pardo, & Han, 2016). These deep approaches are proactive, engaged, reflective, and analytical, which help to achieve meaningful understanding of the subject matter (Nelson Laird, Seifert, Pascarella, Mayhew, & Blaich, 2014). When students do not see the relevance between face-to-face and online learning, they are more likely to approach learning on a surface level, thereby obtaining relatively poorer performance (Ellis & al., 2016).

Surface approaches involve adopting simplistic learning strategies, relying heavily on formulaic and mechanistic ideas to merely fulfill the required tasks and to pass exams (Vermunt & Donche, 2017). The cognitive elements investigated in this study are student approaches to face-to-face and online learning and their perceptions of the blended learning environment.

1.3. Social network research

Originating in sociology, social network research aims to identify, detect, and interpret roles of individuals within a group and patterns of ties amongst individuals (De-Nooy & al., 2011; Wasserman & Faust, 1994). Social network research in education has investigated work and discussion ties amongst teachers (Quardokus & Henderson, 2015), characteristics of formal and informal interactional networks amongst students (Cadima, Ojeda, & Monguet, 2012), the relation between friendship ties and learning outcomes (Brewer, Kramer, & Sawtelle, 2012; Rienties, Hélot, & Jindal-Snape, 2013), students' online communications (Rodríguez-Hidalgo, Zhu, Questier, & Alfonso, 2015), and the associations between learning networks and achievement (Tomás-Miquel, Expósito-Langa, & Nicolau-Julia, 2015).

The current study will investigate the relations between students' approaches to learning, perceptions of the blended learning environment, and quality of collaborations, because of limited extant research. The key social network measures of student collaborations will serve as indicators of social elements in student learning experience.

1.4. Materiality in learning

Research into materiality in learning experience focuses on a combined unit of analysis of "people and things" (artefacts), and how their combination helps to create, consolidate, and disseminate knowledge (Fenwick, 2014). Informed by social constructivism, this body of research challenges the isolated role of human factors and foregrounds things in the learning (Fenwick, 2014).

Hence, objects, things, and artefacts are not considered as merely having meanings attributed to by humans. Instead, they are treated as "continuous with and in fact embedded in the immaterial and the human" (Fenwick, Nerland, & Jensen, 2012:6). This area of research has been used to explore how learning is experienced through learner configurations, tangible and intangible objects, such as learning tasks in class and online (Ellis & Goodyear, 2019). In this study, students' use of online learning technologies is considered an element of the material dimension of their learning experience.

1.5. Research questions

Three research questions guided the current study:

- 1) What are the relations between cognitive elements of learning experience and academic performance?
- 2) What are the relations between cognitive and social elements of learning experience and academic performance?
- 3) What are the relations amongst cognitive, social, material elements of learning experience and academic performance?

2. Material and method

2.1. Participants

Altogether 365 first-year undergraduates (251 females, 113 males; ages: 18 to 53, $M=19.72$, $SD=3.55$) from a metropolitan Australian university were recruited following the university ethics guidelines. They were enrolled in a semester-long blended course – introduction to human biology. They were from faculties of health sciences (162), nursing (22), pharmacy (55), and sciences (124) (two students did not report faculty information).

2.2. Learning context

The face-to-face teaching in the course included a weekly two-hour lecture, a three-hour laboratory class every fortnight, and a two-hour workshop every other week. The online learning required 6 to 9 hours' participation in the weekly activities and collaboration. An important learning goal in the course was to develop students' teamwork and collaborative skills, which was promoted by encouraging students to work in small groups to conduct experiments in the laboratory and to co-write scientific reports in the workshops. The course not only required students to learn disciplinary contents, but it also aimed to develop graduate skills, including inquiry abilities, critical and creative thinking, and collaborative skills.

2.3. Data sources and instruments

The data came from four sources: 1) A 5-point Likert-scale questionnaire interrogating approaches to, and perceptions of, learning (cognitive elements); 2) A social network questionnaire interrogating students' collaboration (social elements); 3) Online learning analytics measuring frequency and time of students' interactions with the online learning technologies (material elements); 4) The final marks (students' academic performance).

2.3.1. The Likert-scale questionnaire

The development and validation of the scales in the questionnaire has been reported in previous studies (Bliuc, Ellis, Goodyear, & Piggott, 2010; Ellis & Bliuc, 2016; Han & Ellis, 2019a), which confirmed the reliability and validity. The items pool was constructed by drawing on interviews with students and consulting with the SAL literature and previous questionnaires using the SAL framework (Biggs, Kember, & Leung, 2001; Crawford, Gordon, Nicholas, & Prosser, 1998). Item analysis, exploratory factor analysis, scale reliability analysis, confirmatory factor analysis, and invariance tests have been used for validating the scales (Han & Ellis, 2019a).

- “Deep approaches to inquiry” scale (DAI: 5 items; $\alpha = .71$) describes that approaches to learning through inquiry are characterized being proactive, initiative, and independent, with deep thinking to pursue a line of inquiry (e.g., “I often pursue independent pathways when researching something”).
- “Surface approaches to inquiry” scale (SAI: 4 items; $\alpha = .63$) are approaches that lack thinking, being simplistic and mechanistic, and are heavily dependent upon others (e.g., “Researching something for a task means only using the resources given to me by the teacher”).
- “Deep approaches to online learning technologies” scale (DAT: 5 items; $\alpha = .72$) assesses using technologies as a way to promote deeper understanding of the key ideas, to facilitate research, to connecting concepts in the course to real-world problems (e.g., “I spend time using the learning technologies in this course to connect key ideas to real contexts”).
- “Surface approaches to online learning technologies” scale (SAT: 4 items; $\alpha = .66$) describes using online learning technologies to a limited extent, and using them as just to satisfy course requirements rather than to promote learning (e.g., “I only use the learning technologies in this course to fulfil course requirements”).
- “Perceptions of integrated learning environment” scale (INTER: 6 items; $\alpha = .88$) evaluates to what extent students' perceptions of face-to-face (e.g., lectures, ideas, and key concepts presented face-to-face) and online learning (e.g., online resources, course website, online activities) are coherent and integrated (e.g., “The online activities help me to understand the lectures in my course”).

2.3.2. The social network questionnaire

The social network questionnaire examined students' choices of collaborators and mode of collaborations. Students were asked to name up to three peers according to frequency of collaborations in this course; and to indicate the mode of collaborations.

Please list up to three students you collaborated in this course according to frequency, and circle the mode of collaboration (F=face-to-face, B=both face-to-face and online): The most frequent: F-B; The second most frequent: F-B; The third most frequent: F-B.

2.3.3. The online learning analytics

The online learning analytics included frequency and time spent on online learning resources and interactive activities. The online learning resources, which included course timetable, learning objectives and learning outcomes, reading materials, video lectures, lecture notes, and digital images, provided sufficient scaffolding and materials.

The online interactive activities included multiple-choice questions, labeling, matching, text entry, short answer questions, biological card games, and these components offered opportunities to interact with biological concepts and receive feedback on their responses.

2.3.4. The final marks

The final marks (ranged from 32 to 90, $M=67.93$; $SD=10.13$) were aggregated scores of six assessments: 1) Summative quizzes for laboratory sessions (15%); 2) Oral presentation of a case study (8%); 3) Online posts following each workshop (3%); 4) Peer feedback for scientific report drafts (4%); 5) Final scientific report (20%); 6) Final examination (50%).

Except for peer feedback, all the assessments were graded by the teaching staff. The final examination consisted of multiple-choice questions based on the learning materials from the course.

2.3.5. Data collection

The questionnaires were completed in class towards the end of the semester. Students were ensured that once their responses to the questionnaire were matched with the online learning analytic data and their final marks, unique codes would be assigned to replace their names in the data analyses.

2.3.6. Data analysis

To answer the first research question, correlation, cluster analysis, and one-way ANOVAs were performed. While correlation analyses examined pairwise relations, cluster analysis and one-way ANOVAs revealed interrelations amongst groups of variables. To answer the second research question, social network analysis (SNA) were applied using Gephi, which visualized collaborative patterns and calculate key SNA measures, including *degree*, *eccentricity*, *average clustering coefficients*, and *eigenvector* (Bonacich, 2007).

The SNA measures across different collaborative patterns were then compared using one-way ANOVAs. To provide the answer to the third research question, one-way ANOVAs and post-hoc analyses were conducted to examine the frequency and time spent on learning technologies amongst qualitatively different collaborative patterns jointly shaped by students' choices in the cognitive and social elements.

3. Results

3.1. Results for research question 1

The results of correlation analyses are presented in Table 1, which shows that DAI was positively and moderately correlated with DAT ($r=.22$, $p<.01$), INTER ($r=.34$, $p<.01$), and final marks ($r=.23$, $p<.01$). DAI was moderately and negatively associated with SAI ($r=-.41$, $p<.01$) and SAT ($r=-.29$, $p<.01$). SAI had positive association with SAT ($r=.28$, $p<.01$), but negative association with DAT ($r=-.14$, $p<.01$), and INTER ($r=-.13$, $p<.01$).

Variable	DAI	SAI	DAT	SAT	INTER
SAI	-.41**				
DAT	.22**	-.14**			
SAT	-.29**	.28**	-.46**		
INTER	.34**	-.13**	.61**	-.44**	
Final marks	.23**	-.10	-.05	-.04	-.01

DAT was moderately and negatively related to SAT ($r=-.46$, $p<.01$), but it positively associated with INTER ($r=.61$, $p<.01$). The INTER, however, was negatively related to SAT ($r=-.44$, $p<.01$). Table 2 shows that the cluster analysis produced two clusters, which had 108 and 257 students respectively.

The scores of all the variables were standardized into z-scores, which were used in the one-way ANOVAs. One-way ANOVAs showed that cluster 1 and 2 students differed significantly on all the variables: DAI ($F(1,363)=35.18$, $p<.01$, $\eta^2=.09$), SAI ($F(1,363)=75.26$, $p<.01$, $\eta^2=.17$), DAT ($F(1,363)=132.08$, $p<.01$, $\eta^2=.27$), SAT ($F(1,363)=264.69$, $p<.01$, $\eta^2=.42$), INTER ($F(1,363)=126.50$, $p<.01$, $\eta^2=.26$), and final marks ($F(1,363)=4.04$, $p=.04$, $\eta^2=.01$).

Table 2. Cluster and one-way ANOVA results

Variable	Understanding (N=108)		Reproducing (N=257)		F	P	η^2
	M	SD	M	SD			
DAI	0.45	0.87	-0.20	1.01	35.18	.00	.09
SAI	-0.63	0.74	0.27	0.97	75.26	.00	.17
DAT	0.80	0.73	-0.34	0.91	132.08	.00	.27
SAT	-1.00	0.62	0.44	0.83	264.69	.00	.42
INTER	0.79	0.65	-0.34	0.96	126.50	.00	.26
Final marks	0.23	0.79	0.03	0.93	4.04	.04	.01

Cluster 1 students reported using more DAI, DAT, and had positive ratings on INTER; which were learning oriented towards understanding of subject matter (“understanding” learning orientation); whereas cluster 2 students adopted more SAI, SAT, and had negative ratings on INTER, which were characteristics of learning towards knowledge reproducing (“reproducing” learning orientation). Understanding students achieved better academic performance than reproducing students in the course.

3.2. Results for research question 2

Using students’ learning orientations (understanding vs. reproducing) and their choices of collaboration (alone, collaborating with students from the same cluster, collaborating with students from a different cluster), five collaborative patterns were identified:

- Understanding Alone (UA) students had an understanding orientation but did not collaborate;
- Reproducing Alone (RA) students had a reproducing orientation but did not collaborate;
- Understanding Collaboration (UC) students had an understanding orientation and collaborated with understanding students;
- Reproducing Collaboration (RC) students had a reproducing orientation and collaborated with reproducing students;
- Mixed Collaboration (MC) students only collaborated with students having a different orientation from them.

Table 3. SNA descriptive statistics

Descriptive statistics	Whole Network	UA	UC	MC	RC	RA
No. of students	365	61	40	56	120	88
No. of collaborations	189	0	25	79	85	0
No. of blended mode of collaborations	238	0	28	31	72	0

The visualization and the descriptive statistics of the five groups of students showing five collaborative patterns are presented in Figure 1 and Table 3 respectively.

Table 4. One-way ANOVAs results on the SNA measures

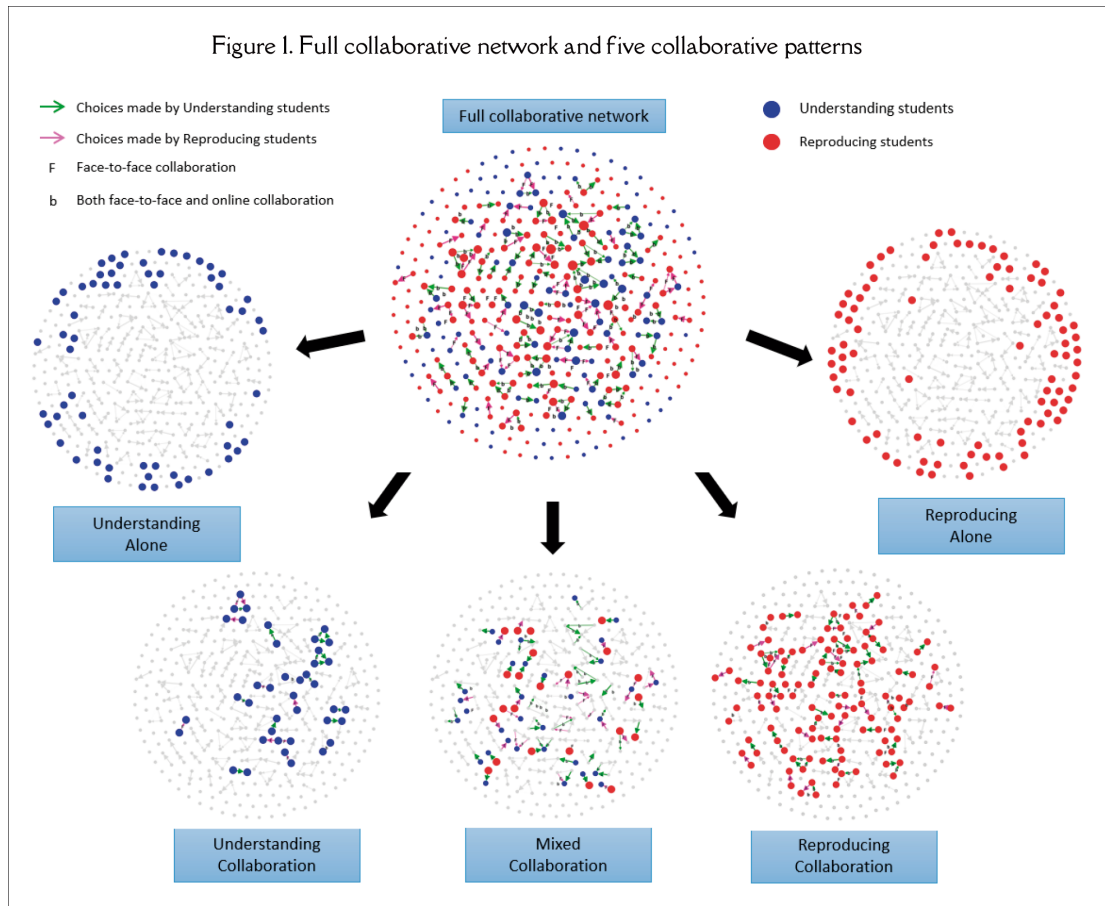
SNA measure	Group	M	SD	F	p	η^2	Post-hoc (effect size: Cohen's d)	
Degree	UC	1.98	0.70	11.24	.00	.10	UC>MC	(0.97)
	MC	1.36	0.59				UC=RC	(0.16)
	RC	1.86	0.80				RC>MC	(0.68)
Eccentricity	UC	1.78	1.37	1.38	.25	.01	---	---
	MC	1.61	0.85				---	---
	RC	1.92	1.21				---	---
Average clustering coefficient	UC	0.58	0.48	9.19	.00	.08	UC>MC	(0.86)
	MC	0.19	0.36				UC>RC	(0.43)
	RC	0.38	0.46				RC>MC	(0.42)
Eigenvector	UC	0.19	0.22	8.71	.00	.08	UC>MC	(0.86)
	MC	0.06	0.07				UC=RC	(1.00)
	RC	0.17	0.20				RC>MC	(0.65)

To compare the quality of students’ collaborations amongst the groups, one-way ANOVAs were applied on the key SNA measures. As the SNA measures were only available for students who collaborated, the analyses were conducted amongst UC, MC, and RC, and the results are displayed

in Table 4. This table shows that the three groups of students differed significantly on degree ($F(2,214)=11.24, p<.01, \eta^2=.10$), average clustering coefficient ($F(2,214)=9.19, p<.01, \eta^2=.08$), and eigenvector ($F(2,214)=8.71, p<.01, \eta^2=.09$).

The LSD post-hoc analyses showed that for the degree, UC and RC students had more collaboration than MC students. UC students had a higher clustering coefficient than RC students, who in turn were higher than MC students. This suggests that UC students were more likely to form closely knitted sub-networks than RC and MC students, hence they had more opportunities to directly interact with all the members in the sub-networks.

Both UC and RC students had higher eigenvector than MC students, demonstrating that UC and MC students were surrounded by others with higher quality of collaborative connections.



3.3. Results for research question 3

The comparison of the use of learning technologies amongst the five groups revealed the material elements of learning experience in relation to the cognitive and social elements and their academic performance, because the five groups of students representing five collaborative patterns were jointly shaped by the cognitive and social elements as well as their learning performance. Table 5 shows that the five groups differed significantly in their frequency of using online learning resources ($F(4,361)=2.50, p<.05, \eta^2=.03$), online interactive activities ($F(4,361)=2.63, p<.05, \eta^2=.03$), and the total time online ($F(4,361)=2.50, p<.05, \eta^2=.03$). The LSD post-hoc analyses found that UC students engaged with online learning more frequently than the other four groups, except for the frequency of access to online interactive activities. There was no difference between UC and MC students. UC students also spent more time online than RC and RA students.

Table 5. One-way ANOVAs results on use of learning technologies

Variable	Group	M	SD	F	p	η^2	Significant post-hoc (effect size: Cohen's d)	
Online learning resources	UA	20.72	17.60	2.50	.03	.03	UC>UA	(0.55)
	UC	35.00	35.40				---	---
	MC	22.98	27.61				UC>MC	(0.39)
	RC	19.92	24.60				UC>RC	(0.55)
	RA	21.08	28.94				UC>RA	(0.45)
Online interactive activities	UA	44.80	32.69	2.63	.04	.03	UC>UA	(0.50)
	UC	65.74	53.72				---	---
	MC	48.09	55.62				UC=MC	(0.01)
	RC	41.22	40.30				UC>RC	(0.16)
	RA	41.64	44.57				UC>RA	(0.14)
Time online	UA	94.19	158.96	2.50	.03	.03	UC=UA	(0.20)
	UC	124.54	140.35				---	---
	MC	102.38	193.27				UC=MC	(0.13)
	RC	64.42	96.28				UC>RC	(0.55)
	RA	62.55	88.67				UC>RA	(0.58)

4. Discussion and conclusion

Before discussing important implications for an ecological perspective to understanding the complexity of student learning experience in blended contexts in contemporary Higher Education, some limitations are noted. The study was conducted in a science course and the participants all majored in sciences and applied sciences. The relations amongst cognitive, social, and material dimensions in their learning experience may differ from humanities and social sciences students. Before strong conclusions are drawn, similarly designed studies in a range of disciplines are warranted. Despite these limitations, the use of different types of data (self-report and observational) and evidence derived from the multiple methodologies offer some valuable insights.

From an ecological perspective on learning, this study investigated personalised learning networks of 365 first-year undergraduates in a blended course. Personalised learning networks on the university student experience emphasizes the value of an ecologically inspired approach to research into learning. The distinction between this type of investigation and closely related previous investigations is a foregrounding of measures of collaborations and materiality in student experience to complement the findings in the cognitive dimension. One of the key shifts in the methodologies used is the unit of analysis comprising both people and things, including measures of their interplay. In this study, we bring together multiple complementary methods from SAL research, social network research, and materiality in learning, to reveal the choices and decisions made by individuals and groups of students in their learning experience. Broadly summarizing, students of the most successful learning experience were UC students, as they not only performed relatively better in learning the contents of the subject matter, but they also developed their collaborative skills, an important attribute required for graduates to be ready for future employment. Apart from obtaining higher academic performance, these students reported deep approaches to learning in class and online, held positive perceptions of the integration of the learning environment, used effective strategies for collaboration, and were more engagement with learning technologies. The following explains in more details of qualitative variations amongst the elements in these three dimensions.

In terms of qualitative variations of cognitive dimension, we identified students reporting contrasting learning orientations described as “understanding” and “reproducing”. “Understanding” students reported using deep approaches to face-to-face and online learning and holding positive perceptions of the integrated learning environment. They performed academically higher in the course compared to “reproducing” students, who reported using surface approaches and holding relatively negative perceptions of how the online part of the experience was integrated into the course design. They obtained relatively lower academic outcomes. These results are consistent with previous SAL research in different academic disciplines, such as engineering (Ellis & al., 2016), business (Han & Ellis, 2019b), and social sciences (Bliuc & al., 2010) in the blended learning settings that there is a logical alignment amongst approaches to learning, perceptions of learning environment, and academic performance. Our results and the similar

previous results together seem to suggest that across disciplines distinctive learning orientations are present based on students' contrasting approaches to and perceptions of learning, highlighting the importance of the approaches and perceptions elements.

The variations in the cognitive dimension combined with students' choices of collaboration revealed qualitative variations in the social dimension of student learning experience. The five identified groups demonstrated students' collaborative experience with varying success: two groups chose not to collaborate (UA and RA) and three did collaborate (UC, RC, and MC). UA and RA students failed to fulfil one of the key course aims of developing teamwork and collaborative skills as an important graduate attribute. Amongst the three collaborative groups, UC students appeared to have more successful collaborative experience. They collaborated more (degree); their collaborative sub-networks tended to be closely knitted, which means that they might have more opportunities to contact directly with each member in the sub-networks (average clustering coefficient); and their neighborhood students (the students whom they directly connected to) were also well-connected in other sub-networks (eigenvector). Together, these findings suggested that UC students not only maximized their opportunities to develop collaborative skills, but also were in a position, which allowed them to gather more information and share knowledge more easily in the class compared with MC and RC students.

Looking at the elements in the material dimension, in general UC students were more engaged with the online learning activities than the other students. This was reflected by the observed evidence of their use of learning technologies. These observations of students' actual use of learning technologies not only demonstrated significant differences in student choice of material dimension, but its consistency with students' self-report evidence triangulates the results and reinforces the overall findings.

The results generated by different data sources and multiple methods across the three dimensions describe key aspects of students' personalised learning networks in their learning ecologies. These unique configurations manifested by students' decision-making processes in learning suggest how complex a learning ecology can be in a blended course design: that multifarious resources, such as people, tangible things, and virtual learning space and learning activities, are drawn and orchestrated in order to learn (Ellis & Goodyear, 2019).

The study offers some theoretical implications. The authors do not delude themselves that this is the first time the idea of an ecological perspective on learning research has been undertaken (Barnett, 2018; Cope & Kalantzis, 2017; Patterson & Holladay, 2017). However, it is the first time that complementary multiple methodologies have been brought to bear on the same population sample producing consistent results in ways that help to push onwards an ecologically informed theory of learning in higher education. The strengths of the study are: 1) its inclusion of both human and non-human elements in student blended learning experience; 2) its adoption of multiple and complementary methods, which allowed structural discovery of qualitative variations of students personalized learning networks that distinguished on the key elements across major dimensions in learning; and 3) its simultaneous use of self-report and observational data sources provides a more holistic understanding of the nature of overall student experience than collecting data from a single source. These methodological merits can be applied in the ecological theory of learning to continuously identify and expand key elements and dimensions in university students' blended learning experience in order to better explain factors impacting on student academic success.

Our fine-grained analyses in and across each dimension also provide specific actionable evidence for teachers so that corresponding strategies can be undertaken in the following ways. The identification of less desirable student learning orientations ("reproducing") early in course delivery can help teachers design activities to encourage students to adjust surface approaches and negative perceptions of the online context. This could be achieved through inviting "understanding" students to talk about their ways of approaching learning, and the strategies when engaging with learning technologies. Teachers could also explicitly discuss the purpose of online activities in terms of course outcomes, so that students can appreciate the coherence between face-to-face and online components in the course. These strategies may increase student engagement both in class and online.

Similarly, to promote collaboration in learning, the identification of the five groupings of students in the course can help teachers understand why not all students develop collaborative skills. Teachers could

fruitfully discover these types of groupings amongst their students in order to pair them. For instance, teachers can consider assigning students who are not likely to collaborate into those collaborative groups (UC, MC, and RC groups). Likewise, teachers could mix UC students with RA and RC students so that all collaborative groups have at least one or two stronger partners.

The university student experience of learning in the current Higher Education context is growing in complexity through new pedagogies and new technologies across a variety of learning contexts. With rapid changes continually occurring, more research is required that reveals how elements across cognitive, social, and material dimensions of the student experience are related to each other and to learning outcomes.

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Mirroring learning ecologies of outstanding teachers to integrate ICTs in the classroom

Ecologías de aprendizaje para usar las TIC inspirándose en docentes referentes

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ABSTRACT

This paper presents an exploratory study to examine the practices of outstanding primary school teachers in their professional development for ICT integration in teaching and learning, as a means of understanding how their learning ecologies develop and function. Outstanding teachers in the context of this study are teachers who innovate pedagogically and who are influential in the community, having successfully developed their learning ecology. Using a qualitative approach, we explore the concept of learning ecologies as a driver for innovation in the professional development of teachers, using a carefully selected sample of nine outstanding teachers. Drawing from in-depth interviews, specific coding and NVIVO analysis, our results show that these teachers develop organized systems for activities, relationships and resource usage and production, which can be characterized as the components of their professional learning ecology, to continuously keep up to date. We also identified some characteristics of teachers that perform outstandingly and factors that potentially facilitate or hinder their learning ecology development. Further research in the field will enable an improved understanding of the professional learning ecologies of school teachers and support future interventions and recommendations for professional development through the cultivation of emerging professional learning ecologies.

RESUMEN

Este artículo presenta un estudio exploratorio que examina prácticas de docentes referentes de Educación Primaria en su desarrollo profesional sobre la integración de las TIC en la docencia y el aprendizaje como medio para comprender el desarrollo y operación de sus ecologías de aprendizaje. Un docente referente en el contexto de este estudio es aquel que innova pedagógicamente y que influye en la comunidad, habiendo desarrollado con éxito su ecología de aprendizaje. Mediante un enfoque cualitativo, se explora el concepto de ecologías de aprendizaje como motor de la innovación en el desarrollo profesional de los docentes, utilizando una muestra cuidadosamente seleccionada de nueve profesores de Educación Primaria. A partir de entrevistas en profundidad, codificación específica y análisis con NVivo, los resultados muestran que estos docentes desarrollan sistemas organizados de actividades, relaciones y recursos, que pueden ser caracterizados como componentes de sus ecologías de aprendizaje para mantenerse permanentemente actualizados. Se identifican algunas de las características y factores que potencialmente facilitan u obstaculizan el desarrollo de su ecología de aprendizaje. Futuras investigaciones en esta línea permitirán mejorar nuestra comprensión de las ecologías de aprendizaje profesional de los docentes, apoyando nuevas futuras intervenciones y recomendaciones para el desarrollo profesional.

KEYWORDS | PALABRAS CLAVE

Learning ecologies, teachers' professional development, primary school education, outstanding teachers, ICT, case studies, influencing factors, training.

Ecologías de aprendizaje, desarrollo profesional docente, educación primaria, docentes referentes, TIC, casos de estudio, factores influyentes, formación.

1. Introduction

Teachers play a key role in the integration and effective use of technology in education (Uluyol & ahin, 2016), and while most primary school teachers recognize the potential of digital technologies and the internet (Admiraal & al., 2017; Correa & Martínez, 2010; De-Jesús & Lebres, 2013; Potter & Rockinson-Szapkiw, 2012), implementation remains limited (Correa & Martínez, 2010; De-Jesús & Lebres, 2013) and technology at school unused (Potter & Rockinson-Szapkiw, 2012).

A survey of adult skills (OECD, 2016), reveals that 87% of teachers (pre-primary, primary and secondary) consider that they have the computer skills needed in their job. The difficulty, then, lies in the lack of skills to use technologies for educational purposes (De-Jesús & Lebres, 2013). The well-known Technological Pedagogical Content Knowledge (TPACK) theory considers pedagogical and disciplinary knowledge applied to technology to be fundamental, and points to the many ways in which techno-pedagogical knowledge can be developed. This theory arose precisely from research into the difficulties encountered by teachers in applying technology to education (Harris, Mishra, & Koehler, 2009; Koehler & Mishra, 2009). The same difficulties led to the development of the Digital Competence for Educators (DigCompEdu) framework (Redecker & Punie, 2017), which attempts to support technology integration in pedagogical practices and in so doing develop the digital competence of students.

Teachers may face difficulties related to insufficient training, the lack of suitable equipment or a lack of flexibility in the curriculum (Nikolopoulou & Gialamas, 2015; Panagiotis & al., 2011; Unal & Ozturk, 2012). Teachers' attitudes towards technology are conditioned by the resources available to them, the support that they receive and the existence of a motivational school culture (Agyei & Voogt, 2014; Uluyol & ahin, 2016).

One of the most important challenges in techno-pedagogical uptake by teachers is promoting effective professional development strategies. The literature suggests that most continuing professional development currently focuses on administrative and institutional aspects, leaving teachers feeling powerless in their own professional development (Jiménez, 2007). A proposed alternative is the empowerment of teachers through a more consensual definition of their professional development (Livingston & Robertson, 2010) and the incorporation of collaborative practices (Kennedy, 2011) and peer-group mentoring (Geeraerts & al., 2015). Another successful innovation is collegial practice transfers, consisting of more experienced teachers instructing less experienced teachers (Lakkala & Ilomäki, 2015). Mentoring has, in fact, been identified as a key factor in the success of in-service teacher training (Dorner & Kárpáti, 2010), as peers can provide both practical and emotional support.

In spite of advances, teachers' professional training is essentially based on (more or less innovative) approaches that are frequently kept separate and that tend to focus on the trainer/coach/coordinator's perspective of learning achievements (Bradshaw, Walsh, & Twining, 2011; Laurillard, 2014; Twining, Raffaghelli, Albion, & Knezek, 2013). However, a more integrated learner-centred perspective is crucial to nurturing teachers' confidence in their own capacity to integrate ICT innovations into teaching (Tondeur, Forkosh-Baruch, Prestridge, Albion, & Edirisinghe, 2016). Below we describe the concept of learning ecologies (LE) as a driver of innovation in the professional development of teachers.

Since the 1990s, ecological approaches to teaching and learning in the digital age have yielded a range of terms and conceptual definitions that have come to be widely used (Sangrà, Raffaghelli, & Guitert, 2019). The term LE has been used in many fields of education, including technologies and gender (Barron, 2004), ICT skills development (Barron, 2006), collaborative learning (Hodgson & Spours, 2009), designs for learning with technologies (Luckin, 2010), learning resources for homeless populations (Strohmayr, Comber, & Balaam, 2015), teachers' professional development (Sangrà, González-Sanmamed & Guitert, 2013; Van-den Beemt & Diepstraten, 2016) as well as personalized learning and lifelong learning (Maina & García, 2016).

Jackson (2011) has further explored the construct of LE, introducing the useful concept of lifewide learning, given that LE embrace many different spaces and types of learning. The concept of LE, therefore, emphasizes a learner-centred and self-determined perspective, which is particularly important for professional development and is particularly applicable to the professional development of teachers. Van-Den-Beemt & Diepstraten (2016) studied the LE of teachers starting to use ICTs, particularly their

assumptions and expectations, and the contexts and key people that encouraged their learning conceived as a horizontal process among a plurality of spaces (Akkerman & Van-Eijck, 2013).

The advent of digital environments has generated another important dimension of analysis for the learning ecology concept, namely, the selection of, and engagement with, more or less digital or analogue/physical learning contexts. While this aspect was envisaged in foundational work by Barron (2004), it emerged sharply in Delphi studies as a lens to characterize LE (González-Sanmamed, Muñoz-Carril, & Santos-Caamaño, 2019).

The above considerations are relevant in recognizing that, while most learning ecology studies attempt to analyse ongoing experiences and practices, few support strategies for professional development (Sangrà, Raffaghelli, & Guitert, 2019). Therefore, and considering the ongoing debate on the need to improve the effectiveness in teachers' professional development, it seemed particularly appropriate to research lifelong LE in primary teachers in an endeavour to support future research, strategies, interventions and recommendations for professional development based on cultivating professional LE.

2. Methodology

Qualitative methods allow deep exploration of emergent discourses and practices. They therefore attempt to grasp the complexity of experiential knowledge, while avoiding the limitations and synthesis required of quantitative methods. Although qualitative methods do not allow the study of causality or the generalization of research results, they do encompass very rich descriptions where emerging new patterns can support further exploration (Ingleby, 2012).

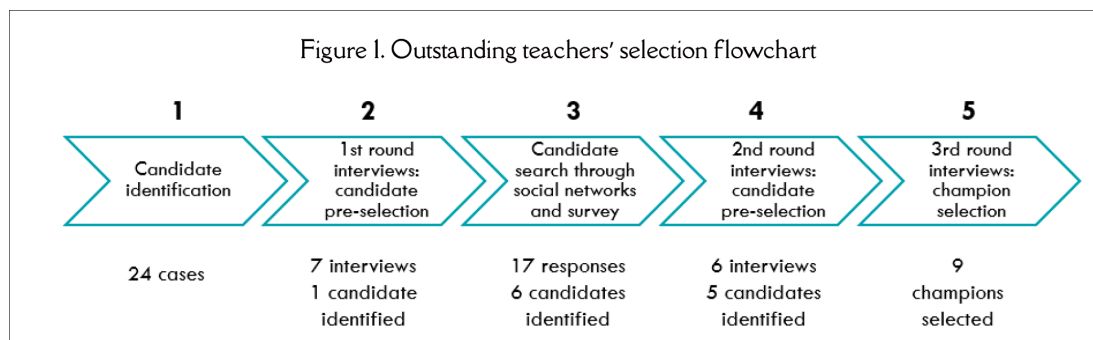
This study aimed to explore outstanding practices in self-directed professional development for ICT integration in teaching and learning, as a means to understanding how successful LE develop and function. In this context, outstanding teachers are understood as those that pioneer pedagogical innovations and are usually influential to others, effectively organizing their self-directed professional development. We conducted an in-depth analysis of a sample of primary school teachers, as a follow-up to an initial phase of expert consultation by means of a Delphi study (Romero, Guàrdia, Guitert, & Sangrà, 2014). The research questions addressed in this study were as follows:

- RQ1: What components shape the professional LE of outstanding primary school teachers?
- RQ2: What other factors influence the development and the maintenance of these teachers' LE?

2.1. Data collection: Case selection and interview structure

The outstanding teachers were teachers who demonstrated on-going technology uptake regarding both their classrooms and their own professional development.

Nine teachers were ultimately selected from an initial sample of 24 candidates, in the five-phase process illustrated in Figure 1.



The sample was drawn from in-service primary school teachers in Catalonia (Spain). The initial criterion for inclusion was varied professional experience. The remaining broad inclusion criteria for outstanding participants were as follows:

- 1) They use a set of reliable relationships and resources that enable them to update continuously.

- 2) They use ICTs to develop their own LE for professional development.
- 3) They have developed a learning ecology that positively impacts their professional practice.

Those broad criteria were further refined to establish more specific characteristics for these teachers, as follows:

- a) They are active in social networks, i.e., they: Participate in two or three social networks; participate in distribution lists; Make frequent use of both networks and lists.
- b) They are interested in innovation, i.e., they: have co-authored a publication: Have received an award; Have participated in an innovation project.
- c) They use ICTs in the classroom, i.e., they: Use ICTs as a support or as a complement; Prepare teaching materials or resources using (reusing) materials found in the Internet.

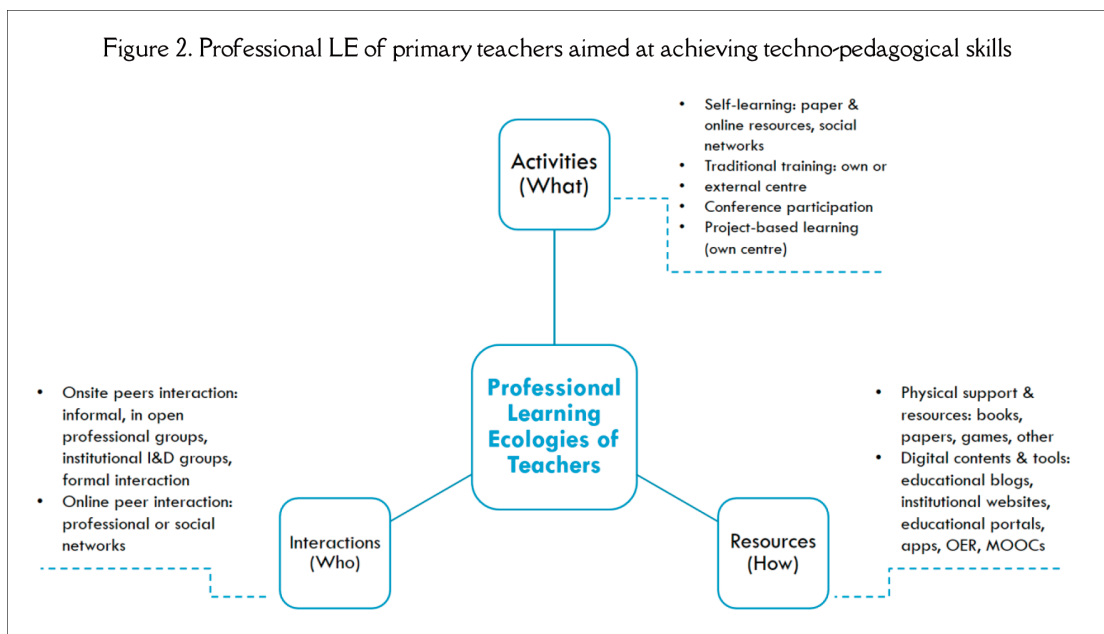
Of the nine selected teachers, three had been teaching for less than 10 years, three between 11 and 20 years, and the last three for more than 20 years.

Three data collection methods were combined: interviews, materials and other products related to the teachers' activities. Our qualitative approach to the analysis of the case studies was based on in-depth interviews as the data collection instrument, using NVIVO software for specific coding and analysis.

2.2. Coding and analysis

Observations of internet and social media practices were triangulated with data collected from interviews, with the resulting textual data constituting our corpus for analysis.

The qualitative analysis was done using NVIVO. The interviews with the nine teachers were coded on the basis of a thematic analysis, with categories and codes theoretically driven by the Delphi study- as shown in the conceptual map depicted in Figure 2: Undertaken in the previous research phase (Romero, Guàrdia, Guitert, & Sangrà, 2014). In this follow-up study we attempted to further elaborate on this map by identifying specific components explaining the drivers motivating teachers to undertake certain activities, strengthen certain interactions and use certain resources in their personal and professional learning contexts.



To obtain a final codebook of axial and basic codes from the inductive research (Table 1), four researchers agreed on the coding strategy and two researchers coded the corpus. The percentage of interrater agreement was 99% for all the codes, for a kappa coefficient of 0.68 (considered an acceptable level of agreement). During the coding process, as well as the three main learning ecology components

of activities, interactions and resources, we detected relevant emerging factors related to drivers behind learning ecology growth and maintenance, which we labelled personal positioning and factors influencing learning ecology development.

Table 1. Codebook resulting from the coding process

Axial code level I	Axial code level II	Basic code (Files, References)	
1. Activities [9-300]	1.1. Formal, self-directed [9-34]	1.1.1. Online (9,34) 1.1.2. a) MOOCs (5,18); b) Other self-directed learning (6,16)	
	1.2. Formal, externally directed [9-106]	1.2.1. Face-to-face or blended (9,106) 1.2.2. a) Courses selected from institutional training (9,36); b) Courses selected from other institutions (9,21); c) Courses externally imposed on the institution (9,49); d) Courses externally imposed in other institutions (0,0)	
	1.3. Informal, self-directed [9-104]	1.3.1. Online (9, 103) 1.3.2. a) Online consultation with experts (9,40); b) Systematic resource/forum/community consultation (9,63); c) Participation in social/cultural projects (0,0)	
		1.3.2. Face-to-face (1,1)	
		1.3.3. Library consultation (1,1)	
1.4 Non-formal, self-directed [9-28]	1.4.1. Face-to-face or blended (0,0) 1.4.2. One-day events and conferences (9,28)		
1.5 Non-formal, externally directed [9-28]	1.5.1. Face-to-face or blended (1,1) 1.5.2. Institutional innovation projects (7,25) 1.5.3. European/interinstitutional innovation projects (2,2)		
2. Interactions [9-221]	2.1. Online interactions [9-116]	2.1.1. Online professional communities (5,23) 2.1.2. Professional networks (7,20) 2.1.3. Social networks (9,73)	
		2.2. Face-to-face interactions [9-105]	2.2.1. Innovation and development institutional groups (4,7) 2.2.2. Formal peer interactions (8,26) 2.2.3. Informal peer interactions (9,55) 2.2.4. Professional groups/memberships (6,17)
			2.2.1. Formal peer interactions (8,26) 2.2.2. Informal peer interactions (9,55) 2.2.3. Professional groups/memberships (6,17)
	3.1. Physical support/content [1-5]	3.1.1. Archives (0,0) 3.1.2. Printed books/magazines/journals (1,5)	
3. Resources [8-88]	3.2. Digital tools/contents [8-83]	3.2.1. Educational blogs (8,42) 3.2.2. Open data (6,6) 3.2.3. Institutional website (5,12) 3.2.4. OER (7,15) 3.2.5. Educational portals/repositories (3,5) 3.2.6. Online books/magazines/journals (1,1) 3.2.7. Personal learning environments (2,2)	
		4.1. Obstacles [7-26]	4.1.1. Historical factors (3,4); 4.1.2 Institutional factors (7,22)
			4.2. Facilitators [7-21]
		5. Personal positioning factors [9-102]	

Note: the "Files" column shows the number of text units for the nine teachers and the "References" column shows the number of mentions in the corpus.

3. Results and analysis

Our results are described considering the three main learning ecology components, namely, activities, interactions and resources, and also considering the two additional factors that emerged during the coding process: personal positioning and factors influencing learning ecology development.

3.1. Characterizing the LE of outstanding teachers

A great diversity of approaches was found throughout the nine cases. As shown on Table 1, there was a great concentration of specific elements across teachers. For example, while all nine teachers participate in formal activities online and face-to-face, only six participate in self-directed activities, and only five have taken massive open online courses (MOOCs). In general, following an established pattern, more diversity is observed for self-directed activities than for externally directed activities proposed at the national or institutional level.

3.1.1. Activities

Regarding which activities the teachers carry out, great discursive density is observed in relation to participation in courses (106 of 302 corpus references), which also offer the opportunity to establish professional networks. The dynamics usually coincide: from face-to-face or online interactions, teachers become followers or friends in social networks. The courses taken vary greatly, from those offered by the centre, MOOCs, etc., but uptake is greater for external and face-to-face courses.

Many teachers opt for formal education, mostly university-based face-to-face or online courses: "I've been looking into TDH courses. And we were looking there the other day and said we should do one. They are courses offered by the centre... We're beginning to get around to it, since we have to start doing this kind of face-to-face thing" (C5, R1_1.2.1b). "One of the reasons for doing the master's in educational innovation was to do that, to learn about and enter the world of people who train and learn how to build training" (C2, R2_1.2.1b).

However, others show a preference for informal and more practical channels: "One of the things I also like to do is to easily access people that I consider referents, without bothering them. I do not have to ask them anything. They are generous in that, once a week or month, they offer their opinions, and I like to hear them, without having to go to where these people give talks" (C1, R1-2_1.3.1a).

Regarding face-to-face activities, it is important to note the attendance to one-day events and conferences as well as informal interactions with colleagues and interns in schools, considered important channels for knowledge updates. Outstanding teachers seem to prefer face-to-face activities, whether formal or informal, that take place in their centre: "Last year together with two other people we presented an innovation project on ideas as to how we could introduce tablets in infants' school, and that took a year, spending just a few hours at a time" (C2, R1-2_1.5.2).

However, specific consideration needs to be given to their participation in informal and self-directed activities. As mentioned above, teachers typically begin with formal activities, and then continue along an informal route that is no longer directed externally but which is managed by the teacher in a process of questioning, demonstrating or sharing professional practices: "That gives you the chance to go to a conference or a talk. Then, of course, you meet people. Through JA, for instance, I found AR, and I had the opportunity to listen to him, he's just something else. And DR came to give us a talk at the school" (C3, R1_1.4.1a).

3.1.2. Interactions

In regard to the personal and professional relationships established by the outstanding teachers, their online interactions focus on seeking information and comparing ideas, knowledge, etc. Social network use is noteworthy, either active (participation) or passive (consultation), and visits to blogs maintained by referents: "I am not into social networks that much, I mean, I'm not very active in social networks, I use them for instance to ask questions, you know? That side I haven't exploited much, I have been more of a passive participant" (C1, R1_2.1.3).

Regarding social networks, Twitter is the most used, for a variety of reasons: to be up-to-date with information from colleagues and referents, to seek specific information, to search, consult and obtain information on a daily basis, to follow referents and colleagues from one's own and other centres, to share resources, information and personal reflections, to draw attention to published works, to request help, information, etc., and to generally keep up to date with both face-to-face and online courses.

Nonetheless, while all the teachers have a Twitter account, they tend to be moderate users in that they

do not post or they only post sporadically. Their use of Twitter is often just for convenience sake and they do not consider themselves to be referents: “Twitter, maybe not, but it’s a great source. If you become a fan of people who are good, for instance, PPL, then many alerts come to you on things that probably you would never have known. Twitter, I think is very handy, you take a look and you say ‘ah, look at that’, and then you search in depth” (C5, R3_2.1.3).

Regarding Facebook, far less popular among these teachers, use is fundamentally personal; typically, the account was initially established for either personal or professional use and, in the latter case, the teacher progressively began to make it more personal and to share information or reflections with and by colleagues: “What happens is that with Facebook I have come to use it in a way that is more personal whereas I’ve used Twitter more professionally. There was a time when I was a ‘100% professional of Facebook’. What happened? Well, of course, there I have friends and, in the end, they give up on you... they get tired. I understand that and I have also stopped to tell myself ‘let me organize my social life’” (C3, R2-3_2.1.3).

Another network that is used sporadically, is LinkedIn (C7, C3), a professional network, for the purpose of posting career resumé online and establishing professional contacts. Less frequently, SlideShare, Keynote and Prezi are adopted to access referents’ presentations (C4, C9) or to share presentations. While these tools are for public use, in some cases the teachers share presentations internally with colleagues (C9), e.g., Ning to monitor forums, Evernote to store information in an orderly way for consultation and analysis, and Pinterest to manage projects and to seek new ideas.

In sum, interactions are distributed homogeneously between face-to-face interactions and online interactions (106 of 302 and 116 of 300 corpus references, respectively). Face-to-face interaction is used for dialogue and collaboration during educational intervention projects or routine practice, whereas online interactions have the advantage of synchrony. All in all, forms of knowledge exchange are established, that allow these teachers to complete, integrate and build their repertoire of professional teaching strategies. Teachers, in this sense, are both receivers and senders, investing, in both cases, cognitive efforts to complete their knowledge through vicarious learning (what others do) and reflective practice (what the teachers themselves do).

3.1.3. Resources

The outstanding teachers are featured by intense online activity, rarely using physical or printed media. Blogs maintained by educational influencers and for educational outreach purposes are the most frequently consulted resource (42 of 82 corpus references). These teachers access these blogs either through Twitter or by subscribing via an RSS feed, in this way, combining social network interactions with access to specific resources: “My usual routine is tracking blogs and Twitter. I have to admit that I did not understand how Twitter worked until a year ago. I’m much more one for blogs” (C1, R1_3.2.1).

However, they are not just passive receivers; some of them are bloggers themselves, whether of a personal blog, group blog or their centre blog. They post and share resources that reinforce specific aspects of educational practice, etc. In these cases, blog post frequency is typically weekly or fortnightly.

There is great variability in the type of resources used in addition to educational blogs, including, specifically, more obvious ones like the institutional website (12 of 83 corpus references), and open educational resources (OER) and open data (which together account for 21 of 83 corpus references).

Finally, in the performance of activities, in interactions and in accessing resources, these teachers mainly use smartphones, tablets and computers. Smartphones and tablets are generally used daily for consultations and for keeping up to date, while computers are reserved for tasks requiring greater interactivity, i.e., reading, research, writing, etc. Most outstanding teachers use commercial software, although some use open software for both their teaching and professional maintenance.

3.2. Factors influencing outstanding teachers’ development of LE

The interviews revealed a number of factors that intervene in how primary teachers configure and update their professional LE in terms of resources, activities and interactions. Two new factors, relating the prior Delphi study (Romero et al., 2014) were identified: personal positioning factors and

factors influencing the learning ecology development, reflecting historical individual development and the institutional context.

3.2.1. Personal positioning factors

The personal positioning of outstanding teachers characterizes their productivity and success in applying technologies in the classroom, reflecting rapid and effective professional learning. Table 2 reproduces some of the comments of the interviewees regarding their personal positioning.

Personal positioning	References
Active searching. For personal and professional guidance.	"What I want is to try to make the leap at a professional level, not so much as a teacher within the school, but more, 'hey people, here I am, we are going to share and to grow together'" (C3, R2_5.1). "So, how can I do that? Well, researching, observing things other people do, surfing the internet in searches, following certain people through Twitter and blogs and doing research in Google, that's how" (C1, R1_5.1).
Curiosity. Exploring interests and resolving doubts and questions.	"At the institutional level, it's not my responsibility because that's what a coordinator is for, but at my own risk, I think I have to know, because it interests me, because I like it and because the ICT and social network issues are important in the school" (C3, R1_5.2).
Innovation. Open, practical and innovative vision of education and ICT use.	"I think everyday you are learning new things, you can't say 'Now, I know everything ...' For example, I haven't used Instagram yet, and it is something I say "maybe you can learn something through Instagram, who knows" (C4, R1_5.2).
Collaboration. Interest elicited by colleagues and in their development.	"What pushes you a lot too is if you have to train other people or if you have to communicate with other people or if you have to share with other people, it all makes you push ahead. I cannot imagine that, without this journey, I would have arrived to where I am. It's not that I've come that far but ... let's say that communicating or passing something on or trying to get others to look here helps you learn a lot" (C2, R1_5.3).
Broad impact. Interest elicited by national and institutional policies and in the centre's development	"I mean, something that started, you know, typically with let's get some good practice using ICTs for the course, that was a long time ago, and now we haven't enough paper to write down all the good practices that are done with ICTs" (C7, R11_5.3).

Evidently personal positioning reflects strong internal motivation to seek resources and establish personal and professional relationships that lead to formal, non-formal and informal learning. In particular, the semantic density in all the nine outstanding teachers' discourse (34 of 102 corpus references) reveals their passion and curiosity, but also their high motivation to search for micro-contexts in their institution that allow the configuration of advanced practices.

3.2.2. Factors influencing learning ecology development

The educational centres act as contexts where negative and positive historical and current aspects become facilitators or obstacles to the development of the learning ecology. Our analysis revealed the existence of training needs that go beyond institutional offerings, which explains why outstanding teachers tend to diversify their own training channels and activities.

The semantic density in relation to this topic would suggest that all the participating outstanding teachers have similar perceptions regarding facilitators and obstacles (20 and 22 of 47 corpus references to facilitating and blocking factors, respectively). Although they mention historical factors, these are less frequent than current, contextual facilitators and obstacles. Negative aspects are generally more related to the national regulatory context than to specific centres, whereas, in relation to positive factors, the concrete actions that centres have set in motion to facilitate the autonomy of their outstanding teachers are noteworthy. Table 3 reproduces some of the comments of the interviewees on this topic.

Table 3. Factors Influencing the Development of the Learning Ecology

Types of Factor	References
Blocking factors	"To begin with, there must be change because it turns out that we evaluate by skills, because we are told that we must have the skills and such, but there are areas. They tell you to work on skills, but the diagnostic test is a memory test of isosceles and equilateral triangles" (C 7, R1_4.1.2). " The training is poor, increasingly badly paid and courses are often cancelled, and I could offer myself to do a course in school X, and this other school could send an expert in another area to come here to give a talk about something else, because the training is very bad now" (C1, R1_4.1.2).
Enabling factors	"They asked me for that and also to be ICT coordinator, doing management. Then I started seeing that there were not only possibilities for technology applied directly in the classroom but also the issue of how we get technology to enter the classroom" (C2, R2_4.2.2). "The truth is that we are very well placed. Two years ago, they started using iPads instead of books in all the secondary schools. We have AppleTV, laptops, digital boards. We have all the resources we need" (C5, R2_4.2.2).

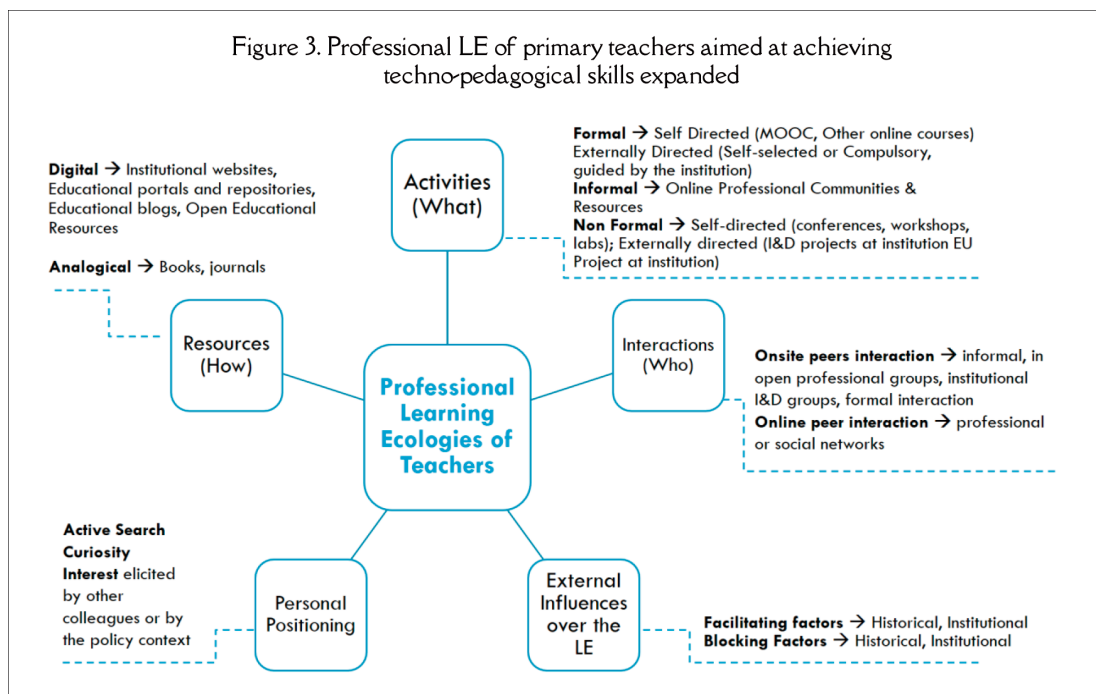
Thus, despite strong historical and contextual constraints, these outstanding teachers generally find support in their centres for their autonomy, in the activation of courses requested by them, time off for training, the facilitation of regular meetings and of ICT projects, the establishment of minimum bases for ICT use, assignment of roles as experts (bring-your-own-device, robotics, programming skills), etc.

In sum, there is a continuous synergy between the characteristics of these teachers and their contexts that stimulate, support and promote their positive and proactive attitudes towards the integration of ICTs in the classroom. Cross-fertilization between teachers of ICTs and other project types (e.g., interdisciplinary approaches, empowered scientific and socio-cultural activities in the community, etc.) generates rich ecosystems in which the specific professional learning ecology finds fertile ground.

4. Discussion

Our results paint a rich picture of the potential LE of teachers within the specific domain of educational technologies in primary schools. However, a number of factors that support the development and maintenance of LE emerged in our analysis that represent a step further in the understanding of professional learning.

Previous learning ecology concepts have emphasized structure (activities, interactions and resources). Emerging from our interviews, however, were two additional factors without which LE could not be sustained: personal positioning factors and the historical and contextual factors influencing learning ecology development. In the first part of our analysis, we observed that professional learning tends to stem from formal activities and is mostly driven throughout on-site relationships with colleagues and participation in institutional projects. External factors, however, evidently function as motivational cues for outstanding teachers to pursue as a pathway to developing their professional skills, for instance, engagement with digital resources and informal online communications as a means for ensuring relationship continuity through social networks. There is an evident inner motivation in these teachers that leads them to connect the external world with an internal ideal picture of how their professional practice should unfold. This hypothesis is further supported by personal positioning factors as supportive of the learning ecology architecture of activities, interactions and resources. If this inner motivation -reflecting the personality and lived experiences of the learner- are in place, then the teacher builds on a spirit of curiosity and passion for innovation, the active search for connections and reflexive practice. Not only do they consult the work of others to shape their own practice, they also have a developmental vision of their own practice context that, in time, implies taking on board national and institutional policies and guidelines. The outline of their LE is represented in Figure 3, where the initial conceptual map (Fig.2) was reorganized and expanded based on the coded discourse of our nine teachers.



5. Conclusions

Our study may advance the re-conceptualization of the constituting components of LE. The qualitative approach through in-depth interviews purported an enriched picture of LE by reorganizing and expanding the semantic nodes within the initial conceptual map obtained through the Delphi study (Romero & al., 2014).

In addition, a further discussion, which sets the stage for future research, outlines the profiling of outstanding teachers. According to our exploration, these teachers are people who:

- Actively seek training opportunities, taking more “traditional” courses as formal face-to-face activities, proposed by the institution, but also following a number of informal, online activities;
- They continue to expand their opportunities to learn through informal interactions in professional communities, where they might play a crucial role as resource developers or curators;
- Not surprisingly, they are active blog readers, with blogs emerging as the main resources selected by them. This aligns with the idea of seeking influential people, whose ideas bring new light to everyday practice.
- As for the new LE components identified in our research, we observed the importance of personal positioning against the context, with teachers that actively engage in innovations, triggered by a high sense of curiosity. Moreover, they understand which facilitating factors exist in their contexts of practice and use them as springboards for their practice, against the deep understanding of reluctant forces in the field of professional practice.

A further inquiry of these outstanding profiles may shed light on micro-factors in the contexts of professional learning (external) or on the personal features which could be mirrored by others in search for positive technological uptake within pedagogical practices.

Our findings have implications for both innovations in professional development and applied research. They suggest the need to identify other potential outstanding teachers in order to explore their creativity as an expression of their personal positioning towards institutional development. The process of discovery and support may be time-consuming, but ultimately, the identification of these teachers could lead to a creative domino process whereby other teachers that are less effective in addressing innovation draw on outstanding teachers’ best practices. This approach could be explored through applied research into school

management strategies, so that a common picture of the learning ecology structure could be generated through participatory meetings and raise awareness of the main components in model LE. Personal positioning and related factors could also be explored since, as has been emphasized in the professional self-regulated learning literature (Littlejohn, Milligan, & Margaryan, 2012), this type of self-awareness could also be the trigger for on-going development of individual professional learning approaches, with each teacher motivated to cultivate and enrich their own professional learning ecology. As for research, analyses of LE could progress to more systematic confirmatory studies using representative samples. Additional research could polish the model further and obtain some predictive insights into the factors influencing the development and configuration of LE. Moreover, design-based research could lead to the development of self-diagnostic tools to raise learners' awareness of how to configure their own LE.

Our study has a number of limitations, the most important of which is that, despite a rigorous snowball sampling procedure, nine teachers represent a small universe of practice. Our configuration of LE could reflect elements that are not representative of primary school teachers. Nonetheless, the findings that characterize our outstanding teachers may help boost changes in their professional development. Therefore, our research, aimed at improving primary teachers' professional development strategies and overall professional learning, can be considered exploratory, contributing to further understanding of lifelong LE.

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The ecology of resilience learning in ubiquitous environments to adverse situations

La ecología del aprendizaje resiliente en ambientes ubicuos ante situaciones adversas

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ABSTRACT

Basic Education in Mexico faces growing challenges arising from the use of Information and Communication Technologies (ICTs). However, formal education requires a critical and contextualized awareness that rescues the experiences of students to resignify adverse situations, while emphasizing resilience from learning ecologies. The objective of this document is to account for the ubiquitous learning acquired by nine distance education, secondary students in a rural context of Hidalgo, Mexico and the benefits of raising awareness of their own learning ecology. Emphasis is placed on the resignifying process that emerged through the different communication channels. The study presents results of a case approached with a mixed methodology, by means of a phenomenological, multisource, quantitative and qualitative information triangulation with hermeneutic analysis, organized in three stages, by means of a questionnaire, semi-structured interviews, focal groups and the use of Google Classroom. The hermeneutic analysis of autobiographies and the use of technological resources boosted the personal analysis of experiences generating learning that may be invisible in formal education, but which might empower the students' critical thinking, collaboration and autonomy to become aware of their own learning and the scope of their social contribution throughout their lives.

RESUMEN

La Educación Básica en México contempla desafíos crecientes a los que se enfrenta mediante el uso de Tecnologías de la Información y la Comunicación (TIC). Sin embargo, en la educación formal se requiere detonar una toma de conciencia crítica y contextualizada que rescate las experiencias del estudiantado para resignificar situaciones adversas, así como dar importancia a la resiliencia a partir de las ecologías del aprendizaje. El objetivo de este documento es dar cuenta de los aprendizajes ubicuos que adquirieron nueve estudiantes de telesecundaria en un contexto rural de Hidalgo y los beneficios de la concienciación de la propia ecología del aprendizaje. Se hace énfasis en el proceso de resignificación que emergió a través de las diferentes aristas de comunicación. El estudio presenta resultados de un caso abordado con una metodología mixta por medio de una triangulación de información multifuente, cuantitativa y cualitativa fenomenológica con análisis hermenéutico, organizada en tres etapas, mediante un cuestionario, entrevistas semiestructuradas, grupos focales y uso de la plataforma Google Classroom. El análisis hermenéutico de las autobiografías y el uso de recursos tecnológicos potenció el análisis personal de experiencias generadoras de aprendizajes quizá invisibles en la educación formal, pero que pueden empoderar el pensamiento crítico, la colaboración y autonomía del estudiantado para la toma de conciencia de sus propios aprendizajes y el alcance de su aportación social a lo largo de su vida.

KEYWORDS | PALABRAS CLAVE

Resilience, learning ecologies, ubiquitous learning, lifelong learning, students, awareness, resignifying, adverse situations.
Resiliencia, ecologías del aprendizaje, aprendizaje ubicuo, aprendizaje a lo largo de la vida, estudiantes, concienciación, resignificar, situaciones adversas.

1. Introduction

Within the framework for action under the 2030 Agenda, the United Nations (UN) has endorsed the need for children and young people to adopt flexible skills and competencies that will be useful throughout their lives, considering a world in need of greater sustainability and interdependence based on knowledge and ICTs (Delors, 1996; Beltrán, 2015; UNESCO, 2016). This implies the need to research and listen to people's possibilities and experiences, assuming the style and control of individual learning processes derived from a variety of formal and informal contexts, as well as the different elements that make up learning ecologies, understood as the basis for future educational models according to the context and characteristics of current knowledge: chaotic, interdisciplinary and emerging (Siemens, 2007; González-Sanmamed, Sangrá, Souto-Seijo, & Estévez, 2018).

In this context, new paths are required that elucidate different approaches to communicate with students in contexts with diffuse horizons, characterized by economic and social disadvantages. It is therefore important to promote awareness of the ecologies of resilient learning in order for adolescents to clarify their potential and strengthen the construction of their identity (Barron, 2006).

Resilience, interwoven with ICTs, can become a means and a capability that people develop to cope with adversity in hostile environments, as well as a mechanism for integration with technological progress that triggers options for adaptation and restoration of past experiences.

There has been little research on the link between resilience and ICTs (Mark, Al-Ani, & Semaan, 2009). While the first resilience studies focused on the characteristics of people, protective factors, resilient tutors and community resilience (Werner & Smith, 1992; Rutter, 1993; Munist, Suárez, Krauskopf, & Silber, 2007; Vanistendael & Lecomte, 2002; Forés & Grané, 2012; Simpson, 2014; Henderson & Milstein, 2003; Truebridge, 2016; Clará, 2017), it is now necessary for the student body to become aware of the "process by which the developing person acquires a broader conception of the ecological environment" (Bronfenbrenner, 1977: 523) to configure their own ecology of resilient learning in adverse situations.

In this sense, Barron (2006: 196) defines learning ecologies as "the set of contexts found in physical or virtual spaces that provide learning opportunities. Each context comprises a unique configuration of activities, material resources, personal relationships and the interactions that arise from them. The case study analysis provides evidence of the potential benefits of students' awareness of their own learning ecology.

In this way, new ubiquitous dynamics are generated through the connectivity achieved through the Google Classroom platform as a bridge for integration in the use of ICTs and for the socialization of adverse and important situations for students, which transcend the school context and often go unnoticed in formal education (Buckingham, 2007; Burbules, 2014a). The concept of resilient learning ecologies, articulated with the ubiquity provided by the Google Classroom platform, was a catalyst between the social context and resilient learning in distance secondary education (Barron, 2006; Santos-Caamaño, González-Sanmamed, & Muñoz, 2018).

The case study is conducted within a rural community in the municipality of Zapotlán de Juárez, Hidalgo, with a wide cultural diversity and little attention to disadvantaged youth. The population is transient, as entire families migrate to the United States or Mexico City. In rural contexts, there are institutions known as "telesecundarias", characterized by classrooms equipped with televisions, computer equipment and video-projectors; however, few have Internet. The educational model is integrated by the teacher, television classes and support materials.

Due to the environment where they operate, they face other types of problems, such as the scarce support for life projects, the recovery of values and the needs of adolescents. In spite of the social and school conditions of this context, there are students who, without economic and family support, successfully finish their studies, which led to the research question: how can the development of resilience be analyzed from the ecologies of learning in "telesecundaria" students?

2. Materials and methods

Due to the complexity of the studied variables, this research was approached from a mixed multi-reference analysis, as suggested by Ardoino (1991: 173) "from different angles, apparently different,

not reducible to each other”, although complementary in terms of achieving the objectives. The phenomenological design focused on the individual subjective experience of participants in order to explore the meaning, structure and essence of an experience lived by the student body in relation to the development of their resilient learning ecology, from a perspective that argues the specific character of human reality, while making it irreducible to the categories of physical reality analysis (Taylor & Bogdan, 2000). As an alternative for analysis, the phenomenological approach proposes the categories of subject, subjectivity and significance. This research focused on the voice of the student body reflected in different moments from its inner self and experience.

Approach	Objective	Variables
Phenomenological	To research the individual subjective experience of the participants	Learning ecology
Exploratory	To identify third year students in “telesecundaria” who experienced adverse situations.	Resilience
Hermeneutic	To raise awareness of the ecology of resilient learning itself	Ubiquitous environments

According to Álvarez-Gayou (2003) and Hernández, Fernández and Baptista (2006), phenomenology is based on the following premises: the aim is to describe and understand phenomena from the point of view of each participant and from the perspective built collectively. It is based on the analysis of specific discourse and themes, as well as on the search for their possible meanings. Consequently, an exploratory analysis was necessary to identify students who lived adverse situations, by first identifying perceptions and actions that they considered pertinent and significant to confront them, facilitating the direction of research efforts based on that reality.

Stages	Objective	Technique, instrument, resource	Sample	M	F
1. Exploratory	To identify students with adverse experiences interested in analyzing them	65-item questionnaire, Likert scale	111	64	47
2. Intervention	To research individual subjective experiences of participants	Google Classroom platform Focus group	18	11	7
3. Closing	To understand the configuration of resilient learning ecologies	In-depth semi-structured interviews Oral and written autobiographies	9	3	6
Validation	Information cross-checking	Methodological triangulation	111	64	47

Table 1 contemplates the integration of hermeneutics to enhance insights into the diversity of conditions and lifestyles from a perspective of present and past. Studies by Sandoval (2002) and Taylor and Bogdan (2000) point out that this perspective seeks a personal understanding of the motives and beliefs behind people’s actions, as well as an understanding of facts through descriptive data and the analysis of spoken or written words.

The hermeneutic method was implemented during the process of analysis and narration of the stories, in order to identify critical phases or adverse situations as core elements for the awareness of resilient learning ecologies (Bolívar, Domingo, & Fernández, 2001).

2.1. Stages of research

The research stages were organized around the complexity of identifying students with resilient characteristics and the subjectivity of the variables. The sample was taken from third year groups of a

rural “telesecundaria”. The first phase began with 111 students, the second one with 18 and the last one closed with nine students (Table 1). Each phase of the study was a sieve that allowed an approach to personal realities in the configuration of resilient learning ecologies for the last nine students.

As shown on Table 2, the challenge during the exploratory stage was to identify third-year “telesecundaria” students with adverse experiences who were willing to analyze them and share them confidentially in order to begin the study of the resilience variable. The intervention stage began with the use of the Google Classroom platform, which integrated written materials, videos and images related to resilience variables and learning ecologies. The Focus Group (FG) technique was applied in person. The closing stage was developed in two scenarios: formal and informal, to raise awareness of the ecology of resilient learning for the student, considering the ubiquitous environment variable. In the formal stage, semi-structured in-depth oral interviews were applied. In the informal setting, Google Classroom was used as a bridge between spoken and written language for the students’ analysis and reflection process while writing their autobiographical stories.

Finally, a phenomenological validation was performed through a methodological triangulation, to ascertain the participants’ sociocultural reality from the perspective of the social actors in their life trajectory (Bronfembrenner, 1976).

2.2. Instruments and procedures

In order to identify students with resilient characteristics, a 65-item questionnaire incorporating the following factors was applied: impulse control, frustration tolerance, assertiveness, self-esteem, empathy, expressing emotions, prospective attitude, self-awareness and responsibility (Melillo, 2001). A four-point Likert scale was used: 1) it is the responsibility of others; 2) it is not my responsibility; 3) I am responsible; 4) I can solve it.

In the second stage, and in order to initiate an exchange of opinions regarding “what can be done in the face of adversity?”, the use of the Google Classroom platform tools, as well as messages and document submissions made it possible to socialize videos with narratives of characters such as Rita Levi Montalcini and Mario Capecchi to connect with stories of people who lived through adversity, faced it and learned from it by becoming aware of their own potential.

The FG technique was also used to exchange experiences of adverse situations and their different ways of dealing with them. The reading and question guide for the FG were written on the basis of contributions from Grotberg (2006), Melillo (2001), Barron (2006), and González-Sanmamed, Sangrà, Souto-Seijo and Estévez (2018). The technique began with an introductory reading of learning ecologies and resilience, followed by the trigger question “what can be done in the face of adversity?” The full cycle of the FG consisted of an opening, climax and closing. During the opening, informed consent information and presentation dynamics among the participants were important; at the climax, the most useful information for the study was identified; and during the closing, consensual conclusions were formulated.

Finally, in the third stage, semi-structured interviews were conducted, starting orally and ending in writing through Google Classroom, to identify critical incidents as adverse situations, as well as the learning obtained through them (Bolívar, Domingo, & Fernández, 2001). The autobiography is a means of inventing the self and what the life of the person will be (Bolívar, 1999), in which hermeneutics and storytelling enable the understanding of the psychological complexity comprising individuals’ conflicts and dilemmas in their lives (Bolívar, 2002).

3. Results

Resilient learning ecologies were identified on the basis of the ubiquitous environment, which promoted networked learning through the Google Classroom platform, which denotes the importance of the use of ICTs in education as a means for students to identify what, how, where and why they should learn (González-Sanmamed, Sangrà, Souto-Seijo, & Estévez, 2018).

In the exploratory study, during the first stage of the study, the sample consisted of 111 “telesecundaria” students with an age range between 13 and 14 years, out of whom 18 students with resilient characteristics

were identified to further research the variables in the next stage. The application of the questionnaire, validated with a Cronbach Alpha of 0.91, enabled the exploration of particularities of the rural context, profiling risks and resilient characteristics.

Table 3. Results of the Exploratory Stage

Categories	Indicators	Results
Risk factors	Personal problems Family problems School-related problems	"I get distracted a lot" (37.4%) "lack of money" (20.3%) "relationships in school" (12.7%)
Resilient traits	Responsibility Assertivity Expression of emotions Self-awareness Impulse control	55% 41% 35% 32% 25%
Sources of resilience	"I respect myself and others" "I am someone who empathizes with others" "I am responsible for my own actions and for accepting the consequences"	
Learning mediators	Television / Internet / computer / people	

In terms of their parents' education level, it went from secondary to baccalaureate, with fathers working in different trades and mothers as homemakers. The number of members per family ranges from four to five. Students reported having personal, family and school-related problems (Table 3). On the other hand, preliminary indicators were found on the ecology of learning that denote fundamental capacities for life, such as factors of responsibility, assertiveness, expression of emotions, self-awareness and impulse control, characteristic of resilient people.

Table 3 presents the most relevant results that outlined the context in which the 111 "telesecundaria" students generate learning. It should be noted that one of the main risk factors they face is personal risk, such as distraction (37.4%). On the other hand, one of the most frequent protective factors was responsibility (55%).

Table 4. Results of the Research stage

Categories	Indicators	Adverse situations
Risk factors	Family problems	"Frequent fights and arguing" "Financial problems" "Parental separation" "Abandonment by a parent" "Illness of a family member" "Beatings among relatives" "Bad communication between loved ones" "Death of a relative" "Infidelity of a parent" "Family lack of understanding"
Resilient characteristics	"It is possible to face difficult situations" "Having the support of someone who loves you: like dad, mom, family or a friend" "The importance of talking about the problem with the person that you trust the most" "Analyze the situation, be aware of it" "Everything has a solution"	
Sources of resilience	"I have one or more people within my family circle who I can trust and who loves me unconditionally" "I respect myself and others" "I can be someone who empathizes with others"	
Learning mediators	"When I feel bad, I try to distract myself" "I go out to the street, I play soccer" "I talk to friends or family" "Chat with friends on Facebook or Whatsapp" "I communicate through the Classroom"	

Likewise, the interactive sources of resilience proposed by Grotberg (2006) supported the analysis and systematization of the diverse factors indicated as constituting external supports ("I have") that promote resilient learning; the internal force ("I am") that develops over time and sustains those who find themselves facing adversity; and finally the interpersonal factors ("I can"), understood as the capacity to solve problems that lead the person to face adversity. The most important source of resilience was being a person who respects himself and others. Mediators who support the learning of participants in problem situations are television, the Internet, the computer, and people.

In the second stage of research, the use of the Google Classroom platform strengthened the interaction between students through shared messages and documents. The 18 participating students experienced adverse situations that they faced using their own resources, thus confirming that resilience, beyond just enduring a traumatic situation, consists of rebuilding and committing to a new life dynamic.

Vanistendael and Lecomte (2006) assert that the notion of meaning in life is very important, to the point of being a vital need for people. The bond and meaning are basic foundations of resilience that emerged within the ecology of "telesecundaria" students' learning, by working collaboratively in the analysis of their adverse situations in a barrier-free space, which went from the formal to the informal.

Table 4 presents extracts from the statements selected through axial coding in which categories and indicators were identified to find a meaning that ultimately reflected a certain trend and was verified through the consensual participation of students (Álvarez-Gayou, 2003). In both Google Classroom and FG, risk factors, resilient characteristics, sources of resilience, learning mediators and the identification of nine students emerged to deepen the hermeneutic analysis.

Table 4 also presents a selection of relevant responses shared by 18 students through Google Classroom and face-to-face during FG to the question "what can be done about adversity?" In their analysis, they realized that they were experiencing similar family problems, perceived in a particular way according to each person's experience. As mentioned above, the population is transient and mostly tends to migrate, which causes imbalances and dysfunctions in family dynamics, thereby affecting "telesecundaria" students' learning.

The use of Google Classroom enabled significant online learning, as students felt at ease, barrier-free and with time to express their thoughts and emotions in writing. This ICT system established peer-to-peer trust and empowerment by validating their potential and identifying sources of resilience and learning who supported the process of resignifying an adverse situation as a learning opportunity.

As for FG, interaction between students was generated in an atmosphere of trust and respect, where Rita Levi's and Mario Capecchi's life stories, the sources of resilience and the learning mediators led to reflection and awareness of the elements that supported the resignification of an adverse situation into a learning opportunity.

The language used in both formal and informal environments demonstrated the importance of interacting with people through different media such as television, Google Classroom, Facebook and WhatsApp, used as affective bonds between students to generate resilient learning in a dynamic process between student and media.

The results obtained in the exploration and intervention stages laid the groundwork for a close-up approach to the subjectivity of the nine "telesecundaria" students, who shared their autobiographies orally, through semi-structured interviews, and in writing using Google Classroom. Thus, a ubiquitous environment was configured where barriers were broken down between the formal space of the "telesecundaria" and the informal realm of the student's personal and family space.

The hermeneutics analysis framework (Table 5) allowed a "hermeneutic encounter" where dialogue was possible between the horizon of understanding and life experience, transcending space and time benchmarks (Sandoval, 2002). The autobiographical analysis was performed through a participatory interpretation of the student, which allowed each of the nine participants to configure their own ecologies of resilient learning in a context tempered by problematic economic situations, parents with low levels of schooling and employment and, for the most part, with little stability. There was also a double perspective of present and past hermeneutic analysis.

Table 5. Results of the Closing stage	
Categories	Extracts of autobiographies
Risk factors	"I got sick with epilepsy and my mom didn't have money for medicine, thank God we made it."
Family problems	"My dad has never looked out for me." "I didn't live with my parents, my mother abandoned me: that day I wasn't at home, only my older sister was there, when I heard the news I was very sad, I spent weeks crying, but with the help of my family I got through it and now I see my mother and feel sorry for how she lives." "When I found out that my mother had an abortion, I felt that she didn't want any more children and that's why she got together with another man." "My family has no money." "My father doesn't live with me, he is a manager in the United States and when he left, I was 5 months old and I don't know him, well, only from pictures and when he calls me on the phone. He already has another wife, he has 2 children, one with his wife and me."
Resilient traits	"I'm a good, intelligent, courageous person, I finish everything I start, my word counts." "I am bold, my goals and aspirations are to continue studying, to give it all, to work, to help my mother and aunt so they don't need to work, to buy them a house and to continue as a united family."
Sources of resilience	"I have one or more people within my family group that I can trust and who love me unconditionally." "I am someone who empathizes with others." "I am responsible for my own actions and accept their consequences."
Learning mediators	"It is helpful to go to the Internet café / play video games on the computer / close relationships with people."
Messages shared in Google Classroom	"I suggest young people who have problems to trust God, to have faith, he will solve it, talk to him, tell him, he loves you, and he will listen to you." "Don't lower your head, you're very important, work hard, the problems don't last a hundred years, in the end, the only thing you're going to complain about is that you didn't have time to be well, so start now, enjoy everything, food, friends, and especially yourself, you're worth a lot and you shouldn't underestimate yourself."

Given this, Table 5 shows that the main risk factors reported by high school students arose in the family, such as infidelity, alcoholism, illness, abuse and economic hardships. The acceptability of the selected extracts had to meet two conditions: 1) that the student explain all available relevant information (if any important significance was excluded or diffusely reconstructed, the interpretation was not considered); 2) that the interpretation proposed was the most plausible to explain the events experienced (Sandoval, 2002).

The use of Google Classroom allowed the students to narrate their autobiography in the first person, which led to a complex process of self-analysis and reflection where they were involved in a critical way. The process of construction of the autobiographies was conducted through successive online and face-to-face approaches, with the aim of accompanying the process in a meaningful way. They highlighted the changes or turns undergone by the subjects. These changes are called "critical incidents" according to Bolívar (1999). It can be argued that one of the features that identify autobiographical narratives or stories is their experiential character. The students recounted situations that they remembered and interpreted, regularly related to other actors in different spaces, which shaped their own ecology of resilient learning.

The validation of the information was carried out through a methodological triangulation aimed at documenting and contrasting multisource information (Denzin, 1989). The filters used to identify resilient students contained socio-demographic data, risk factors and resilient characteristics that were consistent throughout the three research stages. Subsequently, the sample was modified.

4. Discussion and conclusions

In the study, the results show the complexity of the social fabric in which a group of "telesecundaria" students develop, which generates a challenge for education. The result analysis reflects the importance of considering the personal experience of the student body, with the objective of consolidating learning that strengthens their sense of life and autonomy. This implies a paradigm shift in the development of

communicative strategies to create spaces and conditions where students become aware of the importance of their own learning ecology, empower their resilient experience in which they were able to face adversity, and express their thoughts and emotions (Sangr , 2005; Maina & Gonz lez, 2016; Rodr guez, Gonz lez, Garc a, Arias, & Arias, 2016; Burbules, 2012; 2014a; Rodr guez, Cabrera, Zorrilla, & Yot, 2018).

The periphery of the research was the reality described from the students' subjectivity, reflecting their own awareness of the ecology of resilient learning in a ubiquitous environment. Proof of this are the extracts of their interactions in the Google Classroom platform: "I realize that the greatest achievement so far, is to be writing this, because I have a hard time talking about myself, and it is because of my little brother that I want to improve and it is because of him that I do everything". This inner voice realizes that oral and written stories in ubiquitous environments stimulate narrative reflection and resignification through a collaborative interaction that proved to be a tool that enhances the accompaniment of students to express their voice, not yet legitimized in some school environments, which leads to an empowerment of the hybridization between the subjective and the social (Phillippi & Avenda o, 2011).

The bridge generated between the formal and the informal made it possible to connect and exchange emotions, feelings, knowledge and experiences, in such a way that the relationship with others was gradually inked with confidence, security and awareness of the ecology of resilient learning in order to develop fundamental life skills that facilitate social and critical knowledge (Guti rrez, 2012; Duke, Harper, & Johnston, 2013; Fern ndez & Anguita, 2015; D ez-Guti rrez & D az-Naf a, 2018).

Life projects as products of critical thinking in the student body emerged as fundamental pillars in the configuration of the ecology of resilient learning: "buying a house to live with my family, helping my grandmother and aunt with expenses, continuing to study for my loved ones and learning more". Aspects that are not regularly addressed in school contexts. The ability to organize words with clear meaning and meaning through verbal representations allows for the sharing of experienced images and emotions, in order to give them a meaning that can be communicated to make students feel like unique and valuable people. Learning to value the whys and wherefores of problematic situations gives firm support to the awareness of resilient learning ecologies (Maina & Gonz lez, 2016; Herrera, 2013; Jim nez-Cort s, 2015; Peters & Romero, 2019).

The conclusion is that the Learning Ecologies framework supports the configuration of resilient learning. Jackson's (2013) proposal for shaping learning ecologies from an individual setting is considered, highlighting the personal context and the relationship with one's environment in both virtual and physical settings, and integrating both process and purpose. In this sense, by understanding the support they have, such as the sources of resilience and the resources (Burbules, 2014b) on which they can rely for the acquisition of knowledge, people feel greater autonomy and security in the configuration of their own learning ecology.

In the discourse by the students, adverse situations were identified, which they perceived as a constant effect of abandonment and separation from their parents. This implies that learning, as a social construct in which internal elements and external factors converge in a dynamic process, can be triggered by the use of ICT to promote ubiquitous learning (Ladino, Santana, Mart nez, Bejarano, & Cabrera, 2016; Gonz lez-Sanmamed, Mu oz-Carril, & Santos-Caama o, 2019).

The affective style acquired, and the sense attributed to the experienced situations constitute the mental capital that the student uses to face problems. Most of the participating adolescents displayed sensitivity to the contexts where they asserted their judgments and clarified the parameters within which their assertions were framed. Proof of this were their suggestions for other young people living in adverse situations: "don't lower your head, you're very important, work hard, problems don't last a hundred years". The comments reflect a continuous resignification process that fostered critical thinking, configuring their ecology of resilient learning in ubiquitous environments.

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Learning ecologies in online students with disabilities

Ecologías de aprendizaje en estudiantes online con discapacidades

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ABSTRACT

E-Learning environments are enhancing both their functionalities and the quality of the resources provided, thus simplifying the creation of learning ecologies adapted for students with disabilities. The number of students with disabilities enrolled in online courses is so small, and their impairments are so specific that it becomes difficult to quantify and identify which specific actions should be taken to support them. This work contributes to scientific literature with two key aspects: 1) It identifies which barriers these students encounter, and which tools they use to create learning ecologies adapted to their impairments; 2) It also presents the results from a case study in which 161 students with recognised disabilities evaluate the efficiency and ease of use of an online learning environment in higher education studies. The work presented in this paper highlights the need to provide multimedia elements with subtitles, text transcriptions, and the option to be downloadable and editable so that the student can adapt them to their needs and learning style.

RESUMEN

Los entornos de aprendizaje en línea están mejorando sus funcionalidades y la calidad de los recursos, facilitando que estudiantes con discapacidad puedan crear y adaptar sus propias ecologías de aprendizaje. Normalmente, el número de estudiantes con discapacidad matriculados es tan residual y sus discapacidades tan particulares, que resulta difícil identificar y cuantificar qué medidas de asistencia son relevantes para este colectivo en general. El objetivo de este trabajo es hacer entender cómo aprenden los estudiantes en entornos en línea dependiendo de su discapacidad y de las características del entorno. Consistentemente, se definen cinco ecologías de aprendizaje que son más frecuentes. Este trabajo contribuye a la literatura científica en dos aspectos fundamentales: 1) identificar qué barreras se encuentran, qué herramientas de apoyo utilizan los estudiantes online con discapacidad y cómo las combinan para formar ecologías de aprendizaje adaptadas a discapacidades específicas; 2) presentar los resultados en los que 161 estudiantes con discapacidad reconocida evalúan la eficiencia y facilidad de uso de un entorno de aprendizaje online en el ámbito universitario. Se resalta la necesidad de proveer elementos multimedia con subtítulos, transcripciones de texto, y la opción de que sean descargables y editables para que el estudiante pueda adaptarlos a sus necesidades y estilo de aprendizaje.

KEYWORDS | PALABRAS CLAVE

Learning ecology, accessibility, e-learning, disability, PLE, transcripts, assistive technology, students.
Ecología de aprendizaje, accesibilidad, enseñanza virtual, discapacidad, entorno personal de aprendizaje, transcripciones, tecnología de asistencia, estudiantes.

1. Introduction

Learning Content Management Systems (LCMS) provide access to learning content and services independently of time and location barriers. In the new paradigm of ubiquitous learning, academic services are extending their accessibility through technologies and devices (Díez-Gutiérrez & Díaz-Nafria, 2018; Tabuenca, Ternier, & Specht, 2013; Virtanen, Haavisto, Liikanen, & Kääriäinen, 2018), offering new opportunities to scaffold learning ecologies that may be especially favourable for people with disabilities (Bryant, Rao, & Ok, 2016; Perelmutter, McGregor, & Gordon, 2017). People with disabilities can eliminate barriers, thus ensuring an efficient and easy use of ICT. Exclusion from ICT applications has implications beyond remaining outside the information society, it also means being ostracized from an autonomous and independent life. Recent reports refute the fact that people with disabilities are large users of new technologies, and mobile devices in particular (Vodafone Spain Foundation, 2013; Zubillaga-del-Río & Alba-Pastor, 2013; Gutiérrez & Martorell, 2011). Educational systems have difficulties converting ICTs into learning and knowledge technologies. Therefore, it becomes necessary to guide teachers in this transition (Sancho, 2008).

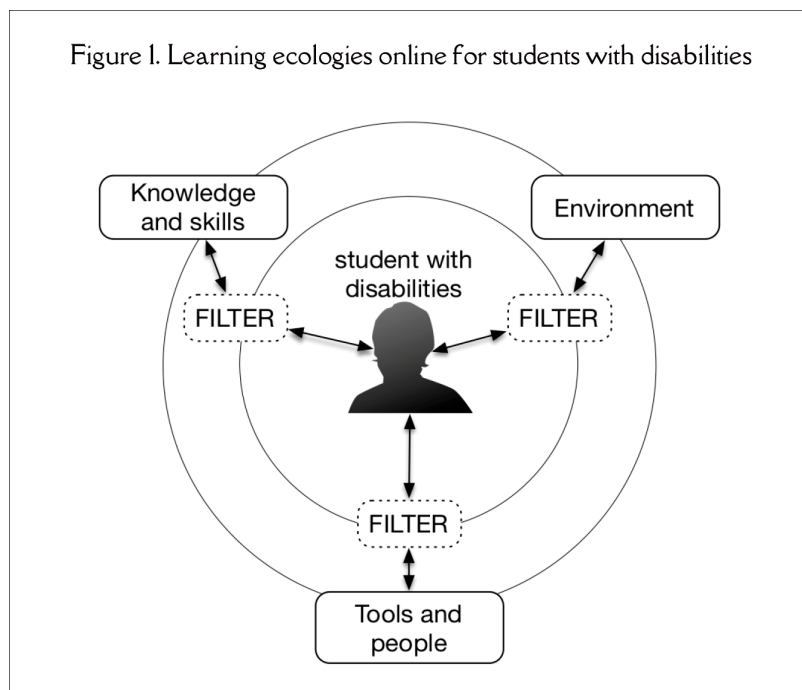
Online courses are usually structured by computer engineers and hosted in LCMS. Teachers then add their subjects and activities according to the curriculum. Each teacher must have a minimum level of digital competence that allows them to enhance these sections with texts, images, assessments, videos and other multimedia content. When teaching students with disabilities, it is not necessary for every educator to become an accessibility expert. However, they should have a clear vision of the existing barriers and a general idea of how these students can make effective use of their computer (Copper, 2006). Almost everyone with disabilities can be taught how to make effective use of the computer with the help of assistive technologies provided by the operating system or specialized software (and/or hardware) (Williams, Jamali, & Nicholas, 2006).

1.1. Resource ecologies in the learning context

A learning ecology is defined as the set of physical or virtual spaces that provide opportunities to learn (Barron, 2004). Jackson (2013) developed a definition indicating that the learning ecology of a specific individual includes the processes, contexts, relationships, and interactions that give rise to opportunities and resources for learning. Indeed, each person has a wide and diverse range of possibilities for training and learning, which requires individuals to take more and more control of their own learning process (González-Sanmamed, Sangrà, Souto-Seijo, & Estévez Blanco, 2018; Caamaño, González-Sanmamed & Carril, 2018).

Ubiquitous technology is encouraging students to learn how to use tools beyond the software and resources that are commonly available to teachers and students. Luckin (2008) designed the Ecology of Resources (EoR) model to cover the need to consider a broader spectrum of learning resources beyond the student's desktop. This model represents how existing tools in the student's usual context can offer new ways of assistance (Luckin, 2010). The fact that students have a wide variety of resources available is not enough. It must be ensured that for each particular environment, the resources are organized and activated in an appropriate manner for each student who may need to access them. In a learning scenario, Luckin distinguishes the following elements that make up an ecology of learning resources. This paper highlights the specialized EoR model in the context of students with disabilities (Figure 1):

- Environment. Usual learning context. For example, the desk and the computer where the student normally studies.
- Tools and people. Tools or people that (added to the usual environment) facilitate student learning. For example, headphones that facilitate adapted listening, or transcripts of videos that allow the student to read the transcripts.
- Knowledge and skills. Capacities or content that the student is interested in acquiring. For example, learning a programming language.
- Barriers or filters. They prevent access to any of the aforementioned elements. For example, in the case of a student with a hearing impairment, there are videos that do not contain subtitles or transcripts.



The working hypothesis is that, according to the Universal Learning Design paradigm (Meyer & Rose, 2000), e-Learning environments must provide a variety of multi-format resources in the form of accessible collections. Specifically, the objective of this study is to answer the following research questions:

- RQ1: Which learning ecologies can be identified in online students with disabilities? And more specifically, what barriers does this group encounter, and what tools do they rely on? A related work study is carried out to represent the ecologies in the EoR model (Luckin, 2010)
- RQ2: How to assess whether the support tools provided in online environments are sufficient and suitable for students with disabilities to learn. The results of a study are presented in which students with certified disabilities evaluate these tools. Furthermore, the creation of ecologies is confirmed.

1.2. Classification of learning ecologies in students with disabilities

Students with disabilities may need more than just one tool to carry out their activity in online environments. The ecologies defined here are not separate, they can combine learning objectives, environments, tools, and barriers. The classification has been made from the perspective of Copper (2006), which considers that, in general, it is not appropriate to consider medical classifications of disability when seeking to identify the means for people with disabilities to make efficient use of the computer. It is preferable to consider the person's abilities and disabilities with respect to what they should do to make more effective use of their computer, adopting a functional approach. Learning ecologies bring together the limitations suffered by people with a certain sensory limitation. This may be a visual, auditory, motor, cognitive, psychic limitation or even suffer specific learning difficulties, such as dyslexia and dysgraphia, or attention deficit hyperactivity disorders (ADHD) and autism. On many occasions the same person suffers from functional and sensory limitations of various types, the casuistry being very diverse.

Five learning ecologies can be distinguished mainly in students with disabilities based on sensory differences and the limitations that each disability presents (Carbó-Badal, Castro-Belmonte, & Latorre-Dena, 2017; Rodríguez-Martín, 2017). In presenting the ecologies, the difficulties inherent in each functional diversity are summarized. Furthermore, technological solutions are presented that help to address these barriers.

1.2.1. Learning ecology in online students with a hearing impairment (EHI)

This group comprises students who suffer from a mild hearing loss or difficulty in hearing to a substantial loss in both ears or deafness. People who wear hearing aids can be included. The barriers are mainly access to audio and video content (e.g. voices and sounds) when reproducers are not equipped to play subtitles or do not provide volume controls (Fuentes, González, Mariscal-Vivas, & Ruiz, 2005). Another barrier is enriched text without the option to adjust the text size, and colors of the subtitles, and web applications that do not allow multimodal interaction (e.g. only with a mouse, without a voice option). Below are some of the main relevant tools to provide an optimal access:

- Transcripts and subtitles of audio content, including audio-only content and multimedia audio tracks.
- Media players that display subtitles and provide options to adjust the text size and subtitle colors.
- Options to stop, pause and adjust the volume of audio content (regardless of system volume).
- High quality audio with the lowest possible background noise.
- See representation of EHI in (Tabuenca & Rodrigo, 2019b).

1.2.2. Learning ecology in online students with a visual impairment (EVI)

This category includes users with severe visual impairments, such as blindness, other moderate visual impairments, such as glaucoma or even color blindness.

People with visual disabilities need to adapt the representations of the data according to their tools. This group mainly faces barriers in accessing multimedia content when they lack adequate audio or textual transcriptions, or if they are only accessible using the mouse (ONCE, 2019). The audio description for visual content, both static (i.e. images) and dynamic (i.e. videos) is very important. In terms of formulas, the fields that are poorly arranged and not accessible by tabulators give rise to a serious difficulty in use. Similar barriers are disorganized contextual menus or menus that are inaccessible via the keyboard (Venegas-Sandoval & Mansilla-Gómez, 2010).

Below are some of the main relevant tools to provide optimal access:

- Enable an option to enlarge or reduce the size of text and images.
- Define font sizes with relative units so that the font size can be enlarged or decreased using the graphic interface options.
- Provide a link to select a high contrast color palette. It is important to provide the possibility to customize text fonts, colors and their distribution on the screen.
- The structure must be clear both for the user who can see the whole content and for anyone who accesses the information through a screen reader.
- Sections must be marked as section headings. Thus, users of screen readers can easily move between the different sections using voice synthesis (pressing the letter "H").
- The HTML and CSS code used must include formal grammars to ensure the correct display of content in different browsers.
- Provide textual transcripts for audios and videos.
- Provide audio descriptions for videos or movies.
- See representation of EVI in Tabuenca and Rodrigo (2019b).

1.2.3. Learning ecology in online students with a physical/motor impairment (EPI)

A motor disability is a series of alterations that affect the carrying out of movements. There are people with complete paralysis and others with motor difficulties in their lower limbs (difficulty in displacement) or higher (difficulty in speech or manipulation problems).

This group mainly faces barriers when using the keyboard and mouse (Sanz-Troyano, Torrente, Moreno-Ger, & Fernández-Manjón, 2010).

Below are some of the main relevant tools to provide optimal access:

- Hardware support (e.g. ergonomic keyboards, keyboard housings, one-hand keyboards, adapted mice, joystick, head pointers and stylus integrated into caps or helmets, mouth rods, page turning devices, armrests, supports and mechanical stands).

- Software support (e.g. predictive virtual keyboard, voice recognition programs and transcribers, digital recorder).
- Provide the student with extra time to complete oral / written activities or assessments.
- Mechanical elements and adaptations in keyboards and mice or pointing pencils.
- See representation of EPI (Tabuenca & Rodrigo, 2019b).

1.2.4. Learning ecology in online students with mental impairment (EMI)

People with mental disabilities are characterized by alterations in cognitive and affective processes. This group faces barriers related to information reasoning and communications skills (Cuesta & Ramos, 2012). The lack of specific information or ambiguous statements can cause a lot of anxiety in these students. They can suffer alterations in their reasoning, difficulty in recognizing reality, processing information, difficulties in adapting to a specific environment, and elaborating contextualized information. They may suffer paranoia or stage fright, which reduces their ability to communicate. They may even suffer cognitive limitations. The pharmacological treatments they receive can affect their attention span, concentration, memory, verbal and written comprehension, and the management of information.

Below are some of the main relevant tools to provide optimal access:

- Provide precise instructions for carrying out the assessment tests and exam modalities.
- Make flexible delivery deadlines for assignments and evaluation tests.
- Use simple and illustrative iconographies with bright colors and simple shapes that help their understanding and memorization.
- Offer alternative types of evaluation tests (e.g. multiple-choice questions or short questions). This adaptation should ideally not affect the evaluation of the skills required to pass the course.
- See representation of EMI in (Tabuenca & Rodrigo, 2019b).

1.2.5. Learning ecology in online students with specific attention or hyperactivity difficulties (EAD)

There is a group of disorders connected with significant difficulties in the acquisition and use of reading and writing, or attention deficits. They are usually caused by neurological alterations or dysfunctions that affect perceptual, psycholinguistic processes, working memory and strategies of learning and meta-cognition (Romero & al., 2005). Dyslexia (difficulty reading) may exist in isolation, but it is usually accompanied by dysgraphia (difficulty in writing), as both processes are cognitively linked.

On the other hand, attention deficit hyperactivity disorders cause dysfunctions in the mechanisms of executive control and behavior inhibition, which directly affects work memory, concentration, the self-regulation of motivation, the organization of tasks, the internalization of language and the processes of analysis and synthesis (Faraone, Biederman, & Mick, 2006).

In general, all of the disorders explained here can give rise to greater impulsiveness, lack of concreteness in completing tasks. Consequently, they may have greater possibilities of failing answers as they usually present poorly readable spelling, crossings out and a lack of organization in their ideas. Below are some of the adaptations that might help these students:

- Computer or tablet with assistive apps, and digital recorders.
- Text-to-speech conversion software (which read, for example, the texts on the computer screen or mobile devices).
- Provide extra time to complete individual activities (e.g. tasks, assignments).
- Receive contextual information of what is being displayed in the blackboard or any presentation document. The instructor must make an extra effort to verbalize aloud what he is pointing at in each moment.
- See representation of EAD in (Tabuenca & Rodrigo, 2019b).

This work is structured as follows: In this first section, RQ1 has been addressed by classifying learning ecologies according to each particular disability, with the aim of clearly identifying the needs to be taken into account when creating learning contents and structuring them in adapted LCMS.

In the next section, RQ2 is addressed by presenting an evaluation study of an online learning environment and its support tools. Section 3 presents the results of the study from the perspective of

161 students with certified disabilities. Finally, in section 4 the conclusions are presented based on the results obtained.

2. Method

This study uses the Technology Acceptance Model (TAM) as a reference to explore how users accept and use technology (Davis, Bagozzi, & Warshaw, 1989). This tool is effective in predicting the acceptance of systems by users (Robles-Gómez & al., 2015). The model has been extended by adding constructs to complete it with additional psychological factors related to the use or intention to use the system: an e-learning system (Liaw, 2008), online lifelong learning (Suh & Lee, 2007), digital skills and Internet (Yi & Hwang, 2003), online social networks (Liu, Chen, Sun, Wible, & Kuo, 2010), cognitive absorption (Venkatesh, 2000), etc.

However, there are no previous models measuring the acceptance of a technological system by exploring its accessibility features. This study proposes to explore improvements in accessibility that influence the willingness to use a specific technological system. In this case, the system is a repository of e-learning audio-visual resources at UNED (CadenaCampus). CadenaCampus allows live broadcasting from the university's videoconference classrooms. There are more than 700 classrooms equipped with video-conference studios. They provide the option of connecting with users via chat and shared desk. The system is integrated into the university's LCMS and also functions as an external repository. The portal features a tagged semantic structure with specific metadata to enable content searches with different criteria.

Table 1. Socio-demographic stats		
Current status	n	%
Studying	64	43.84%
Employed	54	36.99%
Pensioner	45	30.82%
Unemployed	25	17.12%
Self-employed	5	3.42%
Current studies		
Social sciences, trading & law	53	36.99%
Humanities & arts	32	21.92%
Health & wellbeing	26	17.81%
Education	21	14.38%
Sciences	13	8.90%
Engineering, industry & construction	10	6.85%
Services	5	3.42%
Agriculture	1	0.68%
Type of disability		
Reduced handling capacity and strength	78	53.42%
Limited cognitive capacity	26	17.81%
Limited vision	26	17.81%
Limitation in the ability to hear	21	14.38%
Limitation in the ability to hear	6	4.11%
No vision	4	2.74%
No ability to hear	2	1.37%
No colour sensibility	0	0%
Disability recognized by the Spanish government*		
Between 33% and 65%	102	69.86%
More than 65%	38	26.03%
Did not answer	5	3.42%
Did not know	1	0.68%

*optional answer.

This study aims to identify which learning ecologies students with disabilities actually use, assessing the accessibility of the resources provided by the CadenaCampus system and focusing on two key characteristics: 1) The accessibility of the content search engine; 2) The accessibility of the audio-visual

content player. The following constructs have been added to measure the degree of acceptance and use of resources that improve system accessibility:

- Availability of textual transcriptions.
- Availability of subtitles.
- Availability of subtitled videos.
- Audio availability.
- Availability of the option to download the aforementioned elements to use in offline mode.
- Semantic labelling to support the search system and recommendation of educational resources.

2.1. Participants

At the end of the academic year an email was sent to the students with recognized disabilities ($n = 7,397$) in which they were invited to evaluate the accessibility characteristics of the CadenaCampus system. A total of 161 students agreed to participate in the study by accepting informed consent.

The participants in this study were people with recognized disabilities (assigned to the student attention services department for students with disabilities at the university), with an average age of 46.2 years old ($SD = 11.06$), 51.37% being men.

The sociodemographic results (Table 1) confirm that people with disabilities usually have more than one disability due to the diseases or accidents suffered. The most frequent disabilities are reduced manipulation and strength (EPI), limited cognitive ability (EMI), limited vision (EVI), and limited hearing ability (EHI). A large part of the respondents was studying (43.84%), but many others were working as employees (36.99%), were pensioners (30.82%), or unemployed (17.12%).

These data are consistent with the current status of the group of people with disabilities issued in Spain that reflects that this group is poorly integrated into the labor market (Jiménez-Lara & Huete-García, 2018).

2.2. Materials

The self-developed questionnaire was shared with students using a link to an accessible online platform. The wording of the questions (ease of reading and being understood) was reviewed and contrasted by three university academics, experts in the areas of psychology, sociology and technological accessibility. Two technicians with motor and mental disabilities respectively, and an external collaborator with poor vision participated in the writing.

The level of accessibility to the online questionnaire was automatically validated with the TAW tool (Web Accessibility Test) and manually validated by a blind collaborator associated with this research group. The questionnaire is shared in Tabuenca & Rodrigo (2019b) and the results are shown below.

3. Results

3.1. Compliance with audio-visual recordings

The first question explored the degree of student satisfaction with specific characteristics of video and audio recordings, which are very beneficial resources for groups with disabilities (Table 2). Cronbach's alpha was calculated to obtain a good internal consistency ($\alpha = 0.91$).

Table 2. Satisfaction with audio-visual recordings (n=113)

Feature	Very satisfied (5)	Satisfied (4)	Neutral (3)	Unsatisfied (2)	Very unsatisfied (1)	M	SD
Quality	24(21.24%)	47(41.59%)	15(13.27%)	18(15.93%)	9(7.96%)	4.4	0.91
Usefulness	32(28.32%)	50(44.25%)	15(13.27%)	11(9.73%)	5(4.42%)	3.82	1.08
Accessibility	26(23.01%)	51(45.13%)	16(14.16%)	12(10.62%)	8(7.08%)	3.66	1.15

The results were satisfactory despite the recordings being produced by inexperienced users in communications, both live and without post-production.

Table 3. Specific features in audio-visual materials (n=109)

Usefulness of tools (n=109)	Extremely useful (5)	Very useful (4)	Neutral (3)	Slightly useful (2)	Not at all useful (1)	M	SD
Downloadable videos	85(77.98%)	11(10.09%)	12(11.01%)	1(0.92%)	0(0%)	4.65	0.71
Downloadable audios	80(73.39%)	14(12.84%)	13(11.93%)	1(0.92%)	1(0.92%)	4.56	0.80
Downloadable transcripts	71(65.14%)	18(16.51%)	18(16.51%)	2(1.83%)	0(0%)	4.45	0.83
Literally translated transcripts	54(49.54%)	36(33.03%)	17(15.60%)	2(1.83%)	0(0%)	4.30	0.79
Audio-visual materials enriched with transcripts	52(47.71%)	37(33.94%)	18(16.51%)	2(1.83%)	0(0%)	4.27	0.80
Audio-visual materials enriched with subtitles	54(49.54%)	30(27.52%)	19(17.43%)	5(4.59%)	1(0.92%)	4.20	0.95
Ease to use supporting tools (n=110)	Extremely easy (5)	Easy (4)	Neutral (3)	Difficult (2)	Extremely difficult (1)	M	SD
Accessible & easy to find download-video-feature	41(37.27%)	35(31.82%)	18(16.36%)	11(10%)	5(4.55%)	3.87	1.15
Accessible & easy to find download-audio-feature	39(35.45%)	35(31.82%)	18(16.36%)	12(10.91%)	6(5.45%)	3.80	1.19
Accessible & easy to find download-transcript-feature	36(32.73%)	36(32.73%)	22(20%)	11(10%)	5(4.55%)	3.79	1.14
Accessible & easy to find subtitles in audio-visual materials	27(24.55%)	40(36.36%)	27(24.55%)	10(9.09%)	6(5.45%)	3.65	1.11
Accessible & easy to find transcripts in audio-visual materials	28(25.45%)	37(33.64%)	26(23.64%)	15(13.64%)	4(3.64%)	3.63	1.11

3.2. Textual transcriptions as a support tool

Textual transcripts are very important for deaf people, people with cognitive deficits, and old people. They are an intermediate product for subtitling and facilitating the production of abstracts and concept maps easily.

In this case, the transcripts were provided to students as a learning resource and can be downloaded to be used offline. To the question "Do you think that the transcripts helped you to acquire the knowledge better?", 85.5% answered affirmatively (n= 113).

Table 4. Most frequently searched terms on disability (n=113)

Term	Never (5)	(4)	(3)	(2)	Frequently (1)	M	SD
Accessibility	20	18	23	19	20	2.99	1.41
Accessible	22	15	26	13	24	2.98	1.46
Disability	17	15	27	18	23	2.85	1.38
Adaptation	14	19	26	15	26	2.80	1.38
Adapted	14	15	27	15	29	2.70	1.39
Transcript	8	18	21	16	37	2.44	1.35
Functional diversity	12	13	18	20	37	2.43	1.40
Transcribe	8	18	20	16	38	2.42	1.36
Subtitled	8	12	24	15	41	2.31	1.33
Diverse functional	7	13	15	20	45	2.17	1.31
Subtitle	4	12	22	16	46	2.12	1.23
Re-talked	4	10	20	19	47	2.05	1.20

3.3. Usefulness of the support tools

Students with disabilities may require more time to visualize, listen to and process the information. They appraise very positively the availability of resources in download mode to be able to work with these elements more quietly and offline (Table 3). Cronbach's alpha was calculated to obtain a good internal consistency ($\alpha=0.89$).

3.4. Ease of use in the support tools

Resources in CadenaCampus are visually arranged next to the corresponding video with an iconography designed for this purpose and including contextual information. This question explores the

ease of identifying audio-visual materials and their option to download files (Table 3). Cronbach's alpha was calculated demonstrating good internal consistency ($\alpha=0.94$).

3.5. Folksonomy of accessibility

Students with disabilities (like any other student) use search engines to find learning objects adapted to their specific needs. These platforms add metadata to learning objects to make them easier to find by using certain terms. In this research, we have explored the possibility of enriching metadata with terms related to the accessibility of resources. Several experts identified 12 folksonomy terms that could be used to allocate resources in specific formats, taking both the (infinitives and participles of the) verbs and the most similar nouns (Table 4). For each of the terms, students were requested to indicate how often they used them. In addition, they were offered the option of reporting an additional term.

The results confirm the suitability of using a social indexation by means of simple labels on a flat namespace, without predefined hierarchies or kinship relationships. Likewise, they confirmed the use of the terms previously identified by the experts. Alternative terms suggested by the participants of the group studied were "inclusive", "audiobook", "outline", "summary", "video-class", "functional diversity", "exams" and "download". The indexation of learning objects with these metadata implies a valuable support tool for educators and designers when embedding learning objects in any LCMS.

4. Discussion and conclusions

Educators and designers of educational content should have an overview of how students with disabilities can use a computer and what technological tools facilitate the construction of learning ecologies according to their limitations. In this work, five learning ecologies for online students have been set out, classifying them according to the type of disability (RQ1): students with hearing impairment, visual impairment (EVI), physical / motor disability (EPI), psychic disability / mental disorder (EMI), and students with specific attention difficulties or hyperactivity (EAD) (Section 1.2). Inspired by the model proposed by Luckin (2010), we have identified barriers and support tools that can help students with disabilities in their learning activities.

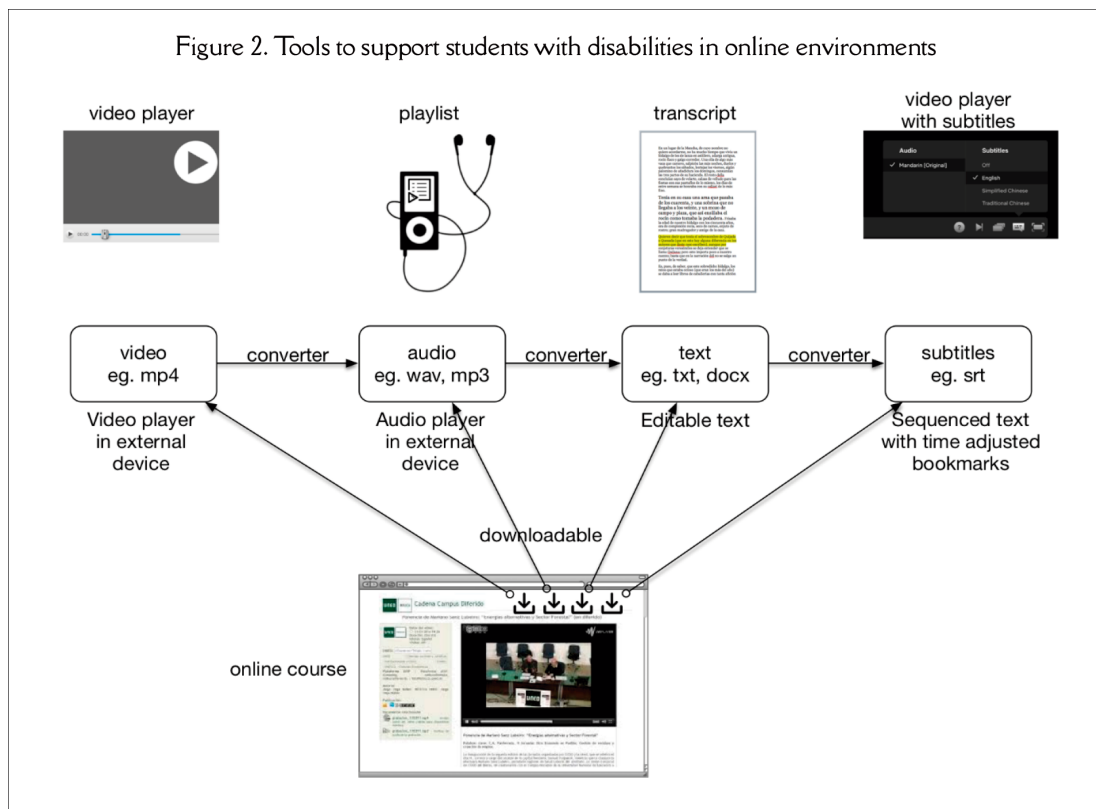
In this work, 161 students with recognized disabilities have evaluated some of the support tools based on their experience throughout their university course. The results confirm that the system being studied includes all the elements raised by Luckin (2010) as necessary to satisfy an accessible and quality learning environment (RQ2). To corroborate these conclusions, the main tools and the access barriers are summarized below:

- Audio-visual recordings. This is one of the main elements in e-learning environments. It was commonly defined in all ecologies (EHI, EVI, EPI, EMI and EAD). The assessment obtained has been good in terms of accessibility, quality, and usefulness of the recordings offered (Section 3.1).
- Textual transcripts. They are essential, not only for students with hearing problems (EVI), but also as an element of assistance for any student. They can be modified to create summaries, concept maps, or to add notes with comments and doubts. 85% of the participants confirm this assertion (Section 3.2).
- Textual enrichment of audio-visual elements through transcriptions and subtitles. This feature supports students with both hearing and visual impairment (EHI and EVI). Participants rated transcripts more positively followed by subtitles. Likewise, they rated very favourably that the transcripts fitted literally with what the teacher had said.
- Downloading materials. This feature allows students to customize contents and organize their study without sequencing or depending on an Internet connection. This tool is key since 53% of the students had reduced handling capacity (EPI), and 21% had some visual limitation (EVI). The LCMS under study offered different support tools to students with disabilities.

The results show that downloading videos was the support tool they found in an easier and more accessible way ($M=3.87$), followed by audio download ($M=4.56$), downloading transcripts, and finally the subtitles (Section 3.4).

With all of the aforementioned, the results reinforce the working hypothesis. Learning environments must have a wide variety of related multi-format resources in the form of accessible collections (Meyer & Rose, 2000). With the convenient semantic labelling and a good profile of registered users, the systems can offer each student the resources that best suit their needs (González-Sanmamed & al., 2018).

Figure 2 illustrates a holistic representation that includes the main support tools, how they can be extracted from each other, and what associated interface the student with disabilities can use in their learning.



The results presented in this study are exploratory and should be taken with caution as they are based on a sample of 161 out of 7,397 students with recognized disabilities. Important aspects such as the assessment of the effect on gender learning and age that have been included as tasks for future work have been omitted from this study.

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Positive or negative communication in social activism

Comunicar en positivo o negativo en el activismo social

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ABSTRACT

This study analyses the role of communication in social activism from models that surpass the mere emotional reaction, prior belief reinforcement or brand identification. This paper tests the hypothesis that a message focused on the cause (and its results) will motivate a previously sensitized audience depending on their interactions with source favorability. The methodology is based on the design of a bifactor experimental action result study 2 (failure versus success) x 2 valences (favorable versus unfavorable source) with the participation of 297 people who are pro-avoidance of evictions. The results allow us to infer that the messages from sources hostile to the cause that report negative results have the potential to emotionally and behaviorally motivate activists to a greater extent than messages with more positive results from favorable sources. The conclusions point to the dialogue between social injustice frames and pro-cause action emotions as a way to increase social mobilization. The theoretical and empirical implications of these findings are discussed in the present-day context of social media prevalence.

RESUMEN

Esta investigación analiza el papel de la comunicación en el activismo social desde modelos que superen la mera reacción emocional, el refuerzo de creencias previas o la identificación con la marca. Este estudio pone a prueba la hipótesis de que un mensaje que centre la atención en la causa (en sus resultados) motivará a una audiencia previamente sensibilizada en favor de dicha causa cuando interactúe con la favorabilidad de la fuente. Se ha diseñado un estudio experimental bifactorial 2 resultado de la acción (fracaso versus éxito) x 2 valencia (fuente favorable versus fuente desfavorable) con la participación de 297 personas pro-evitación de desahucios. Los resultados permiten deducir que los mensajes emitidos por fuentes hostiles para la causa que informen de resultados negativos tienen el potencial de motivar afectiva y conductualmente a los activistas en mayor medida que mensajes con resultados más positivos en fuentes favorables. Las conclusiones finales señalan al diálogo entre marcos discursivos de injusticia social y emociones de acción pro-causa como vía para incrementar la movilización social. Se discuten las implicaciones teórico-prácticas de estos resultados en el contexto actual de predominio de redes sociales.

KEYWORDS | PALABRAS CLAVE

Communication, activism, engagement, social change, efficacy, persuasion, social motivation, reception.
Comunicación, activismo, compromiso, cambio social, eficacia, persuasión, motivación social, recepción.

1. Introduction and state of the art

This empirical research analyzes one of the most pressing questions in forums and publications engaged in communication for social change: How can communication aimed at citizen involvement in social transformation be more effective? (Kirk, 2012; Waisbord, 2015). The activism promoted by social media that induces users to click while on their social networks (Fatkin & Lansdown, 2015), or to make a donation (Nos-Aldás & Pinazo, 2013) is insufficient to bring about social change. Communication strategies aimed at motivating active responses to a social cause require formats that focus on the cause and motivate people to defend it. Participation in pro-cause behaviors seems to go no further than activity in open communication spaces, such as the digital (Sampedro & Martínez-Avidad, 2018), or for the audience to listen only to what they want to hear (Hart, Albarracín, Eagly, Brechan, Lindberg, & Merrill, 2009; Nisbet, Hart, Myers, & Ellithorpe, 2013; Stroud, 2007; Webster & Ksiazek, 2012). Willing recipients of the message are not necessarily active even though they may be defenders of the cause. Exposing oneself to messages that fit prior attitudes and avoiding those that challenge their values can lead to a kind of inactive conformity, summed up as, “that’s the way things are”.

Social media facilitate the widespread dissemination of social causes that represent online what social networks do offline (Bakker & de-Vreese, 2011; Boulianne, 2009; Dimitrova, Shedata, Strömbäck, & Nord, 2014). This feature of online communication can enable the messages from these closed self-confirming circles to be broadcast widely and to raise political awareness (Boulianne, 2009; Sampedro & Martínez-Avidad, 2018). In this new context, activating the social commitment of those already converted to the cause but insufficiently active, could depend on where the recipient’s attention lies when receiving the message. What is the best communication strategy for activating this type of audience? People tend to act with greater intensity and commitment when they feel their participation could be useful or necessary—e.g. when the cause is under threat. This research aims to explore aspects of communication that could intensify social motivation towards the cause among recipients who are already sensitized in that direction.

1.1. Sensitization towards social justice issues

To be socially sensitized is to feel affected, to judge, to think and act in accordance with social-moral values in a coherent way (Haidt, 2001; 2003). This implies an affective and cognitive rejection response towards the perception of moral breakdown resulting from a social action (Haidt, 2003). This does not necessarily result in immediate action, but rather a greater predisposition towards acting in favor of a social cause that motivates the person. The subsequent moral judgement entails evaluating the appropriateness or inappropriateness of the social act that defends the cause, a judgement based on a cognitive-emotional process that is predisposed towards the action (Haidt, 2007). The judgement arises from a communication scenario that should be able to motivate action and commitment. What aspects of the communication structure can stimulate a motivating social-moral judgment that will better predispose someone to act in favor of the cause?

To keep motivation alive, activists need to be sensitized to content that can rouse them to defend the cause beyond merely sending in a donation or feeling comfortable with the brand (De-Andrés, Nos-Aldás, & García-Matilla, 2016; Nos-Aldás & Pinazo, 2013; Pinazo & Nos-Aldás, 2016; Pinazo, Barros-Loscertales, Peris, Ventura-Campos, & Avila, 2012). Activists who ultimately take up the cause will be those who are motivated to follow up the conclusions of the message in favor of the cause, if these are deemed relevant for the defense of their values. The difficulty with those converted to the cause, is that they probably feel they are already active, and perhaps the message no longer moves them to make an effective commitment to specific actions. In this sense, the arguments’ valence could be particularly relevant for social activism in terms of their capacity to motivate. Content that describes the success of the social action (positive valence) or failure (negative valence) can affect motivation to act in favor of the message in different ways. Activists in favor of social causes will tend to search for messages that validate their position. In this sense, they can expect to receive a call to action through negative or positive valence messages from a favorable outlet. If the cause is not under threat, it is only necessary to remain convinced of the value of such messages; however, the need to defend a cause under threat can motivate action, regardless of the source of this information. The consideration of the social action’s outcome as a

persuasive argument has not been widely researched (Reysen & Hackett, 2016; Reysen & Katzarska-Miller, 2013), neither has the interaction between the social action and the source.

1.2. When the source is unexpected

In terms of social sensitization, the recipient is the essential element in the communication process, not for their passivity but for their influence on how that communication is framed, given that it is the recipient who will shape the meaning of the message. The recipient can and should attend to the message actively. Studies on selective exposure seem to suggest that the response to a message is conditioned by the extent of the recipient's engagement with the cause defended, and they essentially relate this exposure to the source of the message (Arceneaux & Johnson, 2015; Briñol, Petty, & Tormala, 2004; Chaffee & Miyao, 1983; Ehrenberg, 2000; Freedman & Sear, 1965).

A source that is confirmatory of the recipient's prior position, sensitizes them to the cause to a lesser extent, as the message is expected to confirm prior beliefs; such trust shifts focus away from other potentially dissonant information (Briñol & Petty, 2015) although it could polarize the political position (Arceneaux, Johnson, & Cryderman, 2013). Commercial communication uses these information reception preferences to associate social causes to brands

This research expands the tools demanded by the global social justice community and reinforces the proposals of communication for social change on the transformative, educational and mobilizing effectiveness of communicative strategies that go beyond emotional reaction or identification with the brand.

in order to boost their image (Becker-Olsen, Cudmore, & Hill, 2006; Pinazo, Peris, Ramos, & Brotons, 2013); this communication strategy does not boost motivation for the cause itself.

In short, evidence shows that the motivation to attend to a message favoring a social cause increases in the presence of a consonant source and can burnish the image of the neutral source (commercial brand). But what happens if someone is exposed to a message that is consistent with his or her social sensibility but comes from a dissonant source? We have found no studies that analyze the effect of a message from a disruptive source on sensitization to a social cause, expressed as an active response (cognitive, affective or behavioral) in favor of social causes.

1.3. Valence of the argument and the source

Possessing attitudes is not enough to influence behavior. People need to believe that their attitudes are correct and feel comfortable with them (Briñol & Petty, 2015). For activists, receiving information on a positive outcome about their advocated social action, can strongly reinforce their position. However, a negative outcome could be seen as a weak argument for the efficacy of the social action. Information containing a positive outcome of the social action can arouse good feelings about their position, thus requiring no further reinforcement. Such information could reduce motivation for action while the weak argument could have the opposite effect.

The credibility of the source interacts with the effect of the argument's valence. Related research on the area shows that when the message contains strong arguments, the highly credible source fosters prior attitudes more than when the source is barely credible; however, this effect is reversed when the arguments presented are weak (Briñol & Petty, 2015). If the argument is weak, it could contradict what the reader expects to receive and undermine confirmation that the action is effective. If the source offers arguments consistent with the person's values, this person will be more inclined to agree with the message, for they will reason that "if the message fits with me and my values, it must be good" (Briñol & Petty, 2015). If one receives information about the effectiveness of the action, it can then be interpreted that there is

no need for further action. A failure of the pro-cause action could rouse an individual to defend it, but if the source is pro-attitude, it could diminish their motivation, as it could be interpreted that the reason why they are reporting a setback is not because it is real but because they want to rouse people to action. Yet a source that is barely credible in its coverage in favor of the cause could boost activist motivation to defend it, as the action could end in failure, perhaps due to the fact that the source is controlled by media hostile to the cause. No research exists dealing directly with this combination of factors in recipients differentiated by the extent of their partiality to a social cause. The communication model presented by Pinazo and Nos-Aldás (2016) suggests that motivation in favor of a cause is modulated by a communication strategy associated to the context in which the message is presented. A context that is negative to the cause in a pro-attitude medium can arouse motivation favorable to the medium, not to the cause.

The results of this study show that positive or negative messages focusing on success or failure (in terms of social psychology and, the message's positive or negative valence) are important for keeping activists in protest mode.

The aim of this work is to assess whether the context of interaction in political activism, as well as the source and valence of the result of the action influence pro-cause motivation. Specifically, we defend the hypothesis that presenting a group of pro-cause activists with a nega-

tive valence message from a source hostile to their attitudes will motivate them more in favor of the cause than presenting them with a negative valence message from a pro-attitude source. Likewise, positive valence messages will have no differentiated effects on pro-cause motivation regardless of the attitude towards the cause of the medium that publishes it.

2. Method

2.1. Sample

The study participants were individuals who fulfilled the following criteria: 1) to be committed to social causes; 2) to have participated in pro-avoidance of evictions mobilizations. Initially, 400 booklets were distributed, of which 24 were discarded for not having been entirely completed. A further 79 people were eliminated from the sample for not having taken part in any initiative demanding justice for those threatened by eviction (demonstrations, strikes, petition drives, filing complaints, use of social media or other types of action aimed at defending the cause of preventing evictions). This was the final distribution by conditions: failure/favorable source (70 individuals), failure/unfavorable source (83), success/favorable source (81) and success/unfavorable source (63). The final sample consisted of 297 individuals. Men accounted for 37.4% of the sample (N=111), women 62.6% (N=186). The age range was 18 to 70 (M=34.23; SD=13.91). Level of education was classified as those without a college degree, 56.2% (N=167), and those with a college degree, 43.8% (N=130). Of the total sample, 34.7% (N=103) held wage-earning employment while 65.3% (N=194) were unemployed. Monthly income was measured on a scale of 1 to 8: no income (1), less than or equal to 300€ (2), 301€ to 600€ (3), 601€ to 1,000€ (4), 1,001€ to 2,000€ (5), 2,001€ to 3,000€ (6), 3,001€ to 5,000€ (7), more than 5,000€ (8). The mean monthly income of those surveyed was between 301€ and 600€.

2.2. Study design and procedure

We performed a bifactor experimental action result study 2 (negative versus positive) x 2 sources (favorable versus unfavorable). A fictitious eviction case in the format of a news item was created then reviewed by a panel of experts in journalism, advertising, sociology, semiotics and social psychology. With the body of the message approved, the experimental conditions for the study were created¹.

The booklets containing the conditions of the experiment were distributed personally by research assistants to those individuals selected to take part in the survey. First, the participants were asked to

provide demographic data (gender, age, education, employment, income) then quantify the extent of their participation in demanding social justice for those affected by evictions. Later, on a separate sheet, each participant read the single news item on an eviction case drafted according to one of the four experimental conditions; on the next page, the participants responded to a series of questions related to the news item.

2.3. Dependent variables

Moral motivation (MM): the same items as in Pinazo and Nos-Aldás (2016) were used to measure moral judgement or the extent to which the action in the news report transgresses norms of social or ethical justice. The respondents had to answer two questions: “do you consider what has happened to this family socially unjust?”, and, “do you consider it immoral to do nothing to prevent this situation?” Both items had a high internal consistency ($\alpha = .798$; $M = 7.47$; $SD = 2.06$).

Affective motivation (AM): a version of the items selected from the PANAS-X scale (Watson, Clark, & Tellegen, 1988) were used, but instead of applying an approach to the effect in two dimensions, one negative and one positive, we opted for items in line with the study objective to assess that affective state (Lambert, Eadeh, Peak, Scherer, Schott, & Slochower, 2014). Two affective motivator states were considered in relation to social activism: 1) the affective state that drives the activist to action; 2) the affective state associated to the rejection of the situation. Items were selected that better represented these states, based on PANAS. For affective motivation for action (AMA), the states selected were “Energetic”, “Enthusiastic”, “Inspired” and “Active” ($\alpha = .800$; $M = 4.54$; $SD = 1.65$), and to represent affective motivation for rejection (AMR) the states chosen were “Hostile”, “Irritable”, “Anxious” and “Angry” ($\alpha = .805$; $M = 5.07$; $SD = 1.83$).

Pro-conduct motivation (PcM): this assessed their predisposition to collaborate in just causes, and consisted of a set of three behaviors related to social activism: “collaborate in protest actions”, “invest my money in ethical banks that do not pay interest and invest only in companies that favor just causes”, “report companies that attempt to deceive customers, or act unjustly to make a profit”. On a scale of 1 (I totally disagree) to 9 (I totally agree), participants were questioned on an eviction demanded by a bank: “what would you be willing to do to participate in a solution to this problem?” Given that the internal consistency of the three items is high, $\alpha = .711$, we created an aggregate variable that assessed predisposition to act in favor of social causes ($M = 6.73$; $SD = 1.83$).

2.4. Control variable

Message credibility: the control variable to assess whether the recipient has understood the message. The effect of a message depends on the recipient’s motivation to process it, according to certain models of persuasion, especially the one relating to elaboration likelihood (Petty & Cacioppo, 1986). As a credibility factor, belief in news veracity was evaluated, based on two questions: 1) “this news item has been manipulated”; 2) “this news item is false” ($\alpha = .565$). The aggregate measure of news credibility was $M = 3.97$ ($SD = 2.44$). A high score indicates that the participants do not trust the news item.

3. Results

The SPSS v24 statistical software package was used to analyze the data. Before studying the effect of the experimental conditions on the dependent variables, several analyses were run to evaluate possible bias in the demographic variables and in the motivation to elaborate the message. The results showed that the sample was evenly distributed according to the various conditions considered for the experiment: the gender proportion in each experimental condition is similar ($\chi^2 = 1.62$; $p = .656$), as is the distribution for education level ($\chi^2 = 0.99$; $p = .805$) and for being in or out of work ($\chi^2 = 0.99$; $p = .092$). ANOVA for age ($F = 0.57$; $p = .634$) and income ($F = 1.72$; $p = .163$) indicates that these variables are also evenly distributed across the experimental conditions.

A univariate analysis of variance (UNIANOVA) was conducted to assess whether the recipients reacted in different ways to the message, in each of the conditions, perceiving it to be either true or false; results showed that different reactions did occur ($F = 5.513$; $p = .001$; $\eta^2 = .053$). The Tukey post-hoc means comparison test was used to reveal differences between various pairs. There were differences ($p = .027$) between news of success versus unfavorable source ($M = 4.62$; $SD = 2.19$) in relation

to news of failure versus unfavorable source ($M=3.50$; $SD=2.40$). There were also differences ($p=.018$) between news of success versus favorable source ($M=4.49$; $SD=2.34$) in relation to news of failure versus favorable source ($M=3.35$; $SD=2.40$). There were differences ($p=.013$) between news of success versus unfavorable source ($M=4.62$; $SD=2.66$) in relation to news of failure versus favorable source ($M=3.35$; $SD=2.40$). Finally, there were differences ($p=.040$) between news of failure versus unfavorable source ($M=3.50$; $SD=2.19$) in relation to news of success versus favorable source ($M=4.49$; $SD=2.34$). These paired differences indicate that the recipients regarded news publicizing the success of the cause as less credible, which shows a predisposition towards an expectation of failure. There was also a tendency of disbelief towards news from the unfavorable source. These differences are expected in people who are favorable to the social cause, demonstrating that the participants had read and understood the cases involved. With confidence in the participants' attention to the study, we assessed the effect of the cases on recipients' motivation towards the social cause.

A multivariate analysis of variance (MANOVA) was used to compare the effect of the interaction of the Result (positive or negative) of the social action versus Source on motivational results (Moral Motivation, Affective Motivation and Motivation for Action). Some indicators showed that the MANOVA statistical assumptions were fulfilled. Box's M test = 69.128, $p < .000$ showed that the homoscedasticity of the covariance matrices was not in question; consequently, the interpretation of the multivariate test could be made with Pillai's Trace (Tabachnick, Fidell, & Ullman, 2007). Levene's test for equality of variances is not significant for the Pro-Conduct Motivation and Affective Motivation variables; therefore, the Tukey test was applied to these variables during post-hoc analysis. On the other hand, Levene's test was significant, which indicated a lack of homogeneity in the sample variances, in the Moral Motivation and Motivation to Reject variables. Thus, Dunnett's C test was used in the post-hoc analysis of these variables.

The MANOVA results for motivation revealed a significant principal effect, the Pillai Trace = .269 ($F=7.191$; $p=.000$), with a small sample of the effect ($\eta^2=.090$). The univariate test showed significant effects in the direction expected for the effects of motivation (Table 1).

Table 1. Results of the interaction between result of the action vs. source on pro-cause motivation						
	Mean	DT	F	GI	p	η^2
Moral motivation (MM)			9.238	3	<.000	.086
Success vs. unfavorable source (n=63)	7.68	1.81				
Failure vs. unfavorable source (n=83)	7.87	1.69				
Success vs. favorable source (n=81)	7.64	1.79				
Failure vs. favorable source (n=70)	6.28	2.77				
Affective motivation for action (AMA)			0.024	3	.995	.000
Success vs. unfavorable source (n=63)	4.54	1.63				
Failure vs. unfavorable source (n=83)	4.56	1.63				
Success vs. favorable source (n=81)	4.56	1.66				
Failure vs. favorable source (n=70)	4.50	1.71				
Affective motivation for rejection (AMR)			14.302	3	<.000	.128
Success vs. unfavorable source (n=63)	5.09	1.75				
Failure vs. unfavorable source (n=83)	5.91	1.50				
Success vs. favorable source (n=81)	5.10	1.97				
Failure vs. favorable source (n=70)	4.03	1.84				
Pro-conduct Motivation (PcM)			15.416	3	<.000	.136
Success vs. unfavorable source (n=63)	6.74	1.77				
Failure vs. unfavorable source (n=83)	7.29	1.62				
Success vs. favorable source (n=81)	6.83	1.77				
Failure vs. favorable source (n=70)	5.34	2.17				

To locate the differences between certain pairs in the interaction model set, we performed the Tukey post-hoc comparison test, which provided the following results: In AMA, the comparison between the four groups did not display any significant differences; in PcM, the pairs comparison in the experimental conditions revealed significant differences between the condition of failure versus unfavorable source with failure versus favorable source ($p < .000$), and the condition of success versus unfavorable source with

failure versus favorable source ($p < .000$). The means comparison (Table 1) suggests that the recipients were more motivated to act when the news of failure came from an unfavorable source.

Dunnnett's C post-hoc test for MM indicated that there are considerable differences in the means when comparing the following: groups of success versus unfavorable source with failure versus favorable source ($p < .000$); groups of failure versus unfavorable source with failure versus favorable source ($p < .000$); and groups of success versus favorable source with failure versus favorable source ($p < .000$). These differences imply that the recipients felt more morally motivated when the news came from an unfavorable source or from a favorable source reporting on the success of the action.

The Dunnnett C test for AMR showed significant differences in the means when comparing the following: groups of success versus unfavorable source with failure versus favorable source ($p = .002$); groups of failure versus unfavorable source with failure versus favorable source ($p = .000$); and groups of success versus favorable source with failure versus favorable source ($p = .001$). The means comparison showed that the motivation to reject the news occurs when news of failure appear in a hostile medium, or in a consonant medium if the news report a success.

The results indicate that the reception of a news item that displays a negative valence in the social action presented by an unfavorable source generates greater affective rejection towards the failure of the cause, and better predisposes the activist to act in favor of the social causes. However, it has no effect on positive affective motivations. To assess whether PcM is a direct effect of the source versus valence of the result interaction, or whether intervening variables exist, we performed a hierarchical regression analysis (Table 2).

Table 2. Result of the hierarchical regression analysis of the effect on pro-conduct motivation						
Variables	β (se)	t	R ²	ΔR^2	F	p
Step 1:			.070		22.07	<.000
News	-.484(.103)	-4.70				<.000
Step 2:			.137	.079	9.013	<.000
News	-.305(.105)	-2.90				.004
Moral motivation	.194(.051)	3.78				<.000
Affective motivation rejection	-.006(.068)	-.09				.929
Affective motivation action	.214(.061)	3.48				.001

One of the objectives of this analysis was to assess whether the effect on pro-conduct motivation is direct, mediated by other variables or modulated by them. The research procedure most frequently used to test mediation was developed by Kenny (Baron & Kenny, 1986; Hayes, 2009) and consists of four stages. First, the causal independent predictor variable, in this case the news, must have a direct effect on the dependent variable. This is verified by observing the effect in MANOVA (Table 1) and in the first regression model obtained (Table 2). Secondly, the independent variable must have an effect on the possible mediator variables. This second supposition is only fulfilled in MM and AMR in our study (Table 1). Thirdly, these three variables (News, MM and AMR) should have a significant direct effect on the dependent variable PcM, which occurs in Step 2 of the regression for the "moral motivation" variable (Table 2). Finally, the effect of the mediator variable on the dependent variable should annul the direct effect of the independent variable on the dependent variable, which does not occur since the effect of the news continues to be significant in Step 2. Therefore, mediation is not observed. The moderation hypothesis is confirmed if the increase in the proportion of variability due to the interaction is significant. Table 2 shows that this criterion is satisfied in Step 2.

The results of the hierarchical regression analysis show that the effect of the news on motivation to act is biased due to the presence of at least two factors: MM and AMA. Analyzing the conditions in order to assess the type of participation of these variables, we observe that they do not comply with the mediation criteria but do so with the modulation criteria, so, we conclude that MM and AMA are modulator variables on the effect of the news on the motivation for action.

4. Discussion and conclusions

Participation in the defense of social causes not only occurs within a favorable context, such as the digital environment (Sampedro & Martínez-Avidad, 2018), the cause itself must motivate the audience. In this study, we have tested the hypothesis that a message focusing attention on the cause (as a result of a successful outcome for the cause) will motivate the audience when it interacts with the favorability of the source. We have analyzed the effect on the pro-cause response of the interaction between source versus result of the pro-cause action on an audience previously sensitized by the social cause defended.

All judgement passed on a social object is determined by a cognitive and affective process (Oskamp, 1991). When assessing the efficacy of the communication, consideration is usually placed upon the utilitarian responses that are normally considered, such as the quantity and frequency of donations (Pinazo & Nos-Aldás, 2016) or the likelihood that a message is shared on social media (Brady, Wills, Burkart, Jost, & van-Bavel, 2018; Hansen, Arvidsson, Nielsen, Colleoni, & Etter, 2011). In both cases, it is brand penetration or the communication piece that is evaluated, rather than the content or sensitization to the cause itself. In this study, we have focused on sensitization in the pro-cause response and the conditions in which it can be identified.

The results show that reporting on the failure of the cause better sensitizes a pro-cause audience. This sensitization means there is greater affective engagement with the rejection of the cause's failure, and a greater predisposition to act in order to reverse this setback. This perception of failure is accentuated when reported in a hostile medium, so that the communication of failure versus hostile medium interaction is a source of affective and intentional pro-cause sensitization that is more effective than its reporting in sympathetic media and the communication of the cause's successes. This effect is modulated by the positive moral and affective motivation of the audience that reinforces this effect. Moral motivation and affective motivation for action modulate the effect of the news on pro-cause motivation. That is, the predisposition to act is in consonance with the reception of news of failure in a hostile medium. But this effect increases or decreases according to the effect of the news on moral motivation and the affective motivation for action. The sharper the perception of social injustice as revealed by the news and the greater the arousal of the emotions to act, the more likely the person will be to act in favor of the cause.

The results show that the message's positive or negative valence is relevant for keeping activists in protest mode. This fits with research that emphasizes the efficacy of designing communication strategies that go beyond mere emotional reaction or brand identification (Pinazo & Nos-Aldás, 2016). The results of this work show that at least one of the reasons why social media could boost citizen engagement and commitment (Boulianne, 2009; Dimitrova, Shehata, Strömbäck, & Nord, 2014; Norris, 2001; Papacharissi, 2002) is by coaxing activists out of their comfort zones. The potential of the media to access sources of information that challenge recipients' convictions could be one way of reactivating their efforts in defense of their causes.

The results of this work broaden the concept of the efficacy of communication for social change, from its ability to mobilize and educate (Obregón & Tufte, 2017; Pinazo & Nos-Aldás, 2016; Seguí-Cosme & Nos-Aldás, 2017).

4.1. Study limitations

Regarding the theoretical contributions of the results, one key limitation is the absence of an analysis comparing the pro-cause sample with an anti-cause sample. A study design that identified this type of audience and analyzed their reactions would be an important empirical and theoretical contribution to the knowledge of how to disseminate social causes.

Given that it is an experiment performed outside the laboratory, the results could have been affected by the diminished internal control that such conditions imply. Although the participants' attention while reading the message was controlled in part, we cannot guarantee that rejection of the source intervened more strongly than the need to carefully evaluate the meaning of the message. Control conditions, therefore, need to be bolstered in future studies.

Another issue that affects the relevance of the results is whether they can be generalized to include other communication frames. Replicating the study in different communication contexts would provide

additional evidence as to how messages against the social cause in hostile media can motivate the pro-cause audience. The study needs to be repeated in samples with population and/or cultural variants.

Notes

¹ See Annex for the experimental conditions applied to the design of the news item, at: <https://doi.org/10.6084/m9.figshare.9852719.v1>.

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Bullying and cyberbullying in LGBT adolescents: Prevalence and effects on mental health

Acoso y ciberacoso en adolescentes LGTB: Prevalencia y efectos en la salud mental

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ABSTRACT

Bullying and cyberbullying have negative consequences on adolescents' mental health. The study had two objectives: 1) to analyze possible differences in sexual orientation (heterosexual and non-heterosexual) in the percentage of victims and aggressors of bullying/cyberbullying, as well as the amount of aggressive behavior suffered and carried out; 2) to compare the mental health of adolescent heterosexual and non-heterosexual victims, aggressors, cybervictims, and cyberaggressors. Participants included 1,748 adolescents from the Basque Country, aged between 13 and 17 years (52.6% girls, 47.4% boys), 12.5% non-heterosexuals, 87.5% heterosexuals, who completed 4 assessment instruments. A descriptive and comparative cross-sectional methodology was used. The results confirm that: 1) the percentage of victims and cybervictims was significantly higher in non-heterosexuals, but the percentage of heterosexual and non-heterosexual aggressors and cyberaggressors was similar; 2) non-heterosexual victims and cybervictims had suffered significantly more aggressive bullying/cyberbullying; 3) non-heterosexual victims and aggressors of bullying exhibited significantly more depression, social anxiety, and psychopathological symptoms (somatization, obsession-compulsion, interpersonal sensitivity...) than heterosexuals; 4) non-heterosexual cybervictims and cyberaggressors displayed more depression and more psychopathological symptoms, but no differences were found in social anxiety. The importance of intervening from the family, school, and society to reduce bullying/cyberbullying and enhance respect for sexual diversity is discussed.

RESUMEN

Acoso y ciberacoso tienen consecuencias muy negativas en la salud mental de los adolescentes. El estudio tuvo dos objetivos: 1) analizar si existen diferencias en función de la orientación sexual (heterosexuales y no-heterosexuales) en el porcentaje de víctimas y agresores de acoso y ciberacoso, así como en la cantidad de conducta agresiva sufrida-realizada; 2) comparar la salud mental de adolescentes heterosexuales y no-heterosexuales que han sido víctimas, agresores, cibervíctimas y ciberagresores. Participaron 1.748 adolescentes del País Vasco, entre 13 y 17 años (52,6% chicas, 47,4% chicos), 12,5% no-heterosexuales, 87,5% heterosexuales, que cumplimentaron 4 instrumentos de evaluación. Se utilizó una metodología descriptiva y comparativa transversal. Los resultados confirman que: 1) el porcentaje de víctimas y cibervíctimas fue significativamente mayor en el grupo no-heterosexual, sin embargo, el porcentaje de agresores y ciberagresores heterosexuales y no-heterosexuales fue similar; 2) víctimas y cibervíctimas no-heterosexuales habían sufrido significativamente más cantidad de conductas agresivas de acoso/ciberacoso; 3) víctimas y agresores de acoso no-heterosexuales comparados con heterosexuales tenían significativamente más depresión, ansiedad social y síntomas psicopatológicos diversos (somatización, obsesión-compulsión, sensibilidad interpersonal...); 4) cibervíctimas y ciberagresores no-heterosexuales también presentaban más depresión y más síntomas psicopatológicos diversos, sin embargo, en ansiedad social no se hallaron diferencias. El debate se centra en la importancia de intervenir desde la familia, la escuela y la sociedad, para reducir el acoso/ciberacoso y estimular el respeto por la diversidad sexual.

KEYWORDS | PALABRAS CLAVE

Bullying, cyberbullying, LGBT-phobia, sexual orientation, prevalence, mental health, homophobia, school violence. Acoso, ciberacoso, LGTB-fobia, orientación sexual, prevalencia, salud mental, homofobia, violencia escolar.

1. Introduction

In recent years, bullying and cyberbullying have aroused considerable social concern and interest in the scientific community. Bullying refers to the existence of a defenseless victim, harassed by one or more aggressors, with power inequality, who frequently engage in aggressive behavior towards the victim (physical, verbal, social exclusion...) with the intention of causing harm.

Cyberbullying is a new type of bullying, which uses information and communication technologies, the Internet (email, messaging, chats, the web, games...) and mobile phones to bully classmates. A review of national and international epidemiological studies has identified a relevant prevalence of bullying and cyberbullying (2-12% victims; 1-10% cybervictims) (Garaigordobil, 2018), along the same lines as the recent study by Save the Children (2016) with adolescent Spaniards (9.3% victims; 6.9% cybervictims). The impact of these behaviors can be devastating. People with a non-normative sexual orientation and identity are a vulnerable population (Poteat & Espelage, 2005), and suffer bullying/cyberbullying and aggressive LGBT-phobic behaviors more frequently. LGBT-phobic bullying refers to bullying motivated by a phobia toward the LGBT population, and homophobia/LGBT-phobia is defined as a hostile attitude of aversion... that considers that a non-normative sexual orientation (homosexual, bisexual, transsexual...) is inferior, pathological..., and that LGBT individuals are sick, unbalanced, delinquents... The study is contextualized within a theoretical framework that considers behavior to be influenced by the social norms prevailing in the socio-cultural environment, and that stereotypes/prejudices fostered by a hetero-normative society stigmatize LGBT individuals, justifying and promoting their bullying, impacting their mental health negatively.

In line with the theory of social identity, in order to maintain a positive social identity, individuals tend to overrate their group, attributing positive characteristics to it, to the detriment of the outgroup, whose stereotype is negative. This categorization and contempt encourage and justify aggressive behaviors toward the other group. Studies show an increase of homophobic insults with age (Espelage & al., 2017), identifying the school context as the main area for their use (Generelo & al., 2012), and the classmates, especially males, playing an important role in the formulation of these insults (Birkett & Espelage, 2015). Given the relevant role of the educational context, it is necessary to assess adolescent attitudes towards sexual diversity and, if necessary, to intervene and reinforce respect and tolerance.

1.1. Prevalence of bullying and cyberbullying in LGBT individuals

In relation to bullying, some research has revealed data ranging from 51% to 58% of victimization in people with non-normative sexual orientation/identity (Generelo, Garchitorena, Montero, & Hidalgo, 2012; Martxueta & Etxeberria, 2014). In cyberbullying, cybervictimization rates between 10% and 71% have been reported in LGBTs (Abreu & Kenny, 2017; COGAM, 2016; Cooper & Blumenfeld, 2012; Kosciw, Greytak, Giga, Villenas, & Danischewski, 2016). The discrepancies between studies are due to the different ages of the samples and the different behaviors measured.

Studies that have focused on comparing victimization levels as a function of sexual orientation suggest that non-heterosexuals suffer a greater amount of bullying compared to heterosexuals (Abreu & Kenny, 2017; Baiocco, Pistella, Salvati, Lovernò, & Lucidi, 2018; Bouris, Everett, Heath, Elsaesser, & Neilands, 2016; Camodeca, Baiocco, & Posa, 2018; Collier, Bos, & Sandfort, 2013; COGAM, 2016; Elipe, De-la-Oliva-Muñoz, & Del-Rey, 2017; Gegenfurtne & Gebhardt, 2017; Toomey & Russel, 2016). Research analyzing the aggressor role from a sexual diversity perspective has focused on the prevalence of aggressors' LGBT-phobic behavior, but it has not compared bullying/cyberbullying perpetration among heterosexuals and non-heterosexuals.

1.2. Bullying/cyberbullying in LGBTs and mental health

Some research has shown that LGBTs who have been victims of bullying and cyberbullying at school show depression and anxiety (Ferlatte, Dulai, Hottes, Trussler, & Marchand, 2015; Martxueta & Etxeberria, 2014; Wang & al., 2018), psychological distress (Birkett, Newcomb, & Mutanski, 2015), and risk of suicide (Cooper & Blumenfeld, 2012; Duong & Bradshaw, 2014; Ferlatte & al., 2015; Luong, Rew, & Banner, 2018; Quintanilla, Sánchez-Loyo, Correa-Márquez, & Luna-Flores, 2015; Ybarra, Mitchell,

Kosciw, & Korchmaros, 2014). Few studies compare heterosexual and non-heterosexual cybervictims and cyber-aggressors in different mental health variables, to explore whether the cyber-victimization of LGBTs is associated with further deterioration of their mental health, compared to health of heterosexual cybervictims and cyber-aggressors.

The studies of Ybarra and others (2014) are worth mentioning. They showed that the relationship between suicidal ideation and bullying was stronger in gays, lesbians and queers, compared to bisexuals, heterosexuals, and those who were uncertain of their sexual orientation. Hence, there is hardly any research that focuses on this differentiation with other mental health variables.

1.3. Objectives and hypotheses

The study had two objectives: 1) to analyze possible differences as a function of sexual orientation (heterosexual and non-heterosexual) in the percentage of victims and

Studies that have focused on comparing victimization levels as a function of sexual orientation suggest that non-heterosexuals suffer a greater amount of bullying compared to heterosexuals.

aggressors of bullying and cyberbullying (victims, aggressors, cybervictims, cyberaggressors) and in the amount of aggressive behavior suffered and performed in both groups; 2) to compare the mental health (depression, social anxiety, interpersonal sensitivity, somatization, phobic anxiety, paranoid ideation...) of heterosexuals and non-heterosexuals who have been victims, aggressors, cybervictims and cyberaggressors. These objectives are formulated in three hypotheses:

- H1. The percentage of victims and cybervictims will be significantly higher in the group of non-heterosexual adolescents, compared to the percentage of victims and cybervictims of the heterosexual group, whereas there will be no differences in the percentage of heterosexual and non-heterosexual aggressors and cyberaggressors.
- H2. The amount of behavior suffered by victims and cybervictims will be significantly higher in the group of non-heterosexuals, compared to the amount suffered by heterosexual victims and cybervictims; however, no differences will be found between the two conditions in the amount of aggressive bullying and cyberbullying behavior performed.
- H3. Compared to heterosexuals, non-heterosexual victims, cybervictims, aggressors, and cyberaggressors will have significantly poorer mental health, which will manifest in more symptoms of depression, social anxiety, increased general psychopathology, and a larger amount of diverse psychopathological symptoms (somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism).

2. Material and methods

2.1. Participants

The study sample is made up 1,748 adolescents aged 13 to 17 years (52.6% girls, 47.4% boys) from 19 schools. Concerning educational level, 60.2% are in 3rd grade of Secondary Education and 39.8% are studying 4th grade (44.7% in public schools and 55.3% in private schools). Regarding sexual orientation, 87.5% are heterosexual, 0.7% are gay, 0.2% are lesbian, 5.7% are bisexual, and 5.9% are unsure of their sexual orientation; that is, 12.5% are non-heterosexual and 87.5% are heterosexual. The sample was selected randomly and is representative of the students of the last cycle of Secondary Education of the Basque Country (N=37.575). Using a confidence level of 0.95, with a sample error of 2.3%, the representative sample is 1,732. A stratified sampling technique was used to select the sample, taking into account the following parameters: province, type of school (public-private), and educational level (3rd and 4th grades).

2.2. Instruments

To measure the variables under study, in addition to a sociodemographic questionnaire requesting information on sexual orientation, four evaluation tools with psychometric guarantees were used.

- **Cyberbullying.** Screening of Peer Harassment (Garaigordobil, 2013; 2017). This assesses bullying and cyberbullying. The bullying scale measures four types of bullying (physical, verbal, social, and psychological), and the cyberbullying scale explores 15 behaviors related to cyberbullying (sending offensive/threatening messages, phoning to insult/threaten, recording an aggression/humiliation and uploading the video, creating rumors to slander, stealing a password, isolating on social networks...). Adolescents report how often they have suffered and performed these behaviors over the course of their lives. Four scores are provided: level of victimization, cybervictimization, aggression, and cyberaggression. The Cronbach alpha coefficients with the original sample show adequate internal consistency (bullying $\alpha=.81$; cyberbullying $\alpha=.91$), as in the sample of this study (bullying $\alpha=.76$; cyberbullying $\alpha=.84$).
- **Beck Depression Inventory-II (BDI-II;** Beck & al.,1996; adaptation of Sanz, García-Vera, Espinosa, Fortún, & Vázquez, 2005). It is composed of 21 items that measure the severity of depression. The items measure symptoms of depression: sadness, pessimism, feelings of failure, loss of pleasure, feeling guilty, feelings of punishment, self-dissatisfaction, self-criticism, thoughts of suicide, crying, agitation, loss of interest, indecision, futility, loss of energy, changes in sleep pattern, irritability, changes in appetite, difficulty concentrating, tiredness or fatigue, and loss of interest in sex. The adolescent reports the degree to which he or she has had these symptoms over the past two weeks. The alpha coefficients with the original sample were adequate ($\alpha=.87$), as in sample of this study ($\alpha=.84$).
- **Social Anxiety Scale for Adolescents (SAS-A;** La-Greca & Stone, 1993; Spanish adaptation Olivares & al., 2005). It is made up of 22 items that evaluate global social anxiety (social phobia) and 3 sub-dimensions: fear of negative evaluation, social avoidance and distress in the face of unknown situations and strangers, and stress in the company of acquaintances. Adolescents report how often (never-always) they have such thoughts, feelings, behaviors... The internal consistency of the test in the original sample was high ($\alpha=.91$), as in the sample in this study ($\alpha=.87$).
- **90-Symptom Checklist-Revised (SCL-90-R;** Derogatis, 2002). This contains 90 items on nine scales that report psychopathological alterations: somatization (experiences of body dysfunction, neurovegetative alterations of the cardiovascular, respiratory, gastrointestinal and muscular systems), obsession-compulsion (absurd and unwanted behaviors, thoughts... that generate intense distress and are difficult to resist, avoid, or eliminate), interpersonal sensitivity (timidity and embarrassment, discomfort and inhibition in interpersonal relationships), depression (anhedonia, hopelessness, helplessness, lack of energy, self-destructive ideas...), anxiety (generalized and acute anxiety/panic), hostility (aggressive thoughts, feelings and behaviors, anger, irritability, rage, and resentment), phobic anxiety (agoraphobia and social phobia), paranoid ideation (paranoid behavior, suspicion, delirious ideation, hostility, grandiosity, need for control...), and psychoticism (feelings of social alienation). A total score is obtained from the summary of the scales of the SCL-90-R (general degree of psychopathology). Studies with Spanish samples suggest good reliability ($\alpha=.81$ to $.90$), as in this study ($\alpha=.97$).

2.3. Procedure

This study uses a descriptive and comparative cross-sectional methodology. Firstly, a letter was sent to the headmasters of the randomly selected schools, explaining the research project. Those who agreed to participate received informed consents for parents and participants. Subsequently, the evaluation team visited the schools and administered the assessment tools to the students (in one 50-minute session). The study fulfilled the ethical values required in human research, having been favorably evaluated by the Ethics Commission of the UPV/EHU (M10_2017_094).

2.4. Data analysis

To determine the prevalence of heterosexual and non-heterosexual victims, cybervictims, aggressors, and cyberbullies, the frequencies/percentages of students who had suffered and engaged in bullying/cyberbullying frequently (fairly often + always) were calculated and, through contingency analysis, the Pearson Chi square was obtained to compare the two conditions. Second, to identify possible differences as a function of sexual orientation in the four indicators of bullying/cyberbullying (victimization, cybervictimization, aggression, cyberaggression), descriptive analysis (means and standard deviations), analysis of univariate variance, and effect size analysis (Cohen's d : small $< .50$; moderate $.50$ -.79; large $\geq .80$) were performed with the scores of the heterosexuals and non-heterosexuals. Finally, to explore possible differences according to sexual orientation (heterosexuals and non-heterosexuals) in various psychopathological symptoms (mental health), first, we selected the sample of bullying victims (who had reported having suffered aggressive bullying during their lifetime), and we performed an analysis of variance (MANOVA, ANOVA) as a function of heterosexual and non-heterosexual group membership. The same procedure was performed with cybervictims, aggressors, and cyberaggressors, respectively. Data analysis was performed with the SPSS 24.0 program.

3. Results

3.1. Prevalence of heterosexual and non-heterosexual victims and cybervictims

The percentages of heterosexual and non-heterosexual students who had frequently (fairly often + always) suffered bullying and cyberbullying were: 1) severe victims: 11% ($n=193$) of the victims had suffered bullying frequently over the course of their lives. The percentage of severe heterosexual and non-heterosexual victims of the sample in each sexual orientation group was 9% heterosexuals ($n=138$) and 25.1% non-heterosexuals ($n=55$). The percentage of victims was significantly higher in the non-heterosexual group ($X^2=50.48$, $p<.001$); 2) severe cybervictims: 7.2% ($n=126$) of the victims had frequently suffered cyberbullying. The percentage of severe heterosexual and non-heterosexual cybervictims of the sample in each sexual orientation group was 6.2% heterosexuals ($n=95$) and 13.7% non-heterosexuals ($n=30$). The percentage of cybervictims was significantly higher in the non-heterosexual group ($X^2=16.16$, $p<.001$). Thus, the percentage of victims and cybervictims was significantly higher in the non-heterosexual group, compared to the percentage of victims and cybervictims of the heterosexual group.

3.2. Prevalence of heterosexual and non-heterosexual aggressors and cyberaggressors

The percentages of heterosexual and non-heterosexual students who had frequently performed (fairly often + always) bullying and cyberbullying were: 1) severe aggressors: 2.7% ($n=47$) had frequently performed bullying behaviors. The percentage of severe heterosexual and non-heterosexual aggressors in the sample of each sexual orientation group was 1.7% heterosexuals ($n=38$) and 0.9% non-heterosexuals ($n=9$). No significant differences were found as a function of sexual orientation ($X^2=0.75$, $p>.05$); 2) severe cyberaggressors: 1.6% ($n=28$) had frequently engaged in cyberbullying behaviors. The percentage of severe heterosexual and non-heterosexual cyberaggressors of the sample in each sexual orientation was 1.7% heterosexuals ($n=26$) and 0.9% non-heterosexuals ($n=2$). No significant differences were found ($X^2=0.75$, $p>.05$). Thus, the percentage of adolescent heterosexual and non-heterosexual aggressors and cyberaggressors was similar.

3.3. Victimization, cybervictimization, aggression, and cyberaggression levels

Concerning differences in the level of victimization and cybervictimization as a function of sexual orientation, the results (Table 1) show that, compared to heterosexuals, non-heterosexual victims/cybervictims had suffered a significantly greater amount of aggressive bullying and cyberbullying (moderate effect size in victimization). In relation to the level of aggression and cyberaggression (Table 1), the results show that the amount of face-to-face aggressive behavior performed was significantly higher in the non-heterosexual group, but the amount of cyberbullying behavior performed was similar in the two groups.

Table 1. Means, standard deviations, analysis of variance, and effect size (Cohen's d) in indicators of bullying and cyberbullying in heterosexuals and non-heterosexuals

	Heterosexuals (n=1.529)	Non-heterosexuals (n=219)	F (p)	d
	M (SD)	M (SD)		
Victimization	0.84 (1.53)	1.96 (2.19)	89.71 (.000)	.59
Cybervictimization	0.92 (2.03)	1.99 (3.32)	43.83 (.000)	.38
Aggression	0.44 (0.92)	0.60 (0.97)	5.26 (.022)	.16
Cyberaggression	0.35 (1.43)	0.42 (1.52)	0.49 (.486)	.04

Notes. M=Mean, SD=Standard deviation, F=Fisher's F, p=Significance, d=Effect size.

In short, non-heterosexual victims and cybervictims had suffered significantly more aggressive bullying and cyberbullying behaviors during their lifetime. Non-heterosexual aggressors had performed a significantly greater amount of aggressive face-to-face behaviors, although no differences were found in the amount of behavior performed by cyberaggressors in the two conditions.

Table 2. Means, standard deviations, analysis of variance, and effect size (Cohen's d) of psychopathological symptoms as a function of sexual orientation in victims and cybervictims

Variables	Victims				Cybervictims			
	Hetero (n=574)	Non-Hetero (n=149)	F (p)	d	Hetero (n=515)	Non-Hetero (n=117)	F (p)	d
	M (SD)	M (SD)			M (SD)	M (SD)		
Total BDI-II	10.19 (8.23)	14.03 (9.55)	23.99 (.000)	.43	10.74 (8.34)	13.95 (9.19)	13.58 (.000)	.36
SAS Negative E.	20.45 (6.88)	21.56 (7.99)	2.85 (.092)	.15	20.37 (7.13)	21.04 (7.93)	0.81 (.370)	.09
SAS A. Strangers	16.61 (4.98)	17.53 (5.62)	3.79 (.005)	.17	16.48 (5.13)	17.09 (5.53)	1.29 (.255)	.11
SAS A. Acquaintances	8.23 (3.26)	9.11 (3.78)	8.04 (.017)	.25	8.05 (3.28)	8.79 (3.80)	4.52 (.034)	.21
Total SAS	45.30 (12.69)	48.20 (15.06)	5.70 (.000)	.21	44.90 (13.23)	46.91 (15.37)	2.08 (.255)	.14
SCL90 Somatization	10.93 (7.99)	14.60 (9.19)	23.35 (.000)	.43	11.36 (7.96)	14.82 (9.41)	16.85 (.034)	.40
SCL90 Obs-Comp.	12.48 (7.94)	16.10 (8.52)	23.81 (.000)	.44	12.74 (8.17)	15.97 (8.65)	14.58 (.150)	.38
SCL90 Interp. Sens.	8.54 (7.15)	10.96 (7.42)	13.36 (.000)	.33	8.58 (6.90)	10.81 (7.72)	9.52 (.000)	.30
SCL90 Depression	11.35 (9.61)	16.74 (11.31)	34.49 (.000)	.51	11.63 (9.70)	16.14 (10.99)	19.55 (.000)	.44
SCL90 Anxiety	7.15 (7.34)	9.88 (9.09)	14.75 (.000)	.33	7.28 (7.48)	9.74 (9.42)	9.31 (.002)	.29
SCL90 Hostility	5.36 (5.01)	6.85 (5.64)	9.83 (.002)	.28	5.65 (5.26)	6.94 (5.77)	5.49 (.019)	.23
SCL90 Phobic-Anx.	2.86 (3.84)	4.07 (4.99)	10.23 (.001)	.27	3.03 (3.86)	4.42 (5.43)	10.42 (.001)	.30
SCL90 Paranoid	5.54 (4.66)	7.26 (5.06)	15.43 (.000)	.35	5.58 (4.68)	7.25 (5.14)	11.67 (.001)	.34
SCL90 Psychoticism	4.73 (5.80)	7.30 (7.06)	21.19 (.000)	.40	4.80 (5.80)	7.28 (7.18)	15.94 (.000)	.38
Total SCL90	68.95 (47.28)	93.75 (53.87)	30.67 (.000)	.49	70.65 (47.50)	93.37 (55.48)	20.44 (.000)	.44

Notes. Hetero=Heterosexuals, Non-Hetero=Non-Heterosexuals, M=Mean, SD=Standard deviation, f=Fisher's F, p=Significance, d=Effect size, SAS Negative E=Fear of negative evaluation, SAS A. Strangers=Avoidance of strangers, SAS A. Acquaintances=Avoidance of acquaintances, Total SAS=Global Social Anxiety score, Obs-Comp=Obsession-Compulsion, Interp. Sens=Interpersonal sensitivity, Phobic-Anx= Phobic anxiety, Total SCL90=Global Psychopathology Score.

3.4. Victimization and cybervictimization in the mental health of adolescent LGBTs

Regarding differences in psychopathological symptoms between victims and cybervictims as a function of sexual orientation (heterosexuals, non-heterosexuals), the multivariate analyses of variance (MANOVA)

performed with all the mental health variables revealed significant differences between heterosexual and non-heterosexual bullying victims, Wilks' Lambda, $\Lambda=0.942$, $F(13,708)=3.36$, $p<.001$ (small effect size, $\eta^2=0.058$, $r=0.24$). The same results were found in cybervictims, Wilks' Lambda, $\Lambda=0.953$, $F(13,618)=2.34$, $p<.05$ (small effect size, $\eta^2=0.047$, $r=0.22$). The results of the descriptive, univariate and effect size analyses of each variable are presented in Table 2. Non-heterosexual victims and cybervictims presented significantly more psychopathology than heterosexual victims/cybervictims (moderately low and low effect size).

Table 3. Means, standard deviations, analysis of variance, and effect size (Cohen's d) of psychopathological symptoms as a function of sexual orientation in aggressors and cyberaggressors

Variables	Aggressors				Cyberaggressors			
	Hetero (n=413)	Non-Hetero (n=81)	F (p)	d	Hetero (n=268)	Non-Hetero (n=47)	F (p)	d
	M (SD)	M (SD)			M (SD)	M (SD)		
Total BDI-II	9.47 (7.91)	13.91 (9.16)	20.29 (.000)	.52	10.65 (8.57)	14.94 (9.88)	9.53 (.002)	.46
SAS	19.71 (6.77)	21.02 (7.40)	2.47 (.117)	.18	19.81 (6.91)	21.53 (8.49)	2.31 (.129)	.22
SAS Negative E.	16.24 (5.03)	17.49 (5.54)	4.09 (.044)	.24	16.60 (4.98)	17.55 (5.96)	1.39 (.239)	.17
SAS A. Strangers	8.05 (3.19)	8.88 (3.19)	4.49 (.035)	.26	8.03 (3.08)	9.13 (3.98)	4.59 (.033)	.31
SAS A. Acquaintances	44.00 (12.52)	47.40 (13.73)	4.81 (.029)	.26	44.44 (12.65)	48.21 (16.39)	3.24 (.073)	.26
Total SAS	10.77 (7.91)	15.19 (9.76)	19.45 (.000)	.50	12.04 (7.99)	13.72 (7.59)	1.79 (.181)	.22
SCL90 Somatization	12.17 (8.16)	16.63 (7.49)	20.72 (.000)	.57	13.19 (8.31)	16.32 (8.61)	5.59 (.019)	.37
SCL90 Obs-Comp.	7.97 (6.86)	11.17 (7.63)	14.17 (.000)	.44	9.06 (7.32)	11.36 (8.39)	3.76 (.053)	.29
SCL90 Interp. Sens.	10.50 (9.44)	16.64 (11.10)	26.95 (.000)	.60	11.82 (9.69)	16.17 (11.85)	7.51 (.007)	.40
SCL90 Depression	6.67 (7.13)	10.14 (9.66)	14.13 (.000)	.41	7.46 (7.71)	10.68 (9.19)	6.56 (.011)	.38
SCL90 Anxiety	5.60 (5.21)	7.27 (6.05)	6.62 (.010)	.30	6.28 (5.49)	8.96 (6.80)	8.79 (.003)	.43
SCL90 Hostility	2.59 (3.62)	4.42 (4.92)	15.09 (.000)	.42	2.99 (4.03)	5.19 (5.99)	10.17 (.002)	.43
SCL90 Phobic-Anx.	5.39 (4.71)	7.41 (4.89)	12.29 (.000)	.42	5.66 (4.79)	7.38 (5.55)	4.90 (.028)	.33
SCL90 Paranoid	4.54 (5.77)	8.30 (7.21)	26.30 (.000)	.58	4.76 (5.55)	8.51 (8.56)	15.14 (.000)	.52
SCL90 Psychoticism	66.20 (47.03)	97.16 (53.06)	28.08 (.000)	.63	73.28 (48.71)	98.30 (60.53)	9.76 (.002)	.46
Total SCL90								

Notes. Hetero=Heterosexuals, Non-Hetero=Non-Heterosexuals, M=Mean, SD=Standard deviation, f=Fisher's F, p=Significance, d=Effect size, SAS Negative E=Fear of negative evaluation, SAS A. Strangers=Avoidance of strangers, SAS A. Acquaintances=Avoidance of acquaintances, Total SAS=Global Social Anxiety score, Obs-Comp=Obsession-Compulsion, Interp Sens=Interpersonal sensitivity, Phobic-Anx= Phobic anxiety, Total SCL90=Global Psychopathology Score.

The analyses of variance (Table 2) confirmed that non-heterosexual victims (compared to heterosexual victims) showed significantly higher scores in depression (BDI-II), global social anxiety (SAS) (avoidance and social distress with acquaintances and strangers), in all the psychopathological symptoms of the SCL-90 (somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism), as well as in the global psychopathology score. Non-heterosexual cybervictims (compared to heterosexuals) (Table 2) obtained significantly higher scores in depression (BDI-II) and in all the psychopathological symptoms evaluated with the SCL-90 except for obsession-compulsion.

However, non-heterosexual cybervictims had a similar level of global social anxiety (social phobia) to the heterosexual cybervictims, although their anxiety in the presence of acquaintances was higher.

3.5. Differential mental health of adolescent LGBT aggressors and cyberaggressors

Regarding the differences in psychopathological symptoms between aggressors and cyberaggressors as a function of sexual orientation (heterosexuals, non-heterosexuals), the multivariate analyses of variance (MANOVA) with all the mental health variables yielded significant differences between heterosexual and non-heterosexual aggressors, Wilks' Lambda, $\Lambda=0.923$, $F(10,479)=3.07$, $p<.001$ (small effect size, $\eta^2=0.07$, $r=0.27$). The same results were found in cyberaggressors, Wilks' Lambda, $\Lambda=0.923$, $F(13,300)=1.92$, $p<.05$ (small effect size, $\eta^2=0.077$, $r=0.28$).

Consequently, non-heterosexual aggressors and cyberaggressors generally present significantly more psychopathology than heterosexual aggressors and cyberaggressors. The results of the descriptive, univariate, and effect size analyses in each variable under study are presented in Table 3.

As can be seen (Table 3), non-heterosexual aggressors (compared to heterosexuals) had significantly more depression (BDI-II), more social anxiety (SAS), more psychopathological symptoms evaluated with the SCL-90 (somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism), and a higher global psychopathology score. Non-heterosexual cyberaggressors had significantly more depression (BDI-II) and more psychopathological symptoms (obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism), except for symptoms of somatization. No differences were found in global social anxiety between heterosexual and non-heterosexual cyberaggressors (moderate effect size in depression and global psychopathology score).

4. Discussion and conclusions

The objective of the study was to analyze possible differences as a function of sexual orientation (heterosexuals and non-heterosexuals) in the percentage of victims and aggressors of bullying and cyberbullying, and in the amount of aggressive behavior they suffer and perform it also compares the mental health of heterosexuals and non-heterosexuals who have been victims, aggressors, cybervictims, and cyber-aggressors.

Firstly, the results confirm that the percentage of victims and cybervictims was significantly higher in non-heterosexual adolescents, compared to the percentage of heterosexual victims and cybervictims. However, the percentage of heterosexual and non-heterosexual aggressors and cyberaggressors was similar. Hypothesis one is confirmed. In addition, the overall prevalence of bullying and cyberbullying found in this study (11% victims; 7.2% cybervictims) confirms the prevalence found in recent epidemiological reviews and studies (Garaigordobil, 2018; Save the Children, 2016).

Secondly, the results show that non-heterosexual victims/cybervictims, compared to heterosexual victims/cybervictims, had suffered a greater amount of aggressive bullying and cyberbullying. Non-heterosexual aggressors had engaged in significantly more bullying behaviors, although no differences were found in cyberaggressors. Hypothesis two is partially confirmed, as non-heterosexual aggressors were also found to engage in a greater amount of aggressive bullying than heterosexuals.

The high vulnerability of people who do not match the stereotypes based on hetero-normativity is confirmed. The results point in the same direction as other studies that have shown that the LGBT collective is more vulnerable to bullying and cyberbullying (Abreu & Kenny, 2017; Baiocco & al., 2018; Birkett & al., 2009; Bouris & al., 2016; Camodeca & al., 2018; Collier & al., 2013; COGAM, 2016; Elipe & al., 2017; Gegenfurtne & Gebhardt, 2017; Pichardo & al., 2002; Shields & al., 2012; Toomey & Russel, 2016). As there are no studies comparing the prevalence of aggressors/cyberaggressors between heterosexuals and non-heterosexuals, the results of this study contribute to the knowledge.

Third, the results show that non-heterosexual victims and aggressors (compared to heterosexual victims and aggressors) have significantly more depression, social anxiety, and more psychopathological symptoms in all the scales (somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism). Non-heterosexual cybervictims

and cyberaggressors (compared to heterosexuals) present significantly more depression and more psychopathological symptoms (interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism). No differences were found in global social anxiety between heterosexual and non-heterosexual cybervictims and cyberaggressors. Hypothesis three is almost entirely confirmed, as greater social anxiety was not found in non-heterosexual cybervictims and cyberaggressors.

Therefore: 1) non-heterosexual victims and aggressors (versus heterosexuals) show more symptoms in all the evaluated psychopathological disorders (somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, social anxiety); 2) non-heterosexual cybervictims and cyberaggressors (versus heterosexuals) have more psychopathological symptoms (interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism), although they do not have more social anxiety; in addition, non-heterosexual cybervictims do not have more symptoms of obsession-compulsion, nor do cyberaggressors show more somatization; 3) non-heterosexual victims have greater anxiety/social phobia than non-heterosexual cybervictims.

Although there are no prior studies comparing diverse psychopathological symptoms in heterosexuals and non-heterosexuals who have suffered and/or performed bullying/cyberbullying—which is a contribution of this work—the results obtained confirm those found in research that has revealed psychopathological symptoms in victims with a non-normative sexual orientation that also found depression and anxiety (Ferlatte & al., 2015; Martxueta & Etxebarria, 2014; Wang & al., 2018).

The study provides data on the prevalence of LGBT-phobic bullying/cyberbullying and shows that LGBTs, in addition to being bullied/cyberbullied more frequently, also develop more psychopathological symptoms due to the victimization/cybervictimization they suffer than do heterosexuals who are bullied/cyberbullied. Among the limitations of the study are: 1) the use of self-reports with the desirability bias involved; 2) although there is greater visibility of LGBTs, many people still conceal their sexuality. If this is a reality in the general population, adolescents find it even more difficult to identify themselves as non-heterosexual. Hence, in the study emerged a percentage of adolescents who are uncertain about their sexuality and who were included in the non-heterosexual group, as other researchers have done; 3) the cross-sectional nature of the study, which does not allow causal inferences. Future studies could analyze the role of victim-aggressor, expand the LGBT sample, perform analyses as a function of age and gender, and design anti-bullying programs based on stigma, evaluating their effects on the stereotypes and prejudices towards LGBTs.

Both aggressive behavior towards sexual diversity and the internalized discrimination that characterizes LGBTs can be considered as the result of a society that is educated by a hetero-normative system. Children are not born as homophobes, they are modeled since their birth through messages received from their family, school, and social environment. Therefore, it is necessary to educate in sexual orientation/identity from different contexts, so that children grow up respecting differences in general and sexual diversity in particular. The results have practical implications and suggest the need to develop specific activities during childhood and adolescence that stimulate respect and tolerance for sexual diversity and activities within anti-bullying programs that address LGBT-phobic bullying/cyberbullying due to non-hetero-normative sexual orientation/identity. Among these programs, we can mention Cyberprogram 2.0, an intervention program to prevent cyberbullying that addresses bullying due to sexual orientation (e.g., open cyber-secrets, sexting, false promises...). The program has been evaluated experimentally, confirming a reduction in bullying and cyberbullying (Garaigordobil & Martínez-Valderrey, 2014; 2015; 2018).

Earnshaw and others (2018) observe an increase in interventions to address stigma-based bullying (against young LGBTQs, overweight or disabled youth...). Although many Spanish schools carry out anti-bullying activities, few programs contain specific strategies to reduce stereotypes and prejudices, which are needed to address stigma-based bullying. Future intervention proposals should include such strategies to address the bullying of stigmatized groups.

Finally, we underline that interventions to reduce stigmatization and bullying/cyberbullying of LGBTs should be multidirectional. Family education in tolerance for diversity plays a key role. School is a relevant context for anti-bullying activities that focus on vulnerable groups, promoting tolerance for diversity. A third axis of intervention should be society in general, as the norms and values it promotes condition

behavior. It is important to spread messages of tolerance through the mass media (TV, radio, press, Internet, social networks...), as these media are privileged tools to promote empathy and tolerance towards diversity in general and sexual diversity in particular, eliminating stereotypes and prejudices. However, clinical intervention should not be forgotten because of the risk of suicide of people suffering from LGBT-phobic bullying/cyberbullying.

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Self-perception about emerging digital skills in Higher Education students

Autopercepción sobre habilidades digitales emergentes en estudiantes de Educación Superior

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ABSTRACT

The current labor market demands new qualities and knowledge from recent university graduates, including digital skills, and there is not enough research on the self-perception of students in this regard. The objective of this study was to measure student self-perception about their own 21st century digital skills related to the use of information and communication technologies (ICT) in Higher Education. A questionnaire was generated and applied to 356 students with the stratified random sampling technique. A principal component analysis was carried out, supported by adequate values of the Kaiser-Meyer-Olkin coefficient and the Bartlett sphericity test. The data indicate that students primarily use digital technology in academic projects and are quite skillful when using ICT for information management, to develop critical thinking and to solve problems, as well as to manage mobile devices. However, their self-perception in the use of ICT in teaching classes is low. The results suggest that the students do not believe that the use of ICT in the classroom is useful for developing this type of emerging digital skills. On the other hand, they think that carrying out academic projects does strengthen the acquisition and development of such skills in relation to the use of ICT.

RESUMEN

El mercado laboral actual exige nuevas cualidades y conocimientos a los recién egresados de las universidades, incluidas las habilidades digitales, no existiendo suficientes investigaciones sobre la autopercepción del estudiantado al respecto. El objetivo de esta investigación fue medir la percepción que el estudiantado tiene sobre sus propias habilidades digitales del siglo XXI, en relación con el uso de las tecnologías de la comunicación (TIC) en la Educación Superior. Se generó y aplicó un cuestionario a 356 estudiantes con la técnica de muestreo aleatorio estratificado. Se realizó un análisis de componentes principales avalado por valores adecuados del coeficiente Kaiser-Meyer-Olkin y de la prueba de esfericidad de Bartlett. Los datos indican que el estudiantado usa la tecnología digital en proyectos académicos primordialmente, y posee alta habilidad al usar las TIC para la gestión de información, para desarrollar pensamiento crítico y para resolver problemas, así como para manejar dispositivos móviles. Sin embargo, su autopercepción es baja respecto al uso de las TIC en la impartición de clases. Los resultados sugieren que el estudiantado no cree que el uso de las TIC en el aula sea útil para desarrollar este tipo de habilidades digitales emergentes. En cambio, indican que la realización de proyectos académicos sí fortalece la adquisición y desarrollo de tales habilidades en relación con el uso de las TIC.

KEYWORDS | PALABRAS CLAVE

Emerging digital skills, factorial analysis, principal component analysis, higher education, ICT, survey, self-perception. Habilidades digitales emergentes, análisis factorial, análisis de componentes principales, educación superior, TIC, encuesta, autopercepción.

1. Introduction

1.1. 21st century skills and 21st century digital skills

Some years ago, university graduates only had skills that would not be considered enough to compete in today's knowledge economy. Nowadays, new arrivals on the labour market are required to have both "hard" and "soft" skills; the latter also being known as "21st century skills". The Organization for Economic Co-operation and Development (OECD) defines these as being necessary for young people to become effective workers in the present knowledge society (Ananiadou & Claro, 2009). The 21st century skills often mentioned in research studies, as in those by Wegerif & Mansour (2010), Fullan & Langworth (2013), Anderson (2010) and the World Economic Forum (Schwab, 2016) are the following: communication, critical thinking, creativity, collaboration, problem-solving and technological competencies.

In addition, the correct and efficient use of the information and communication technologies (ICT) requires new graduates to also possess an additional capacity, which consists of having the soft skills, but developed through the ICT which are known as the "21st century digital skills". These are necessary to be able to participate in the labour market, which is based on the knowledge economy, and to make these professionals responsible for their own learning, taking the most advantage of the ICT (Van-Laar, Van-Deursen, Van-Dijk, & de-Haan, 2017). Van-Laar and others (2017) specifically define "21st century digital skills" as: technical skill, information management, communication, collaboration, creativity, critical thinking and problem solving, all within the context of digital technologies.

Although the Higher Education institutions can collaborate in promoting the development of these skills in university students, there is still a gap between what is taught in Higher Education, and what the productive sector needs (Intel-Microsoft-Cisco Education Taskforce, 2009). Due to this, research on the skills forged at the universities and those required by the labour market is extremely important for educational research (Ramos, 2015). The above-mentioned gap is more pronounced in the developing countries, and at the same time, it holds back their preparation for full entry into the knowledge economy (Alfaki, 2016). In this way, the "21st century skills" is an emerging topic in educational research, so that they can be classified as emerging digital skills, since they represent the appearance of a construct supported by digital technology. Therefore, from now on we will use the term "Emerging digital skills" to refer to the "21st century digital skills".

1.2. Use of ICT in Higher Education

In a previous qualitative study on ICT in Higher Education by two of the present authors (León-Pérez & Escudero-Nahón, 2017), three main constructs were defined: academic projects, the use of ICT by teachers, and the use of ICT by students. The study method was based on analyzing the strategic planning of a leading Mexican university and semi-structured interviews with the heads of faculties in the same university. The information obtained was analyzed by thematic coding, a strategy based on constant comparison, which segments and categorizes the data by a reduction technique to capture the important concepts and is known as thematic analysis (Given, 2008: 867).

The results of the study indicated that the way in which teachers and students use ICT influences the development of their digital skills. They also found that teachers used ICT's didactic dimension only at a basic level, e.g. solely as a substitute for a blackboard and chalk, basically because many teachers find it difficult to adapt to new technologies and thus are reluctant to use them in class. It was also found that academic projects are an important transversal element as regards topics and participants (both students and teachers) from different branches of knowledge.

On the other hand, the present student community in Higher Education is composed of the so-called "digital natives", who are able to make complex and confident use of digital devices and technologies; in addition, the so-called "millennials" have little faith in organizations and are highly independent (Alvarez, Najarro, & Paredes, 2017; Pardue & Morgan, 2008). However, this does not mean that this generation makes correct use of the ICT in education. In fact, they often only use digital technology to look for, select and use quality information on the Internet at best, and at worst, they become confused by it. In any case, their confidence and ability to use the technology does not enable them to build knowledge autonomously.

1.3. Perception studies

Although observational studies are a good method of measuring skills, they are costly and time-consuming, which limits their application to large-scale data collection (Van-Deursen, Van-Dijk, & Peters, 2012), while “the measurement of perceptions, opinions, and attitudes of people do not replace events or behaviors measured in objective terms. However, it manages to capture information on issues and events of reality under investigation that could not be otherwise obtained” (Mazziotta & Pareto, 2012: 17).

Some studies have used perceptions to reach important conclusions on the subject of education, such as that by Conchado, Carot & Bas (2015), who define the competencies required for knowledge management; or the one by Pérez-Mateo, Romero & Romeu-Fontanillas (2014), who analyze the acquisition of digital competencies; or the study by Cabero & Marín (2014), who aim to determine students’ perception of social software and collaborative teamwork. The aim of the present study was to measure students’ self-perception of their emerging digital skills in relation to the use of ICT in Higher Education.

2. Materials and methods

2.1. Participants

The study population consisted of 4237 students from the Universidad Autónoma de Querétaro (UAQ) who had studied at least six semesters of their degree course at the City of Querétaro campus in Mexico.

The sample size was calculated for a 95% confidence level and 5% margin of error, giving a total of 356 observations, of which 59.5% were females and 40.5% males. The mean age of the participants was 22 years and 9 months, with a standard deviation of 2 years 3 months.

The sampling technique used was the simple stratified random sampling. Each of the university’s 13 faculties was considered a stratum, and the number of observations per faculty was proportional to the number of students in each faculty. Randomness was ensured by drawing names from those in the different semesters until reaching the necessary sample number for each faculty.

2.2. Measures

Since questionnaires are the tools most frequently used to measure perceptions, a questionnaire was given to the Higher Education students on the subject of their emerging digital skills, and how they used the ICT.

The questionnaire’s underlying theoretical framework consisted of two blocks: the first contained the concepts of digital skills by Van-Laar and others (2017), and the second was a study of the use of ICT in Higher Education by (León-Pérez & Escudero-Nahón, 2017).

Category	Indicators (items)
Problem solving with ICT	1-2
Technical skill with mobile devices	3-7
Collaboration with ICT	8-9
Critical thinking aided by ICT	10-22
Creativity through ICT	23-34
Communication by ICT	35-48
Information management by ICT	49-54
Academic projects	55-58
Use of ICT by students	59-66
Use of ICT by teachers	67-72

To define the indicators in the first block, a search was made for instruments that explicitly measured the emerging digital skills dealt with in this study without success, as the nearest approach involved only instruments for measuring digital competencies. However, there is a considerable number of instruments for measuring “21st century skills” that have been validated and published in scientific journals.

The principles of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2010) were followed in order to choose

from these instruments those that present a solid method and a well structured validity process. For the communication skill based on systematic revision (León-Pérez, Escudero-Nahón, & Bas, 2019), the instrument proposed by Wilkins, Bernstein & Bekki (2015) was chosen.

The instruments that deal with collaboration skills (Van-de-Ven & Ferry, 2000), creativity (Kaufman, 2012), technical skill (Van-Deursen & al., 2012), information management (Van-Deursen & al., 2012), and critical thinking (Sosu, 2013) were selected in the same way.

The chosen instruments were then adapted to generate indicators adapted to the theoretical framework. Problem solving was the only skill for which a suitable instrument could not be found, so that the items were based on the literal definition of the theoretical framework. The definition of the items in the second block was also based exclusively on the theoretical framework.

The instrument was composed of 76 items: 4 of these requested descriptive data (faculty, degree course, age and sex) and 72 were indicators, and used a Likert scale with 5 options (ranging from “Very high” to “Very low”). The categories of the theoretical framework included in the instrument are given in Table 1.

The contents were validated by two procedures: 1) revision of the theoretical models on which the original instruments were based, and 2) evaluation by experts from the Universidad Autónoma de Querétaro and the Universitat de València, from both the area of the redaction and validation of instruments and from the area of ICT.

A pilot test was also carried out on 51 students from four faculties and was used to change the wording of items that were not easily comprehensible, to ensure inclusive language and determine the average response time (17 minutes). The Cronbach’s alpha of the pilot test data was calculated as 0.956, which reflected a high degree of internal consistency. Construct validity was by factorial analysis (described below), and its results are given in the corresponding Section.

2.3. Procedure

All the faculty heads consented to the application of the questionnaire by means of a face-to-face survey of 356 students to guarantee complete responses, since the voluntary support by an online application involved a risk of the non-participation of the students.

The questionnaire was printed on both sides of two sheets of letter-size paper and was applied by the authors during a period of 45 days.

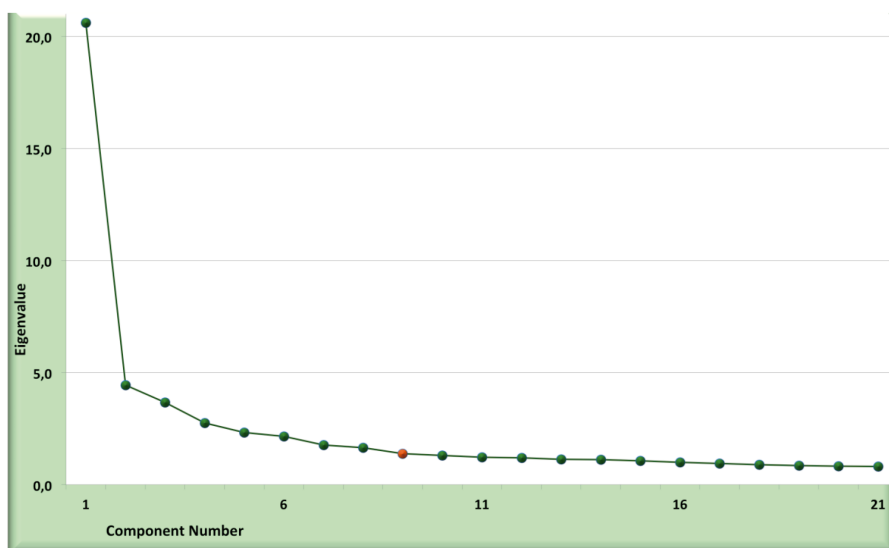
3. Analysis and results

Principal Component Analysis (PCA) can be used to obtain the minimum quantity of components that explain most of the total observed variability in a set of variables. The following values were calculated to determine whether it was possible to apply a factorial analysis to the data:

- The Kaiser-Meyer-Olkin coefficient (KMO), which compares the observed correlation coefficient values with the partial correlation coefficients, giving a result of 0.925.
- Anti-image correlation matrix, to determine whether the partial correlations were low and also the factors underlying the set of indicators. Almost 99% of the absolute matrix values of the anti-image were below 0.3, and the diagonal values (measures of sampling sufficiency of individual indicators) were all around 0.8.
- Bartlett’s sphericity test, to check the hypothesis that the correlation matrix was an identity matrix, obtaining a significance level well below 0.05 and $\chi^2=15339$, which allowed the rejection of the null hypothesis that the variables were not correlated.

The results indicated that a factorial analysis could be carried out on the data. The principal component analysis started by defining the appropriate quantity of components, for which the drop contrast criterion or Castell’s elbow test, which analyzes the sedimentation graph (Figure 1) and detects the point at which the component curve becomes almost horizontal, which was determined to be component 9. The vertical axis (self-value) indicates the quantity of variance explained by each factor on the horizontal axis. The first nine components (principal components) explain 56.36% of the total variance.

Figure 1. Sedimentation graph of the PCA application



The rotation varimax method was chosen to generate the component matrix. This is an orthogonal rotation of the factorial axes to ensure that the correlation of all the variables is as close as possible to 1 with only one factor and almost null with the rest. This was used to delineate the groups of indicators corresponding to each principal component (factor), which were assigned a name according to the category of the theoretical framework from which the indicators proceeded (see Table 1). Since the emerging digital skills include the ICT by definition, the factors were named without explicitly mentioning them when this was possible. The factors identified by the PCA were: “Communication”, “Critical thinking and problem solving”, “Technical skills”, “Use of ICT by teachers”, “Information management”, “General creativity”, “Technical creativity”, “Academic projects”, “Use of ICT by students”, about each of which information is given in Table 2.

Table 2. Resulting factors of Principal Component Analysis by varimax rotation

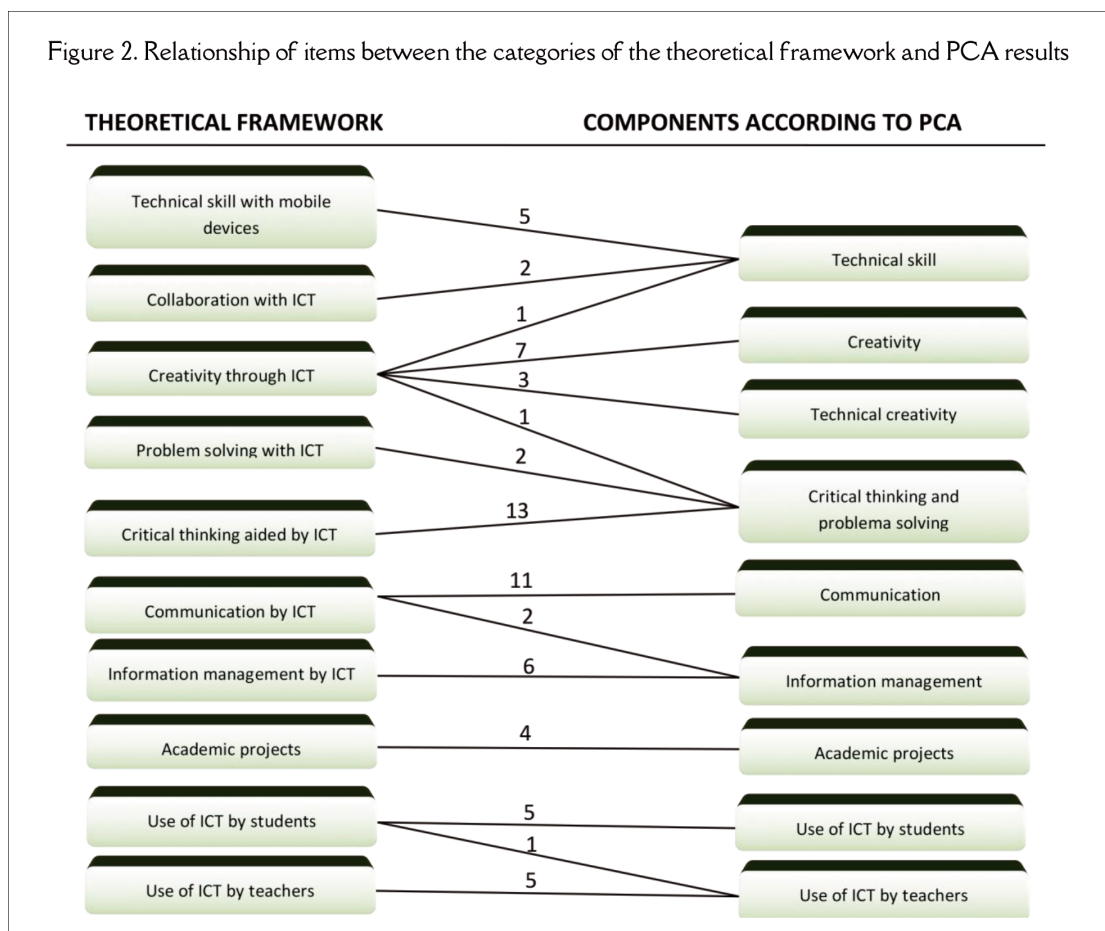
Factor	Indicators (items)	Percentage of explained variance	Cronbach's alpha
Communication	38-48	28.62%	0.932
Critical thinking and problem solving	1, 2, 10-23	6.174%	0.902
Technical skill	3-9, 34	5.098%	0.843
Use of ICT by teachers	65-72	3.822%	0.550
Information management	36, 37, 49-54	3.243%	0.857
General creativity	24-30, 35	2.994%	0.854
Technical creativity	31, 32, 33	2.468%	0.795
Academic projects	55-58, 63	2.021%	0.753
Use of ICT by students	59-62, 64	1.927%	0.720

The nine factors identified were very similar to the constructs defined by the underlying theoretical framework. In fact, the only factor generated was “Technical creativity”, which came from the “Creativity” construct (labelled here as “General creativity”), and the only non-resulting factor in the PCA as regards the underlying theoretical framework was “Collaboration with ICT”, considered within “Technical creativity” (see Fig.2), i.e. students consider that their ICT skills (especially on mobile devices) include the capacity to establish collaboration processes with others, probably by means of the continuous and extensive use of social networks. The indicators for the constructs “Problem solving” and “Critical thinking” were grouped within a single component.

Table 3. Items eliminated based on PCA results			
Item	Indicator	Theoretical framework construct	Factor in which included by the PCA
35	Communication of information and ideas to multiple audiences	Communication by ICT	General creativity
63	Percentage use of ICT in academic activities	Use of ICT by students	Academic projects
65	Improvement in use of ICT during the degree course	Use of ICT by students	Use of ICT by teachers
71	Teachers' dependence on ICT	Use of ICT by teachers	Use of ICT by teachers

Communication is the factor that best explained most of the variance, while the use of ICT by students was the last factor selected and explains the smallest quantity of the variance. All the factors have a high Cronbach's alpha, except the use of ICT by teachers, which, represents acceptable internal consistency although it is the lowest.

Figure 2. Relationship of items between the categories of the theoretical framework and PCA results



From the first results, an analysis was made of the indicator distribution of the diverse factors. This eliminated four items from the instrument, due to the content concept in the item not completely fitting in with the factor assigned by the PCA (items 35 and 36), probably due to ambiguous interpretation by the subjects of the survey (item 63) and to raise the Cronbach's alpha value (item 71). The items eliminated are given in Table 3.

After eliminating the items, the Cronbach's alpha of each factor was again calculated to determine the impact produced. The "General creativity" component fell from 0.854 to 0.843; "Academic projects" fell from 0.753 to 0.741. For these components, variation was quite small and did not affect the good level of

internal consistency. Finally, “Use of ICT by teachers” rose from 0.550 to 0.719. In fact, the elimination of item 71 was specifically designed to obtain this effect.

The distribution of the 68 items of the final version of the instrument in each of the factors identified is given in Figure 2. The number above the line is the number of items in the theoretical framework construct placed in the identified factors.

Total Cronbach’s alpha was calculated, giving a value of 0.944, indicating high internal consistency. Finally, the descriptive statistics were calculated of the data obtained in the items in the final version of the instrument (see Table 4).

Factor	Mean	Standard deviation
Academic projects	4.059	0.970
Technical skill	3.863	0.891
Information management	3.818	0.858
Communication	3.643	0.854
Critical thinking and problem solving	3.625	0.834
General creativity	3.277	1.049
Use of ICT by teachers	3.249	1.015
Use of ICT by students	2.537	1.170
Technical creativity	2.34	1.164

The results given in Table 4 show a clear and efficient perception of the use of ICT for academic projects. There is also good self-perception of the technical skill in the use of the ICT, being noteworthy that the PCA found that this skill included collaboration by means of ICT. On the other hand, as regards the use of ICT by teachers, the perception is that it does not have a large impact on the teaching-learning process, while the perceptions of creativity and the use of the ICT by students are also low.

The standard deviation (SD) of each of the factors shows an interesting pattern. The set of factors with an SD lower than 1 is composed of those most highly considered by the students, while the set of factors with an SD higher than 1 are those least valued. This correspondence indicates a more homogeneous perception of the digital skills of critical thinking and problem solving, communication, information management, technical skill and recognition of ICT in academic projects. Students and teachers’ use of ICT and creativity shows a higher degree of variation, which appears to indicate a less clear perception by students of ICT use in the university and of its usefulness in creative processes, and this could be the reason for the students’ low self-perception of these factors.

4. Discussion and conclusions

The results of this study confirm the close relationship between critical thinking and problem solving, concepts which a number of studies have found to have a strong semantic association. For example, the World Bank Institute (WBI Development Studies, 2007) considered that the critical thinking inherent in problem solving should be stimulated. Fullan & Langworthy (2013) combine them into a single skill for deep learning, and the World Economic Forum defines critical thinking as “the capacity to identify, analyze and evaluate situations, ideas and information in order to solve problems” (World Economic Forum, 2015: 3). Vásquez & Findikoglu (2011) define both as cognitive competencies, together with reading, writing and arithmetic.

One interesting finding was the identification of factors that refer to creativity: both “creativity in general” and “creativity in technical activities”. A high percentage of studies on creativity in the fields of education and technology measure it in specific contexts, such as in classrooms (Souza, Leão, Carmona, Ruas, Carneiro-da-Cunha, & Nassif, 2018; Stana, 2017) in developing software engineering (Mohanani, Ram, Lasisi, Ralph, & Turhan, 2017), in technological and engineering education (Yasin & Yunus, 2014) and in collaborative design in workshops (Landoni & Diaz, 2015). However, in the present study, ICT-aided creativity clearly distinguished between one factor that defines creativity in technical activities with ICT (technical creativity) and another in which ICT only provide support to creative development (general

creativity). The good perception of the use of ICT in academic projects coincides with the findings of previous studies that gave a high value to projects as a means of learning and acquiring skills, as in the case of Cisco, who when defining the characteristics of 21st century students (Cisco Systems Inc., 2009) emphasized the use of project-based interdisciplinary tasks. It also agrees with recent studies on the good results of research on project development in diverse areas (Hadinugrahaningsih, Rahmawati, & Ridwan, 2017; Menkhoff, Tan, Ning, Hup, & Pan, 2018; Milbourne & Bennett, 2017) because projects involve interdisciplinary activities that require capacities for administration, collaboration, problem solving and use of ICT, among others.

In fact, closely connected to the technical skill dealt with in this paper, studies have been carried out on how to acquire digital competencies through projects (Pérez-Mateo, Romero, & Romeu-Fontanillas, 2014) and define projects as a fertile means of using and taking advantage of ICT when the students have the ability to do so. The good self-perception as regards technical skills corresponds with studies that even suggest that mobile phones should be introduced into Higher Education (Champagne, 2013; Simonova & Poulouva, 2016; Yong, 2016).

The results on the use of ICT by teachers define a scenario in which students perceive themselves to be well able to achieve solutions, but do not attribute this to the use of ICT in the educational institutions. This could correspond to the concept that what the present students require from Higher Education institutions does not coincide with what they are actually offered (Oblinger, 2003).

The low perception of creativity and both teachers' and students' use of ICT are in line with the DMGT model (Gagne, 2012), which indicates that the university environment can be used as a catalyst for the way in which creativity can be expressed in a variety of dominions and also, indicates that these influences include classroom instructors, as Miller & Dumford (2015) found in their empirical study. It is thus reasonable to believe that the teachers' influence on the use of ICT corresponds to the students' self-perception of its creative properties.

The results obtained in this study can be used to design and build study and curriculum plans in Higher Education institutions, including the transversal use of the ICT, with a view to the development of the emerging digital skills.

In terms of the disadvantages encountered when carrying out this work, it should be mentioned that perception studies always involve a risk of the non-uniform interpretation of the tool by the subjects involved in the survey, an effect to which this study was not exempt, in spite of the considerable effort made to validate the contents.

One of the study's limitations is that the results reflect the context of only a single country. Also, even though the tool is powerful and robust, and covered a student population from different fields of study, it was applied to a sample from a single Higher Education institution. However, it can be used as the basis for application to other institutions in other geographical areas, which will help to validate the results, improve the tool designed and obtain new findings.

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UNESCO's Media and Information Literacy curriculum for teachers from the perspective of Structural Considerations of Information

Currículo de Alfabetización Mediática e Informacional de la UNESCO para profesores desde la perspectiva de la Estructura de la Información

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ABSTRACT

The discipline Structural Considerations of Information explores the interests underlying communicational dynamics and information strategies, as well as the ways in which they correlate with messages. Considering this knowledge to be key in Communication Education, and having confirmed its close relationship with the dimensions of media competence, its presence is analyzed in the Media and Information Literacy (MIL) curriculum for teachers, whose training is crucial for the success of the process, developed by UNESCO, an organization that is a global referent in the field. A semantic content analysis reveals, from a quantitative perspective, a strong presence of thematic areas covered by the Structural Considerations of Information subject within the competencies and contents of the curriculum. However, at a qualitative level, there are fundamental weaknesses in its relationship with the structural approach to information. This occurs when the critical spirit of the text declines, starting with a definition of the media as sources of reliable information. The ubiquity of disinformation, and the key role played by stakeholders' knowledge, as well as the development of critical thinking to address it requires an update of this curriculum—the present review contributes to this development—highlighting the current necessity to address it from a structural vantage that fosters critical citizenship and a democratic process.

RESUMEN

La disciplina Estructura de la Información estudia los intereses que subyacen a la dinámica comunicacional y a las estrategias de información, y su correlación con los mensajes. Considerando clave este conocimiento para la Educación en Comunicación, y una vez confirmada su estrecha relación con las dimensiones de la competencia mediática, se analiza su presencia en el currículo de Alfabetización Mediática e Informacional (AMI) del profesorado, cuya formación es crucial para el éxito del proceso elaborado por la UNESCO, órgano de referencia mundial en el área. El análisis de contenido semántico desvela, desde un punto de vista cuantitativo, la fuerte presencia de las áreas temáticas de la Estructura de la Información en las competencias y contenidos del currículo. No obstante, aplicado cualitativamente, se detectan debilidades de fondo en la relación con el enfoque estructural de la información. Ocurre cuando decae el declarado espíritu crítico del texto, empezando por definir a los medios como fuentes de información fiable. La ubicuidad de la desinformación y el papel crucial del conocimiento de los agentes envueltos en la misma y del desarrollo del pensamiento crítico para afrontarla, obliga a la actualización de este currículo—a cuyo desarrollo se contribuye con esta revisión—, haciendo, además, más necesario que nunca el afrontarla desde un enfoque estructural que favorezca una ciudadanía crítica y el proceso democrático.

KEYWORDS | PALABRAS CLAVE

Media literacy, critical thinking, structural considerations of information, media competence, teacher training, media systems, media production, disinformation.

Alfabetización mediática, pensamiento crítico, estructura de la información, competencia mediática, formación del profesorado, sistema de medios, producción mediática, desinformación.

1. Introduction and state of the art

The present study arises from the consideration of the key role that the knowledge of Structural Considerations of Information, that is, the “web of interests of all kinds that lie beneath journalism [...] and the correlation with its messages” (Reig, 2017: 25), has for Education in Communication. A network that Masterman (1993) qualifies as determining factors of media documents, among which are ownership and control of the media, media institutions, the state and the law, economic determinants, advertisers and audiences. Buckingham (2005) points to production, language, representation and audience as key concepts in media literacy, the same as those adopted by UNESCO (Frau-Meigs, 2006). Production implies recognizing the economic interests at stake, profit-making processes, the globalization of media industries and the balance between global and local media (Buckingham, 2005) and, rather than grasping the details of ownership, understanding “global models of media ownership and control while recognizing other important sources of power and influence” (Masterman, 1993: 87).

The purpose of this approach is to find out the importance of learning the Structural Considerations of Information (from here referred to as SI) within UNESCO’s Media and Information Literacy (MIL) Curriculum for teachers, as an international reference organization in the development of this curriculum and in teacher training, supporting it in “the design, implementation and evaluation of Media and Information Literacy programs for secondary school students” (Wilson, 2012: 17). Teacher training has been addressed through the analysis of university curricula (Masanet & Ferrés, 2013; Ferrés & Masanet, 2015; López & Aguaded, 2015) and the media skills of non-university teachers (González-Fernández, Gozálvarez-Pérez, & Ramírez-García, 2015; Tiede, Grafe, & Hobbs, 2015) as well as those of university professors (Pérez-Escoda, García-Ruiz, & Aguaded, 2018), and in many of these cases the development of assessment tools and the proposal of specific actions. It has received extensive attention grounded in the crucial role that teacher training plays in the media literacy process (Osuna-Acedo, Frau-Meigs, & Marta-Lazo, 2018).

This document, which arrived shortly after the European Parliament’s proposal (12/2008) for the creation of the course “Media Education,” is conceived as a flexible curriculum and, since its publication, many countries have developed their own adaptations (Perez-Tornero & Tayie, 2012), coexisting with a multiple and diverse environment of media literacy policies, supporting models and effective situations (Pérez-Tornero, Paredes, Baena, Giraldo, Tejedor, & Fernández, 2010; Tulodziecki & Grafe, 2012; Frau-Meigs, Flores, & Vélez, 2014; Flores, Frau-Meigs, & Vélez, 2015; Wallis & Buckingham, 2016; De-Pablos-Pons & Ballesta-Pagán, 2018). UNESCO’s proposal contemplates its revision by educators, “in a collective process to shape and enrich the curriculum as a living document” (Wilson, Grizzle, Tuazon, Akyempong, & Cheung, 2011: 19), a task in which this study is framed, revising it in order to contribute to its development.

1.1. Definition and content scope for Structural Considerations of Information

Structure refers to the “disposition or way in which different parts of a set are related” (Real Academia Española, 2014). From this it can be deduced, firstly, that by Structure we are referring to the form that this set takes. In second place, to the relations between the parts, establishing a position for them and assigning them a function (Rangel-Contla, 1975). Finally, the existence of an aggregate of several elements; therefore, when referring to Structure we are simultaneously including the elements that comprise it and the totality. All this taking into account the existence of supra-structures, namely, structuring elements, relations, and superior sets that are above the structure itself.

In this context, Structure is paired with the term information and not with communication because information –understood as a strategy for conveying messages from ancestral-mercantile transmitters, once the receivers have been studied (Benito, 1973)– takes precedence over communication –which includes this strategy and the reaction of receivers– despite the fact that it might seem otherwise. Although nowadays receivers are simultaneously transmitters that influence and interact with the media, their participation is based on established guidelines (Mancinas-Chávez, 2016). In addition, when the digital media are independent from the major corporate groups and the commercial and financial world (Almirón & Segovia, 2012; Almirón, 2009), we cannot ignore the fact that the Web itself belongs to large corporations and

that these media have not been consolidated nor are they profitable, that is to say: they are neither totally outside the Structure, nor are they instituted as a force that substantially modifies the structural order.

On the other hand, since information is a structuring factor (Sánchez-Bravo, 1992), it acts by articulating the parts of the whole to preserve what is established, prioritizing economic benefit and the survival of the structure itself over the human right to information. In short, when we refer to SI we are referring both to the grouping of the media in structures called media groups or conglomerates, as well as to the relations that connect them to other structures and superstructures.

Behind communication messages there is a comprehensive information strategy that pursues both the logic of commercial gain and, in many cases, its influence on present and future behavior.

Macro-commercial activity may exceed its legitimate and necessary functions, in such a way that they may violate legal norms such as laws for the protection of female imagery and dignity or the right to accurate information and basic knowledge to strengthen the involvement of media education in the democratic process and social development (Pfaff-Rüdiger & Riesmeyer, 2016).

The ubiquity of disinformation, the need for critical thinking to address it, and the pivotal role of understanding the agents involved, require an update to UNESCO's MIL curriculum for teachers. It is necessary to seek cohesion between the critical nature stated in writing, in order to reinforce the structural approach.

It is essential to approach information from a structural stance (Reig, Mancinas-Chávez, & Nogales-Bocio, 2017) and, as far as media education is concerned, the focus should go beyond the details of media ownership towards how this ownership affects their products. This need, now more than ever, is reaffirmed in the face of the omnipresence of disinformation, which threatens society and democracy and whose dependence on post-Internet technologies “has modified the very nature of collective interpersonal communication” (Del-Fresno-García, 2019: 2). The analysis of the originating agents of disinformation, and others involved—the one who creates the message may be different from the one who produces it and the one who distributes it (Wardle & Derakhshan, 2017)—as well as their implicit or explicit connection, is a fundamental aspect for a complete study of online disinformation (Alaphilippe, Gizikis, Hanot, & Bontcheva, 2019).

SI studies the underlying factors of communicational dynamics and those behind information strategies, leading to an inquiry into the types of institutions and people who dominate media ownership and to an analysis of the content they project. It is what Bourdieu (1997) already called invisible structure of power, which offers explicit messages (conveyed through news, series, etc.), and whose emitters are scarcely known.

The studies and lines of work of the current SI (Birkinbine, Gómez, & Wasko, 2017; Reig & Labio, 2017; García-Santamaría, 2016; Martínez-Vallvey & Núñez-Fernández, 2016), have focused mainly on the alliance and merger processes of corporate communication, telecommunications and technology companies, with a common purpose: developing entertainment spaces to unimaginable levels in order to enable receivers to generate their own means of information, distraction or escape through digital tools of their choice. The visualization of this whole relational dynamic between media and corporate power, as well as the messages, is a central point of the rationale behind SI, which seeks to train critical citizens.

1.2. Preliminary approach to UNESCO's MIL curriculum for teachers

The document “Media and Information Literacy: Curriculum for teachers” (Wilson & al., 2011) includes the conceptual framework and pedagogical guidelines proposed by UNESCO for their training. It highlights the fundamental role of having a critical understanding of the communicative phenomenon,

so that citizens can exercise their fundamental freedoms and rights, thanks to MIL processes in all phases of education and life, becoming key among teachers.

The curriculum is based on three main areas concerning media: knowledge and understanding for social participation, the evaluation of texts presents in the media, as well as their production and use. Many of the subjects that cover them, fundamentally the first two, have a direct relationship with media ownership, market rationale and power, which illustrates, beforehand, the presence of SI in UNESCO's theoretical approach to MIL content and the attempt to foster a critical understanding of communication.

1.3. Structural Considerations of Information and the critical nature of Media Education

UNESCO's active commitment to the promotion of media education dates back to the early 1960s. As early as 1969, it states that "schools must assist students in acquiring a critical attitude towards the media" (Aguaded, 2001: 122). This spirit characterizes the UNESCO-sponsored MIL international conferences. Much of the reference literature considers critical thinking as an underlying element of media literacy, both to confront it and to provoke it (Pérez-Tornero, 2000a; González-Yuste, 2000; Aguaded, 2001; Frau-Meigs, 2006), to the point that it is "a form of critical literacy" (Buckingham, 2005: 73). The MIL curriculum also pursues critical thinking, as a general framework, understood as "the ability to examine and analyze information and ideas in order to understand and evaluate their values and assumptions, rather than simply accepting proposals at their nominal value" (Wilson & al., 2011: 194).

The spread of misinformation and fake news poses a severe challenge to education systems, with the development of critical thinking and analytical skills as the keys to successful educational intervention and numerous initiatives in Europe addressing this education (McDougall, Zezulakova, Van-Driel, & Sternadel, 2018). Likewise, a response to digital competence focused on critical skills and digital citizenship is underway (Redecker, 2017), enabling "the interaction with culture on the web, as well as its recreation in a critical and emancipatory way" (Area, Borrás, & San-Nicolas, 2015: 31).

The main objective of critical pedagogy, which is the approach to media education, is to learn how institutions and audiences "construct meanings" (Fecé, 2000: 136). Some authors advocate against the adoption of the term because it presupposes the existence of a correct and a confused perception, although they understand that it is necessary to adopt a social theory of literacy, which "means enabling learners to understand these contexts, and to recognize how they are shaped and how their own responses are produced" (Buckingham, 2005: 192). Critical training begins with a model of critical school and active teaching trends, and it is also grounded in reception research (Aguaded, 1999). It enables transcending a simplistic approach that only looks at the message and leaves aside the receiver and how he/she conditions the process, since, although the text reproduces mostly the dominant ideology, it is necessary to take into account the dialectics with the public (Fecé, 2000). This is particularly the case when the user is faced with a wide range of possibilities for choosing and managing self-consumption, at least apparently, since the path leads both "towards personalization and interactivity, and towards the hegemony of a few" (Pérez-Tornero, 2000b: 27) in a concentrating and globalizing process that has never been experienced before.

From SI the focus is placed on how institutions build or can build meanings. This is the most problematic aspect given that openly approaching it raises the silence of the media and ideological critics, although the structural approach itself is situated in critical thinking, which does not necessarily have to be Marxist or left-wing and is critical not only with the market and the capitalist system but also with "classical" critical thinking itself and its socio-economic and political alternatives (Reig, 2011).

2. Material and methods

The material used as primary source and object of study was UNESCO's MIL Curriculum for teachers (Wilson et al., 2011), which includes information providers such as libraries or archives. This required limiting the text to the media and their products. The method used was semantic field content analysis, both quantitative and qualitative. Specific free software was used, incorporating the "Keyword in context" (KWIC) technique, applying filter stop words, lemmatization, groupings and concordances. Given that the terms included are common when dealing with media, journalism or information from a variety of approaches, part of the process involved verifying whether their presence in the text was related to the

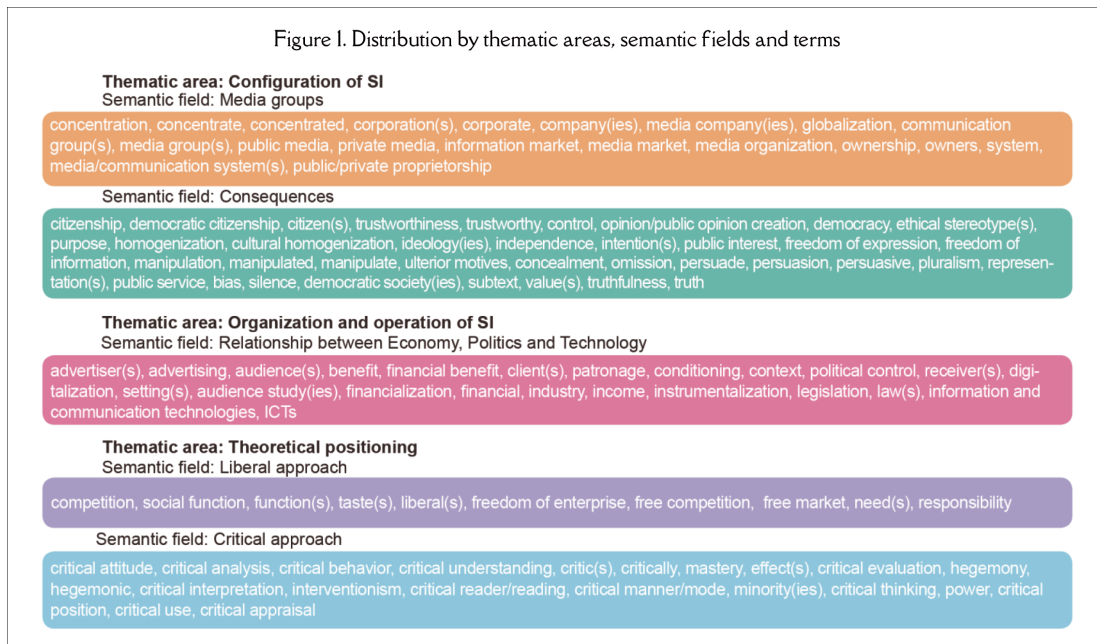
structural approach. Once each term was detected, it was analyzed within the sentence, as the first unit of context. Since the number of terms per field varies, we assessed the frequencies of occurrence and applied probability calculations to detect representativeness. A unit of external context was also used: UNESCO, as the source of the text, and its historical positioning, fundamentally the one emanating from the 1989 Paris General Conference, which closes the schism and debate that emerged in the 1970s around the “MacBride Report” and the New World Information and Communication Order (Quirós & Sierra, 2016).

The work was organized in two successive phases. During Phase 1, a preliminary content analysis was conducted, with the aim of finding the links between SI and Media Education, to the dimensions of media competence established by Ferrés and Piscitelli (2012), promoters of “a line of research to improve media education for citizens” (Pérez-Escoda, García-Ruiz, & Aguaded, 2018: 3), and providing a methodological basis for numerous referential studies in the area. Likewise, MIL competencies specified in the curriculum were examined to identify a first relationship with SI and to delimit the units of analysis within the document. During Phase 2, it was applied to the content within the previously delimited modules and units of the curriculum.

2.1. Setting indicators for content analysis

The semantic fields were conceived considering the contents and approaches of the SI in Spanish public universities. The review of the curricula for Journalism Degree programs from all public departments of Information Sciences/Communication –where this discipline is taught under various designations– made it possible to locate the subjects and analyze their teaching guides, achieving a definition of SI as an academic subject. This implies the study of media systems, from the point of view of ownership, organization and operations (mainly the dynamics influenced by the economy, politics and technology), and the consequences of their existence, addressing the various theories underlying their study and, largely, following a critical approach and through a contextual analysis.

Figure 1. Distribution by thematic areas, semantic fields and terms

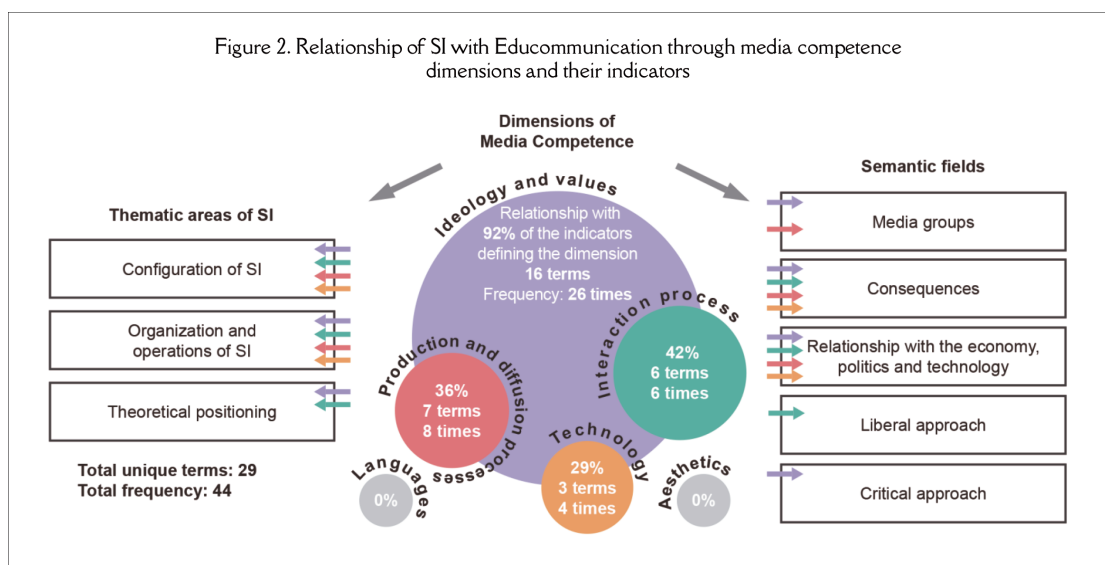


The examination of the descriptors for these areas and the review of texts for some fields (Gozálvez, 2013; Ferrés, Masanet, & Marta-Lazo, 2013), together with the reflection and teaching experience in SI, has led to the development of a repertoire of terms distributed in semantic fields by areas of study within SI (Figure 1), without repetition, making reasoned decisions when they could be in more than one location. The terms under “Relationship with Economics, Politics and Technology” are presented

together by specifying, in many cases, their classification into dimensions of reiteration. With “Liberal Approach”, we simplify the Economy of Communication, and with “Critical Approach”, we simplify the Political Economy of Communication.

2.2. Content analysis application to media competence indicators

The semantic content analysis for the six dimensions of media competence indicators (Ferrés & Piscitelli, 2012) confirmed the close connection between SI and Media Education (Figure 2). Except for “Languages” and “Aesthetics”, the other dimensions, as a whole, are linked to all the fields of SI areas through 29 unique terms with a joint frequency of 44, especially with those in “Consequences” (12 terms and the highest representativeness after the probability study) and “Relationship with Economics, Politics and Technology”. The closest relationship exists with the “Ideology and Values” dimension (92% of its indicators are related to the structural approach), in which references to the “Consequences” field prevail (10 terms and the highest representativeness), followed by those assigned to the “Critical Positioning” field.



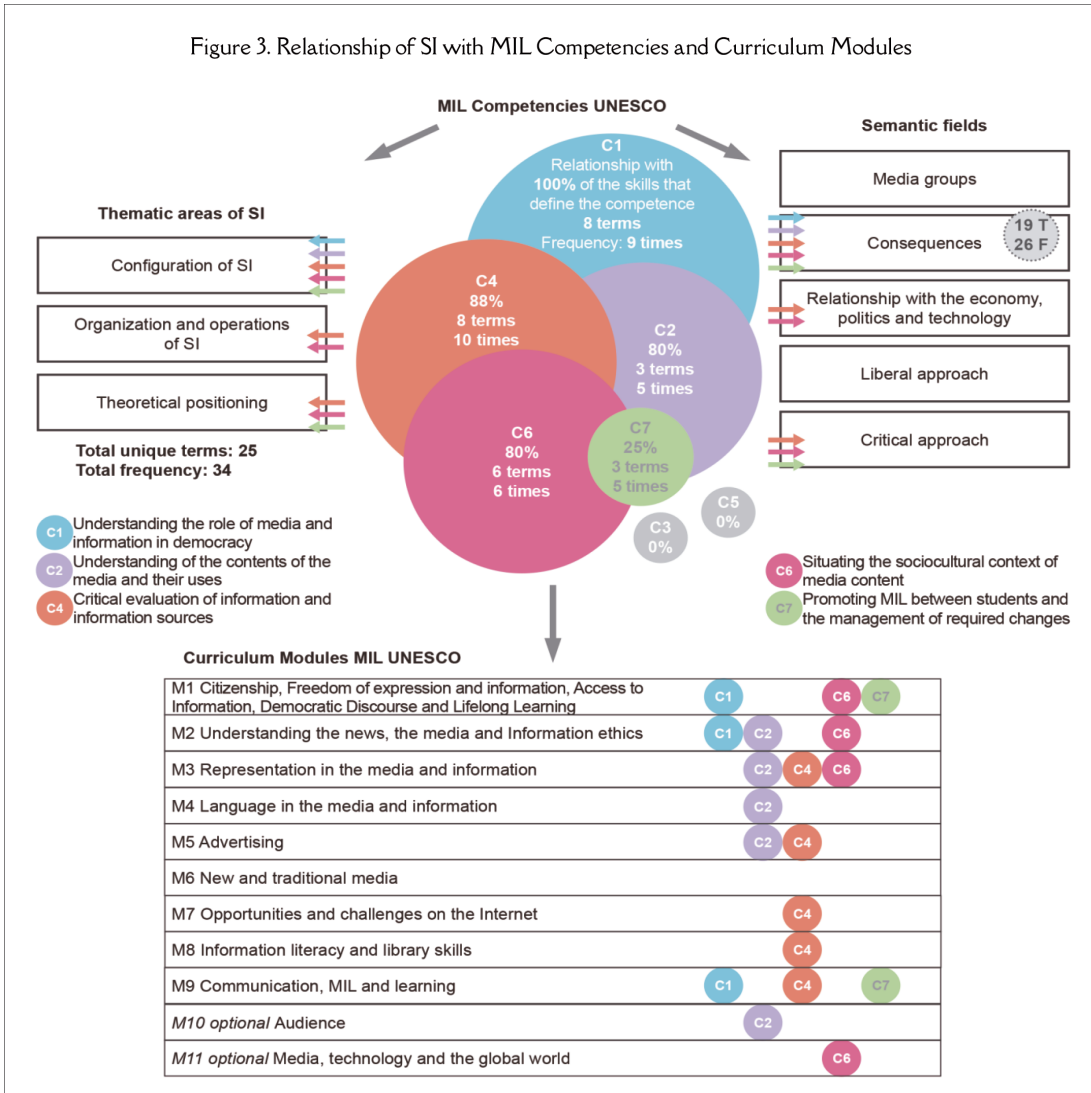
2.3. Content analysis applied to MIL competencies in the curriculum and definition of units of analysis

The curriculum under study proposes seven competencies that should be acquired through training and relates them to the modules and units in which content is structured. A connection is established with SI (Figure 3) through the skills and abilities of five of its competencies (except C3 and C5) and, specifically, with the field “Consequences” (19 terms). The competencies most directly related to the structural approach are present in all modules except one (M6) out of the 11 that comprise the curriculum.

3. Analysis and results

The content analysis of the MIL curriculum reveals a link with SI (Figure 4) through 62 unique terms (T), which appear 568 times (frequency, F). The majority come from the field “Consequences” (27 terms, frequency 264 and the highest representativeness) and “Relationship with Economy, Politics, and Technology”. It should be noted that the number of terms appearing and the frequencies of “Liberal Approach” and “Critical Approach” have been practically identical, although, after the study of probabilities, the former is more representative. Of all the modules (M) of content analyzed, in three of them (M4, M8 and M9) there is no single term related to the structural approach. The rest offer a non-uniform link, weaker in the case of modules M7 and M10 and stronger in the case of modules M1 and M11. The cross-reference of terms and frequencies by modules with MIL (C) competencies that they seek to develop yields C1 and C6 as fundamentally related to SI.

Figure 3. Relationship of SI with MIL Competencies and Curriculum Modules



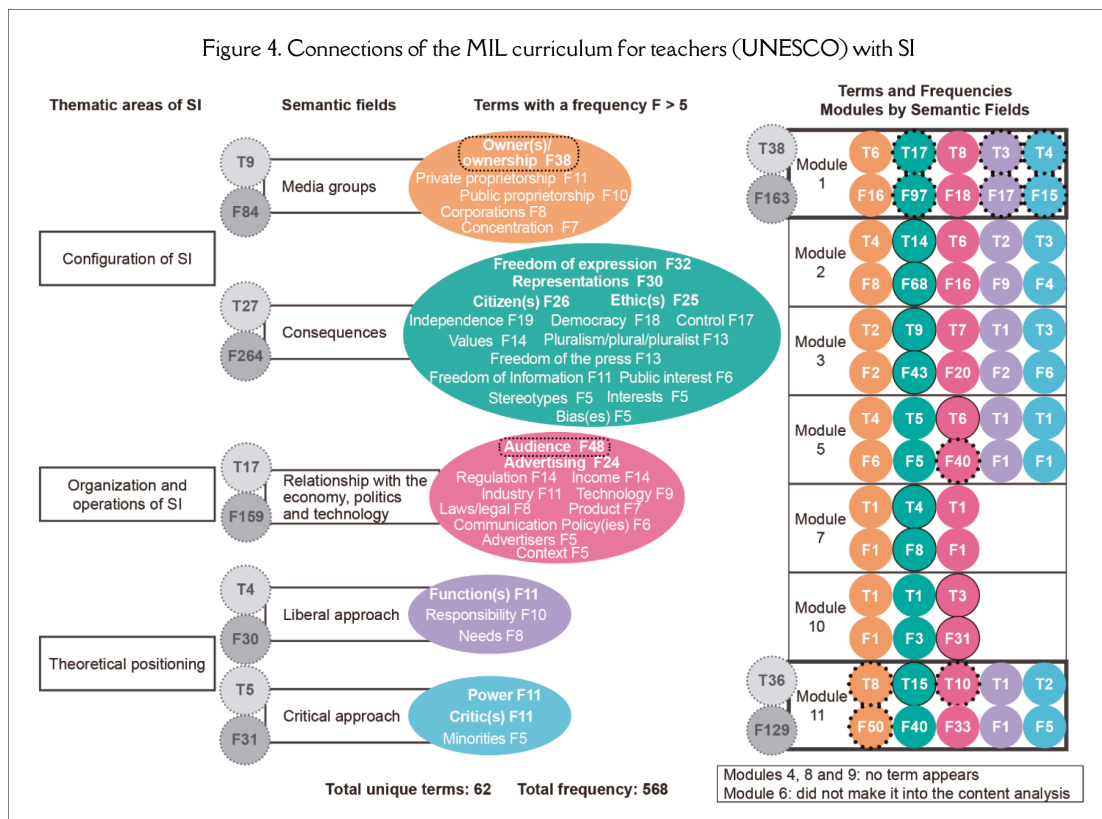
In order to correctly assess the link between the curriculum under study and the structural approach, it is necessary to consider its definition of the media as a source of reliable and up-to-date information, created through an editorial process guided by journalistic values, which can be attributed to a specific organization. The final glossary replaces the adjective reliable with credible.

The document lists truth, independence or accountability as key factors in journalistic practice –a window to the world. It specifies that, according to some critics –exact quotation– such freedom and independence for journalists is influenced by the financial and political motivations of both employees and media owners. And editorial independence is explained as the professional freedom of publishers to make their editorial decisions without any interference from media owners or any other actor.

It attributes an oversight function to the media with regard to the government and the power of any significant public or private entity. It considers that, although the media have great power over society and can direct and challenge it, they also reflect it, since the stories and representations they provide are what society demands and accepts. It understands that, if the state regulates the media, it interferes with the independence of journalists, and advocates for their self-determination from state or government control, as a guarantee for effective freedom of expression and the exchange of information and ideas. The effects of media consolidation are linked to pluralism, which is defined by the existence of media diversity in

relation to media ownership and support. It relates the pressure of advertising to the possible silencing of issues and the use of entertainment to attract audiences that, at the same time, are presented as active. It addresses the challenges and risks posed by the virtual world to young people by relegating the knowledge of who the owners are. It highlights the increased access to information and knowledge afforded by the new digital and electronic media, as well as the greater possibilities for freedom of expression and good governance which favor democratic participation.

With regard to globalization, it is worth noting its potential for bringing development issues with a global impact to public awareness and debate, and its positive impact on policy by increasing the flow of information within and beyond national borders and platforms for public discourse.



From the first content module, in which the key MIL themes and concepts are presented, it is stated as essential to know the media market, its ownership and control, since it defines contents and processes. The last module, catalogued as optional, is dedicated almost completely to the market and the media industry: knowledge of ownership, analysis of the socio-cultural and political dimensions of globalized media and the emergence of alternative media.

4. Discussion and conclusions

Having established the close connection of SI with education in communication through the dimensions of media competence (Ferrés & Piscitelli, 2012), it is worth noting its interrelation with the "Ideology and values" dimension, a result that is emphasized by corroborating that teachers of Education and Communication in Spanish universities consider this dimension to be "one of the most relevant to approach media education teaching" (López & Aguaded, 2015: 193). The relationship of SI with MIL competencies in UNESCO's curriculum for teachers is determined fundamentally through those that include an understanding of the roles that the media and information have in democracy, the analysis of the socio-cultural context of content and its critical evaluation. In all cases, the strongest connection is through the field of SI that we have called "Consequences", with terms coming from the context of the

rights to freedom of expression and information. The content analysis also confirms, from a quantitative standpoint, that many of the key themes addressed by the MIL curriculum for teachers are related to those of the SI. Moreover, through a qualitative analysis, a series of fundamental weaknesses in this connection are detected. The rupture with the structural approach occurs mainly when the curriculum loses its stated critical spirit, contradicting itself, the result of certain tensions in a struggle for the politically correct, in many cases only understandable in light of historical processes (Quirós & Sierra, 2016). It contradicts the conceptualization of the media, asserting that one can trust what they say and, at the same time, address them in a critical way, a key to educational success in the current context, where skills for ascertaining the credibility of information are crucial (Kahne & Bowyer, 2017). The same happens when mentioning the existence of editorial processes—implying the selection and production of contents— but which, when assumed to be determined by journalistic values, are relieved from any interest outside journalism. Similarly, it decays when journalistic activity is portrayed as a window to the world and its functions are explained: the idea of the media as the fourth power is still an idealization, ignoring the fact that the major media are themselves immense corporations.

Another point under review is UNESCO's emphasis on the key factors of journalistic practice, such as the organization of knowledge, truth or independence, in relation to the journalist rather than the businessperson. Other divergences are found in the conceptualization of pluralism that is skewed towards the market, without questioning the fact that multiple media and even numerous owners do not necessarily imply a diversity of voices. Added to this index of weaknesses is its stance on globalization—although the UN has already lowered the level of optimism (Puddephatt, 2016; UN, 2017)—including technology and new media, by not stressing the crucial role of understanding Internet ownership. In fact, the study module entitled “Opportunities and Challenges on the Internet” is the one that, of those related to SI, has the weakest link to it. In the MIL curriculum, an awareness of media ownership, basic to all other aspects of SI, is considered crucial as it implies knowing who is delivering the message. Even more so when, at present, the promoters of disinformation and “fake news” have created “pseudo-media, which, with professional presentations and a legitimate appearance, have extinguished the limits between information, opinion and ideology” (Del-Fresno-García, 2019: 6). And since disinformation agents do not act independently but use a network of apparently autonomous sites and accounts to replicate content (Alaphilippe & al., 2019) and increase trust. The placement of the module dedicated almost exclusively to the ownership and control of the media at the end of the curriculum and its classification as optional is incongruous. Despite the degree of flexibility and adaptability in the application of its modules, the document offers an organization and structure, implicit in the evaluation of the themes and prioritization of the contents.

The curriculum fails to provide valid tools to gain knowledge about the media market, given that information about the ownership and ultimate control of companies is not always easily accessible. In addition, it involves more than just knowing which groups have which media, it requires delving deeper into questions like who the owners are, relationships with other industries, the degree of dependence on the financial environment, its implications as advertising media or the degree of concentration of information and advertising in a given market, some of which are subsequently pointed out by UNESCO itself (Mendel, García-Castillejo, & Gómez, 2017). This underscores the need to update some of the fundamental approaches of UNESCO's MIL curriculum for teachers, aligning more closely with the spirit stated in writing. It is a challenge to confront the power of the media and to assume the rejection that the existence of a real critical vision can generate within the media. However, rapid technological change, the ubiquity of disinformation and the pivotal role of understanding the agents involved, as well as the development of critical thinking to address it, require an updated curriculum and its periodic revision, making it more necessary than ever to approach it from a structural perspective that favors critical citizenship and the democratic process.

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Studygrammers: Learning influencers

Estudigramers: Influencers del aprendizaje

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ABSTRACT

Today's learning ecologies stand out due to their variety, dynamism and mutability, demanding an observation that matches them. This paper focuses on emerging youth informal learning cultures, with the main objective of recognizing and characterizing a new figure in online social media: the studygrammer. Using questionnaires (N=256), discussion groups organized using Philips 66 (N=56) and Atlas.ti (thematic analysis), as well as participant observation, we analyzed: practices of academic use of social networks by Communication students outside the institutional environment, the opinion about the #Studygram community, and the analysis of profiles. The main results are centered on a proposed definition of the studygrammer: namely the student who works as a mentor and peer leader in Instagram's academic field. This profile not only shares notes (which stand out for their neatness and detailed aesthetics), but also conveys advice, support and experiences. In fact, studygrammers keep influencer genetics by prioritizing aesthetics and monetization in their publications. The conclusion is that the academic purpose adds exclusive characteristics to the community, where the visual code functions as a lingua franca between fields of study. In fact, studygrammers have followers from various academic backgrounds who seek "know-how" (management and planning of their own learning) as well as a fundamentally rational adherence.

RESUMEN

Las actuales ecologías de aprendizaje destacan por su variedad, dinamismo y mutabilidad, lo que requiere una observación análoga de las mismas. Este trabajo se centra en las culturas de aprendizaje informal juvenil emergentes, tomando como objetivo principal reconocer y caracterizar una nueva figura en medios sociales en línea: el estudigramer. Empleando cuestionarios (N=256), grupos de discusión organizados mediante Philips 66 (N=56) y Atlas.ti (análisis temático), y observación participante, se analizan: prácticas de uso académico en redes sociales por parte de estudiantes de Comunicación al margen del entorno institucional, la opinión sobre la comunidad #Studigram, y el análisis de perfiles. Los principales resultados se concentran en una propuesta de definición del estudigramer: véase aquel estudiante que ejerce la labor de mentor y líder entre pares del ámbito académico en Instagram. Este perfil no solo comparte apuntes (que sobresalen por su orden y detallada estética), sino que también transmite consejos, apoyo y experiencias. De hecho, el estudigramer mantiene la genética influencer al priorizar la estética y monetización en sus publicaciones. Se concluye que el fin académico añade características exclusivas a la comunidad, donde el código visual funciona como lengua franca entre ámbitos de estudio. En efecto, los estudigramers cuentan con seguidores de diversos grados académicos que buscan el «saber hacer» (gestión y planificación del aprendizaje), así como una adhesión fundamentalmente racional.

KEYWORDS | PALABRAS CLAVE

Studygrammer, Instagram, influencer, informal learning, social media, learning communities, communication students, transmedia literacy.

Estudigramer, Instagram, influencer, aprendizaje informal, redes sociales, comunidades de aprendizaje, estudiantes de comunicación, alfabetización transmedia.

1. Introduction

After an extensive decade of usage and exploration of social networks fluctuating between panacea and apocalypse (Piscitelli, Adaime, & Binder, 2010), the maturity of their life cycle (IAB, 2018) invites a more pondered reading of their possible effects (Allcott & al., 2019). The scientific literature records both negative consequences, normally associated with intensive uses such as: personal discomfort and depression, digital addiction, distancing from healthy activities and physical personal relationships, increased consumption of biased information and political polarization (Mosquera & al., 2019); and positive consequences: obtaining information and entertainment, evading isolation, fostering relationships and social participation (Valkenburg & Peter, 2007). While the concerns are well-founded and legitimate, these authors suggest preventing the negative from obscuring the positive (Allcott & al., 2019).

The need of individuals to relate to the group as an anchor for a sense of belonging, and the creation of group and individual identity, which is also forged in relation to the group (Fisher, 1992), is characteristic of human beings. Social networks play a great role in this sense, since they have the power to exert influence from the dawn of their existence (Castells, 2001). In this way, relationship and influence are considered outstanding ingredients in the concept of community.

These online platforms can connect people with common interests, although this is certainly not new. Fans have always gathered around their affinities, but, in this case, with the peculiarity provided by the Network to replace a physical space by a virtual one. This enables associations to stick to the subject that concerns them jointly and, once the common objective has been achieved (or not), the link is dissolved, since "there are no membership cards or membership fees, only common concerns" (Bajo, 2015: 114). An example of this are the various changes that took place in this century under the umbrella of technopolitics (Castells, 2009; Candon-Mena, 2013) led by the so-called "smart mobs" (Rheingold, 2004).

The growth of participative culture on the Web (Jenkins, 2009) also reaches the didactic field. Thus, "transmedia literacy" (Scolari, 2016) implies a new relationship between subjects, ICT and educational institutions that doubly affects the youth population. On the one hand, this group is in full formative development, and on the other, it is openly exposed to media and technology. However, it is important to maintain a watchful function from the research community, the home and the school, given that a longer screen time "does not guarantee the development of a reflective attitude nor does it favor learning" (Caldeiro-Pedreira & Aguaded, 2017: 102). It is for this reason that adolescents are invited to demand "the ability to reflect in order to achieve audiovisual autonomy" and to "develop a critical view that allows them to survive in a digitalized world" (Caldeiro-Pedreira & Aguaded, 2017: 102).

1.1. State of the art

The greatest contribution of the Internet and ICTs to the field of education has been the promotion of teacher innovation. The logic and dynamics of digital technology itself have become natural allies of the new teaching model based on collaborative, autonomous and decentralized work. The scientific framework related to the positive effects of the introduction of technology in learning processes covers all types of scenarios, skills and procedures.

Experiences in the formal environment report advances in terms of methodologies such as flipped learning, which relies on the use of digital resources inside and outside the classroom (Serrano & Casanova, 2018), the usefulness of Personal Learning Environments (PLE) and gamification (Torres-Toukourmidis, Romero-Rodríguez & Pérez-Rodríguez, 2018), from which an increased acquisition of skills is identified (Callaghan & Bower, 2012; López-Pérez, Pérez-López, & Rodríguez-Ariza, 2011).

The empirical verification of these experiences includes both formal and informal processes. Pereira, Fillol and Moura (2019) state that, despite the excessively institutionalized view of education, informal learning strategies contribute to the development of useful skills and competences from a school viewpoint. In fact, the skills acquired through the use of information technologies go beyond the cognitive realm to also cover the social and emotional realm (Tan & Pierce, 2011). Simply, the cross-sectional nature, ubiquity and versatility of virtual space makes it more "friendly" for young people, who also take advantage of it to learn without establishing differences.

The unlimited digital space does not respond to the stagnant logic of the pre-digital world, since "unlike other environments exclusively dedicated to learning (...) the opportunity for interactivity offered by social networks configures a completely hybrid space where it is not possible to distinguish when young people are sharing and when they are learning" (Arriaga, Marcellan-Baraze, & González-Vida, 2016: 213).

The existential journey of social networks also enables us to observe an evolution in their uses. Although in the beginning, a predominance of entertainment was detected, there has been an increase in their use for professional purposes since 2015 (Fundación Telefónica, 2016). Recently, the Internet Oxford Institute has detected a decrease in their use to stay informed in favor of the consumption of news via traditional media (Marchal, 2019). Piscitelli, Adaime and Binder (2010) talk about the potential of social networks to influence education through the collective intelligence of groups of prosumers (content producers and consumers).

The pedagogical and cultural possibilities of YouTube have also produced valuable scientific literature (Gilroy, 2010; Burgess & Green, 2018), discovering figures such as, for example, the booktuber: a young Internet user who recommends books in vlog format (Vizcaíno-Verdú, Contreras-Pulido, & Guzmán-Franco, 2019).

Studygrammers offer freely (on Instagram) and for the entire virtual community, what students usually exchange via WhatsApp: notes, doubts and/or encouragement. The order and aesthetics in their publications, together with the humanization of the relationship, complete the contribution of this informal learning community headed by their leaders-coaches.

The veteran and versatile nature of Facebook can also be seen in the scientific production generated (Selwyn, 2009; Piscitelli & al., 2010; Sánchez, Cortijo, & Javed, 2014) and, by extension, in the rest of platforms such as WhatsApp and Twitter (Abdullah & Darshak, 2015; Túñez & Sixto, 2012), the contributions of this epigraph have significance beyond the national scale, since they include populations from different places, such as: Portugal, United Kingdom, United States, Australia, Turkey, Israel, Singapore and Indonesia.

The social network focus of this research, Instagram, is the most recent (2010), and continues to expand increasing in users, rating and notoriety (IAB, 2018).

In addition, it has been the object of several studies, which report the positive reception of students to the inclusion of Instagram as part of the learning methodology. Some of the results observed highlight the improvement in the presentation of papers through a flipped classroom model (Supiandi, Sari, & Subarkah, 2019), or the improvement of expression skills in the acquisition of a second language (Barbosa & al., 2017; Jalaludin, Abas, & Yunus, 2019).

However, the scope of this line of research has the following limitations: a) most existing references deal with the educational use of Instagram in a limited field known as SMILLA (social networks as an instrument of language learning); b) references are mostly concentrated in Asia; and c) studies are published extensively in the infamous "predator journals", which is why they are not referenced in this text. In contrast, there is not much scientific activity in the West. Moreover, most papers focus on docent view on this social platform, which justifies the relevance of undertaking a study focused on the academic activity of students, regardless of the institution.

2. Material and methods

2.1. Objectives and approach

This research addresses how Communication students use social networks outside the institutionalized educational environment, although directly linked to their higher education, with the aim of identifying new components and emerging learning processes. Within the heterogeneous digital ecosystem, attention is

focused on a new actor: the studygrammer. A student who leads the #Studygram community of Instagram. The main purpose of the text is, therefore, to define and characterize his figure, while understanding the relationship and opinion of students in the Communication area about this phenomenon.

The analytical approach is comparative in relation to other networks or "influencers" of other fields, other degrees and other training stages. In this way, "Instagram use by Communication students" and "role played by the studygrammer" are established as dependent variables; and the independent variables are: "types of social network: Instagram or other", "purpose of learning: formal or informal", "field of knowledge: communication or other" and "education stage: university or earlier."

2.2. Methodological design

The present design offers a triangulation of three techniques: questionnaires, participant observation and Philips 66 processed with Atlas.ti. The data on the academic uses in social networks and, in particular, from the #Studygrammer community, were obtained from 256 students from all the courses of the different degrees in Communication of a Spanish public university, both in person and online. The main collection instrument was an online questionnaire.

The innovative nature of the phenomenon initially posed a stumbling block to the development of sufficiently representative categories of variables. A pilot questionnaire was conducted that collected open-ended answers to those questions with less certainty about the possible options. The replication of responses to the pilot questionnaire facilitated the development of representative categories, which gave rise to manifest variables for analyzing behavior through closed options (many of them with a "multi-response" option).

During the participant observation, an appropriate technique to become acquainted with groups or communities outside the researcher (Gaitán & Piñuel, 1999), 15 random profiles (Spanish, English and Portuguese speaking) were followed for two weeks under the label #Studygram. This qualitative evaluation on the images and the associated "post" (the 10 top posts of each "hashtag" eliminating duplicates and posts not related to the object of study) allowed to characterize the figure of the studygrammer.

The methodological design was completed with the execution of a Philips 66, a conversational technique that is useful to organize the participation of large groups in limited times (Peñañiel, Torres, & Izquierdo, 2016). According to the protocol of the technique (Gaitán & Piñuel, 1999), 10 discussion groups were organized with a total of 56 participating subjects, all of them students of the double degree in Journalism and Audiovisual Communication.

The design of the groups did not determine homogeneity or heterogeneity variables, precisely because the first type (age, studies) adequately served the design of previously established independent variables. In addition, variables irrelevant to the ultimate purpose of the study were recognized, such as gender (which was randomly distributed and naturally annulled by the spontaneous group formation). Each group had a secretary who collected the main findings of the "group discourse" (Ibáñez, 2003) in writing. Alphanumeric coding was used to maintain the confidentiality and anonymity of the participants (Cohen, Manion, & Morrison, 2007), and a spokesperson exposed the data in a meeting where each group had two rounds of intervention.

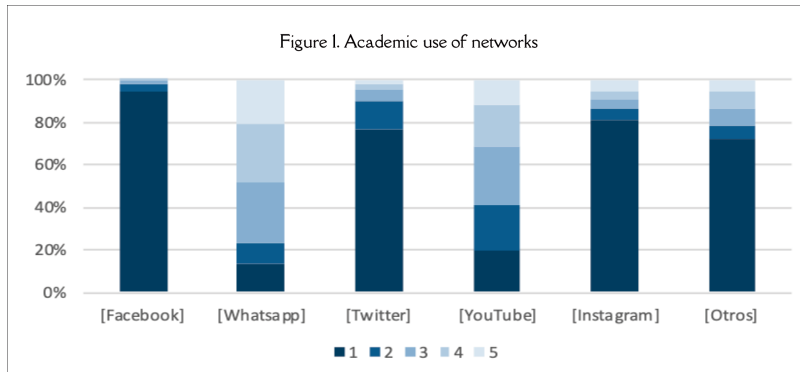
The exploitation of the documents generated by the groups was carried out with the Atlas.ti program, following the method of "thematic analysis", which allows to identify, organize and provide patterns or themes for the understanding of the phenomenon (Braun & Clarke, 2006). The strategy of open, axial and selective coding (Strauss & Corbin, 1990) was also used to create and organize the codes through networks or flow diagrams that graphically represented the possible systems of relationships between categories and/or codes. That is to say, linking participants' concepts and opinions.

In order to increase validity, another Philips 66 was carried out, whose data were not processed, although it did enable the verification of the hermeneutic unit of analysis in which a previously formed group (a classroom of peers) was constituted, which did not produce group biases in the discourse produced. An external auditor's review of the codebook was also requested (Creswell, 2012). The data collected in this phase of the study responded to the objective of knowing the relationship and the opinion of Communication students on the studygrammer phenomenon.

3. Analysis and results

3.1. Use of social media in informal learning

To contextualize the topic of learning in a peer community, one begins with the question: "habitually, what notes do you use to study?", where the answer "Those I take in class complemented with those of a colleague" obtained 70.07%.



Regarding the usefulness of the educational use of social networks (Figure 1), only WhatsApp and YouTube have a significant utility (represented by lighter tones in Figure 1), where Facebook is indicated as the least useful, followed by Instagram and Twitter.

In relation to specific features, WhatsApp stands out for "solving short and practical doubts." It is the only platform that has been indicated as very useful for: "sharing notes", "sharing general information about the degree and/or the university", "obtaining diagrams and summaries", "receiving encouragement" and "reviewing in company" (although the last three in less intensity). YouTube is considered the most appropriate for "complete explanations of complex subjects", its usefulness was most recognized in previous stages of training. In this sense, the data relating to the authorship of the videos that are consumed as academic support stands out: in secondary education 50% of the videos were made by professional teachers, in higher education this figure dropped to 30%. "The possibility of stopping and repeating the explanation" (sample testimony) and "we did not know how to make our own websites, blogs or profiles" (sample testimony) are the arguments offered. Likewise, it is relevant for this study to emphasize that the option "none" was the option most frequently mentioned with respect to receiving "study and planning advice."

In order to completely understand the assessment of the educational use of social networks, it is essential to underline that the adjective most commonly used is "collaborative" (indicated 70.6% of the time), followed by "fast" (63.25%), while adjectives such as "clear" and "organized" obtained low scores: 3.3% and 9.6% respectively. The assessment "reproduces errors" had a significant incidence of 35%. Another element detected as a barrier when associating social networks and study was identified as a danger of distraction. Despite the balance expressed, a door remained open for the manifest opinion: "these are still used sparingly, but they could be used more and better", which obtained 58.3% support.

3.2. The figure of the studygrammer

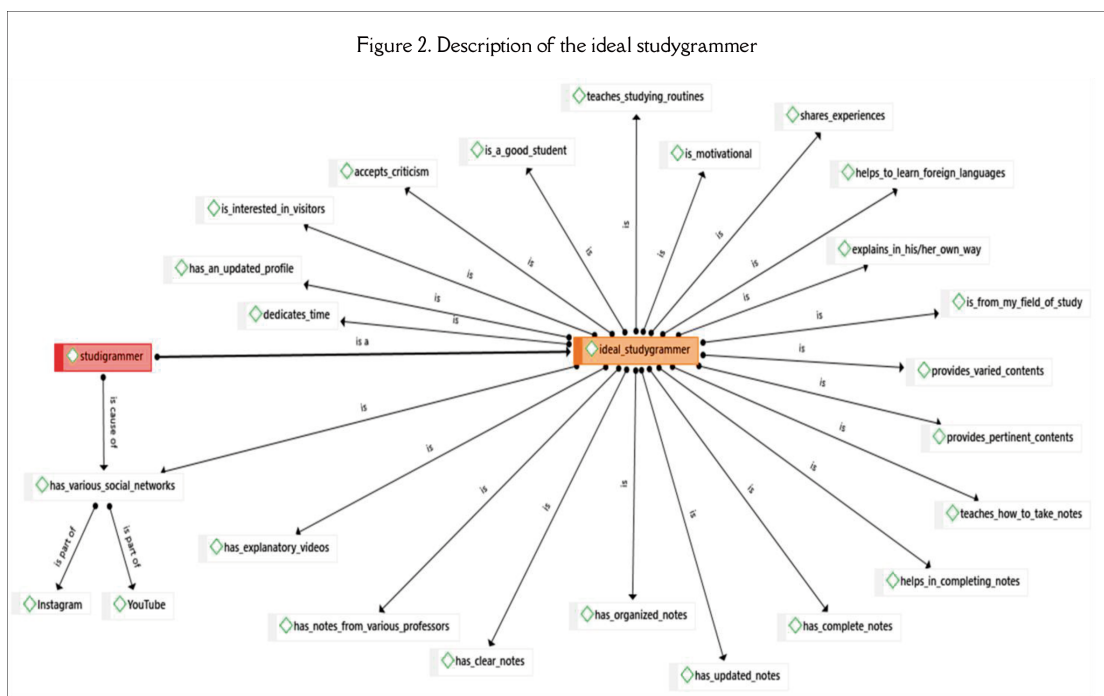
3.2.1. Analysis of profiles and activities of the studygrammer

Instagram has over 3.5 million #Studygram publications. During the month of February, 2019 it accumulated 9.1 million interactions (Instagram, 2019), these figures invite an empirical observation of the phenomenon. The term #Studygram (also #Studigram, #Estudygram or #Estudigram) comes from the English root "Study" and the suffix "-gram" in reference to Instagram, where the "hashtag" or tag (#) indicates a particular community on the Web. The word "studygrammer" designates the person who publishes in the community, and although in its Spanish version it resembles English terms in line with other similar terms such as "youtuber", "booktuber" or "studytuber", it uses the suffix "-er", which in English forms nouns that indicate profession or occupation, equivalent to Spanish "-or" or "-ero." In

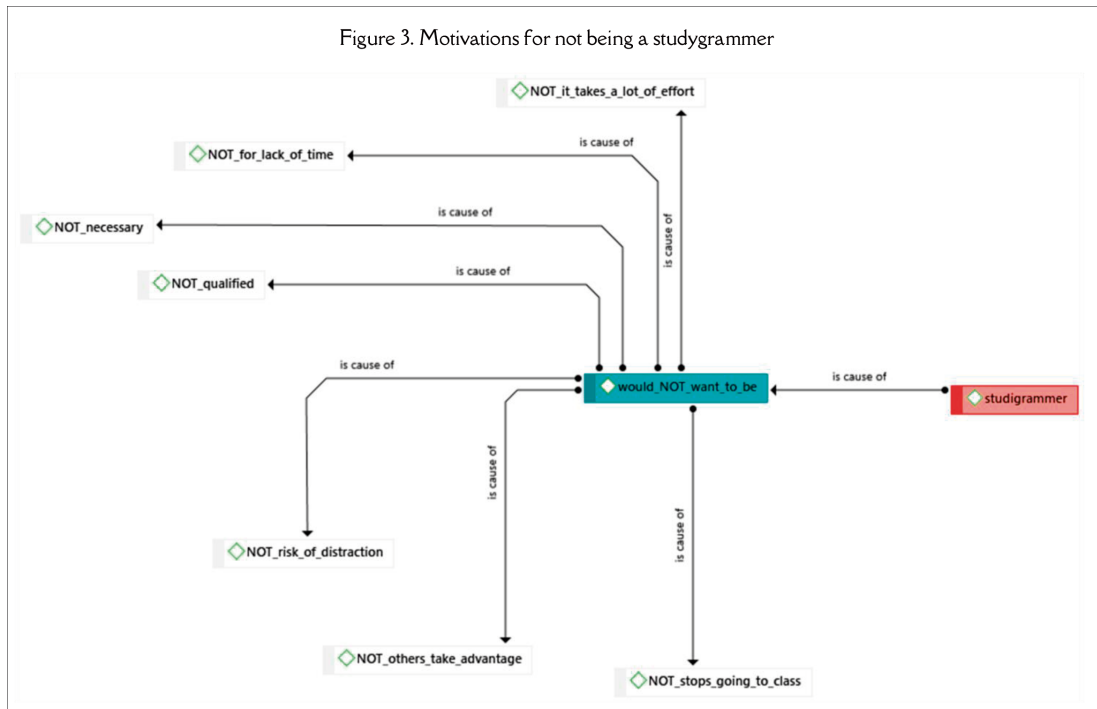
general, studygrammers post their notes, share experiences of their student life, offer advice on planning and studying, and sometimes resolve questions. It is a profile that dominates Instagram's communication codes, as their publications show meticulous care for all visual aspects: colors, calligraphy, framing and lighting. The order of both the content shown and the environment (table and/or desk) take center stage. In fact, this question is related to additional data obtained from the questionnaires, where 95% of the subjects "consider that having well-ordered notes that are pleasing to the eye can be a motivation to devote more time to studying." Therefore, the use of these codes and visual elements of organization can produce a personal and community effect. The motivational factor does not only arise from inspiration it is also expressed explicitly. The phrases of self-improvement and the exchange of good wishes are present in the analyzed publications, where two message recipients are observed: themselves and the community. Analyzing the economic aspect, we observe two relevant elements: the presence of brands and online stores. The most important companies are those of markers, such as Stabilo Boss. Studygrammers also monetize their online community by selling their diagrams, agendas and planners through online portals and/or with their personal brand. The most outstanding example is that of the British Communication student "Emma Studies", who has more than 450,000 followers and an online store.

3.2.2. Studygrammers in Communication undergraduate programs: Perception and assessment

The most relevant data obtained both from the questionnaires and the discussion groups on the relationship (follow-up and opinion) of Communication Degree students with the studygrammer are the following: the students stated that they knew fewer studygrammers from their own degree program (4.4%) than from other fields (12.1%), among which they mentioned Medicine, Biology, Architecture, Fashion Design, Philosophy, Law, History, Engineering, Teaching, Physics and Mathematics. For 87.9%, the criteria for choosing to follow a studygrammer should be based on content, while for 12.1% on personality. However, to follow a generic influencer the personality does gain importance, increasing the degree of agreement to 58%. Considering the reasons to follow them, the most frequently mentioned is: "to complete notes" with 56.3%. Other reasons for deciding to be part of a studygrammer's community are: "for doubts" and "for advice" (both mentioned 37.6% of the time), followed by "for help to get organized" with 31.1%. These questions are reflected in the description that the reporting subjects make of their "ideal studygrammer" (Figure 2).



The variable "explains in his/her own way, with a language appropriate to our age" also stands out from this representation. Based on the economic question, 19.7% think that "having the activity of the studygrammers for educational purposes, they should not get any benefit. 48.7% think it is appropriate for them to "monetize their online community by selling their schemes and other content", and for 31.6% to do so "through collaborations with brands." The fact that the economic variable comes into play in the #Studygram community does not seem to generate strong disagreement. A fact that may be explained by the opinion expressed regarding the reasons students consider that lead a person to become a studygrammer: "for helping" (50%), "for money" (43.8%) and "because they consider that they are good students" (37.5%). On the other hand, although 68% think it is a useful figure, 75% say they would not like to be a studygrammer. The reasons for this refusal are shown in Figure 3.



4. Discussion of results

The manifestations of the performance of informal peer learning reflect a certain "sense of community", with spatial limits that extend when social networks come into play, where they orbit around content sharing.

Initially, the educational usefulness of social networks perceived by students seems limited, because along with positive aspects, other negative factors continue to be identified. From the perspective of the learner, this opinion agrees with the one obtained from the teacher's point of view (Waycott & al., 2019) which, as previously commented, places its effects in both poles (Allcott & al., 2019). On the one hand, motivational benefits and community building are described; on the other, there is concern about the risk of students feeling exposed or having poor digital behavior (Waycott & al., 2019); only the value of WhatsApp, which functions as a virtual extension of what is usual in face to face interaction: sharing notes, doubts and encouragement with classmates, is highlighted.

During high school, YouTube is considered to play an outstanding role, not as a tool used among peers, but as a space for technical training (foreseeably also for personal development). Moreover, the professional teaching staff seems to favor, during the previous training stages, the delegation of regulated content in spaces outside the classroom, where the digital ecosystem helps as an extension of the lesson at home. This notion of "physical extension" (teaching staff, content), which is planned in the stories

networks and studies is marked by the recognition of the threat of distraction that these can pose when working (although it is also assumed that this is a factor of self-control).

The fact that it is a contemporary community appears to add value to the groups, since the subjects valued the fact that studygrammers used familiar words (appropriate to their age group) in explanations. The analysis of booktubers also reflects the generational alignment, positively reporting the prosumer role of young people around training, from which "new youth exercises in social networks find new tactics of literary development in environments that are beyond academic control, but which, likewise, are positive" (Vizcaíno-Verdú & al., 2019). In general, the whole "conversation" of the study moves within a specific framework that adequately focuses the phenomenon of study and enables one to understand its dimension as expressed in the following word cloud developed with the interventions in Philips 66 (Figure 4).

To finalize the characterization of the studygrammer, the general influencer phenomenon is analyzed in relation to the particular influencer for studying. The data on the "content" is seven times greater than the data related to "personality." As a follow-up motivation, a more conscious decision is made to adhere to a learning community rather than a recreational one. This finding is in line with the results of Vizcaíno-Verdú and others (2019: 104) on the booktuber, when they state that, "unlike other studies on the identity and autobiographical fame of the youtuber (...) booktubing has created a synergy of collaboration, recommendation and participation among equals in which physical or psychic aspects are not as important as preferences and reflections."

From the economic perspective, the differences between general influencers vs. influencers for studying are not so conclusive. On the one hand, half the subjects expressed their agreement with the monetization of the community of followers, when the answer for the reasons why someone becomes a studygrammer was very much "for helping" rather than "for benefit."

The contribution of the present study limits their contributions to present-day culture and moments, since there are many factors that influence the life cycle of Web trends and, therefore, many cases of exhaustion of practices and actors by the socio-digital dynamics themselves.

5. Conclusions

The #Studygram phenomenon represents the new transmedia competences that Ferrés and Piscitelli (2012) describe as: 1) learning by doing what you like; 2) learning by simulation; 3) learning by perfecting one's own or others' work; 4) learning by teaching, where the young person transmits and receives knowledge. The first skill is led by the studygrammer, the second by the follower, and the third and fourth by the whole community. This places studygrammers and their activity within the growing group of informal digital practices that contribute to the young people's learning (Scolari, 2018), exemplifying the so-called visual culture learning communities (Freedman & al., 2013).

As a result of this research, a definition of studygrammer is proposed: "A student who exercises, through Instagram, a peer-to-peer mentoring role in the academic field, not only sharing notes and outlines, but also transmitting advice, encouragement and experiences." Likewise, the following characterization proposal is proposed as a result: "The studygrammer incorporates the influencer nature: mastery of the aesthetics and monetization of online activity, where the academic purpose adds its own characteristics." Among their followers the rational motives have more weight than the emotional ones for community adhesion, that is to say, what to follow becomes more important than who to follow.

The visual code functions as a lingua franca between fields of knowledge. In fact, a studygrammer can be followed by students from other degrees because "how it's done" is also relevant. The learning mechanisms that underlie the studygrammer's activity and their virtual community are considered a practice and a positive contribution to the formative needs of today's society.

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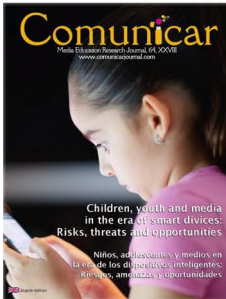
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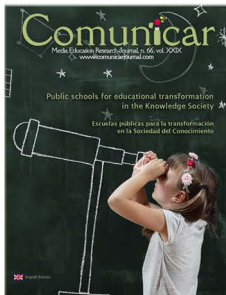
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