How to cite this article in bibliographies / References

J Tabja Salgado, C Broitman Rojas, A Camiñas Hernández (2017): "Perception of Scientists and Journalists on the Dissemination of Science and Technology Issues in Chile". *Revista Latina de Comunicación Social*, 72, pp. 1.107 to 1.130.
http://www.revistalatinacs.org/072paper/1210/60en.html
DOI: 10.4185/RLCS-2017-1210en

Perception of Scientists and Journalists of the Dissemination of Science and Technology in Chile

Jorge Tabja Salgado [CV] [] Profesor de emprendimientos periodísticos, Universidad Mayor, Chile / jorgetabja@cienciaymedios.cl

Claudio Broitman Rojas [] [] Assistant Professor, School of Journalism, Universidad de Santiago de Chile / claudio.broitman@usach.cl. H-Index: 1

Anastasio Camiñas Hernández [CV] [] [] Professor, Department of Audiovisual Communication and Advertising, Universidad de Málaga, UMA, España / tasio@uma.es

Abstracts

[ES] Introducción: El presente artículo muestra la percepción de los científicos y periodistas chilenos sobre la divulgación de las ciencias y las tecnologías en los medios de comunicación. **Metodología:** Se hizo una consulta dirigida a científicos (n=139), la cual fue triangulada con tres investigaciones periodísticas como validación. **Resultados y conclusiones:** Los resultados muestran que la divulgación científica en Chile es de mala a regular calidad y las razones para no estar presente en los medios se fundan en la ausencia efectiva de una política pública, falta de interés de los medios y carecer de redes profesionales que incrementen la visibilidad de noticas especializadas. Sin embargo, el 84,2% de los investigadores ha otorgado una entrevista alguna vez. Un hallazgo controversial - de ambos grupos - es considerar el uso insuficiente que los periodistas hacen del lenguaje científico. Es fundamental desarrollar políticas públicas con indicadores de divulgación de las ciencias y profundizar la reflexión de los periodistas científicos.

[EN]Introduction: This article shows the perception of Chilean scientists and journalists in relation to the dissemination of science and technology issues in the media. **Methodology:** As a layout, it was held a query addressed to Chilean scientists (n=139), which was triangulated with three journalistic research studies to further validate its outcomes. **Results and conclusions:** As a conclusion, the results show that scientists consider that the dissemination of science issues in the media in Chile is poor in quality and the reasons for not being highly present in the media are based on the lack of effective public policies, interest of the media or the lack of professional networks that might increase the visibility of the topic news. However, 84.2% of respondents have given an interview sometime. . A

controversial finding - in both groups of professionals- is to consider that journalists use insufficient scientific language in relation to what the population requires. It is essential to develop public policies with specific indicators for the dissemination of science and scientific journalists need to do some serious reflections on the matter.

Keywords
[ES]percepción; ciencia; divulgación; política pública; medios de comunicación; indicadores.
[EN]perception; science; dissemination; public policy; media, indicators.

Contents

Verónica Yáñez (Traductora)
Colegio de Traductores de Chile
COTICH (N°251)

1. Introduction

Science and technology (S&T) are a core part of 21st Century culture because there are few important things left to do that do not depend on sciences (Calvo, 2002). The precarious dissemination of S&T in the media in Chile and the low presence of scientists in the media, leads us to analyze the dissemination phenomenon from different perspectives. Therefore, the objective of this study is to reveal the perception of scientists in relation to the dissemination of S&T. We understand scientific dissemination as a primary stage of democratizing knowledge. In view of the above, we consider the process of scientific literacy a central axis and a higher stage of social and economic development of a country (Calvo, 2002; Cantabrana et. al, 2015). It is therefore essential to promote a solid democratic culture, in the broad sense, to mobilize the values of participation, deliberation, pluralism, human rights, legitimacy, accountability, non-discrimination, among others (Carrillo, 2013).

1.1. Background Information

The deep-rooted reflection is: Why Implement a public policy (PP) for communicating S&T in the media? For Harry Collins and Trevor Pinch (1966) (in Alcívar, 2002: 17) it would be more interesting for the public to know of the micro environment of the science than the science itself, that is, to know how scientific knowledge is built and how it is shaped by the uncertainty, doubt and debate; the relationship between the political, economic power and science, between ethics and experimental models; or the social consequences of technological innovations. The above is not solved with the pure data collection and socially decontextualized socially scientific contents. Science is understood, in this context, not only as knowledge, but also as a cultural practice (Pickering, 1992). In other words, public participation is possible only if there is an informed and critical vision of the relationships between science, technology and society.

The idea of a dialogging scientific body that rejects the deficit model of one-way science communication is installed in the literature since the 1990s (Wynne, 2006). However, the dialog model has subsequently also been criticized due to its ambiguity. It is sought to replace the idea of scientifically educating an ignorant public for the scientific paradigm that responds to the concerns of the public, in the media as well as in all kinds of spaces. However, Wynne (2006) himself admits that in many occasions this type of replacement is only semantics. Trench (2008) is moving toward a third model, of participation, where both public and scientists are involved in the construction of the problems and establishing the science agenda and negotiating meanings.

In this order of ideas, science PP programs would be to familiarize the public with the concepts of science and with its final products, and not with the compression of the processes, and much less with their construction. This dissociation reveals the lack of intention to empower the public, or to assume more active or participatory roles, which could put the privileged epistemological status of scientific knowledge at risk, thus facilitating its desecration (Nieto, 2002).

On the other hand, it is commonplace for the fields of power to fall into complacency and deception, instead of really encouraging social education that enables citizens to appreciate the pros and cons of scientific and technological progress for the society of the 21st century (Camiñas, 2002).

This freshly stated problem moves us to reflect on how and where S&T is communicated in Chile. Although it is not evident, this is related to access to information, freedom of expression or the dissemination of complex knowledge in the face of a citizens who are aware of the importance of science, but not of how to manage its principles or foundations in developing their lives. In the latest survey of Social Perception of Science and Technology (2016) conducted in Chile, the respondents feel (77%) little or not at all informed about science, and 65%, little or not at all informed about technology. In a similar correlate, 54% of the respondents indicated having received little or no education in S&T. Despite this, the Chileans acknowledge the importance of S&T disease prevention and health improvement (85.1%), care for the environment (67.9%) and better understanding of the world (71.9%). This data indicates that Chileans do recognize that both disciplines are important to their lives, from a cultural and health care point of view; and also to know about the environment and how to protect it.

2. Methodology

To identify scientists' perception of the dissemination of S&T in Chile, a targeted descriptive non-probabilistic consultation of our own design was conducted to understand the phenomenon in all its

complexity and not only its measurement (Martínez-Salgado, 2012). The methodology used consisted of four stages (Figure 1):

2.1. Query Design

The stage was a preliminary approach to politicians, scientists and academics in order to determine the priorities, scope, design and measurement of the consultation.

The requirements defined were: to be in possession of a PhD, to be actively conducting research in basic or applied sciences, and to live in Chile. The design of the consultation was mixed - open and closed questions- and with qualitative variables. The qualitative format provides a summary description of the data and the opinions collected without an attempt to reinterpret the particpants' comments or statements (Sandelowski, 2000). The design of the query (digital) recorded the identification of the researcher, then the query itself, which addresses three dimensions of interest**:** A) Scientists and Society; (b) Scientific and Media and (c) Science and Technology in the Media.

2.2. Sample Population

During the second phase, a survey - via e-mail, telephone consultations and web review-of 1,250 researchers who met the requirements requested through selective sampling (Martínez-Salgado, 2012). The research areas selected, according to the data available, were: Astronomy, Engineering, Physics, Mathematics, Biochemistry, Chemistry, Biology, Forestry, Marine Science, Health, among others. This query was conducted in universities, research centers, foundations, and available sources of information. The data collected included: name, scientific unit or department, university or research center, region, e-mail and telephone. At the same time, directors of research centers and administrative authorities were consulted, explaining the scope of this study to prevent any type of dissatisfaction or distrust with the query.

2.3. Digital Instrument

Once the database was concentrated - during a third stage of this study- we proceeded to engage sponsorship and design a (digital) *flyer* to inform and motivate responding to the query**.** Having the flyer and and indexed query in hand, we ran a test to detect technical considerations of opening of the information and how it was understood. In the fourth and final stage, the *flyer* was sent to each *e-mail* collected through a *Google Form*, giving 14 days to respond to the consultation and close the process of responses by the method of saturation (Morse, 1995; Krueger, 2000). The on-line format allows large geographical coverage relevant to the target group, through multimedia, with reminders and storage of responses (Alarco et al, 2012; Arney et al, 2012).

2.4. Validation

Subsequently, in order to amplify the representativeness of this tool and to mitigate the effects of not having access to email accounts, there were three levels of analysis - with journalists and journalistic media-as a complementary strategy (Minayo et al, 2003) of triangulation to the query: 1) one case study [(1)] of a digital media 2) query for journalists, with a model similar to the one carried out with researchers, including mirror questions between both groups and 3) obtaining curricular background that has an impact on the formation of future journalists.

2.5. Considerations and Obstacles

Methodology of the Query

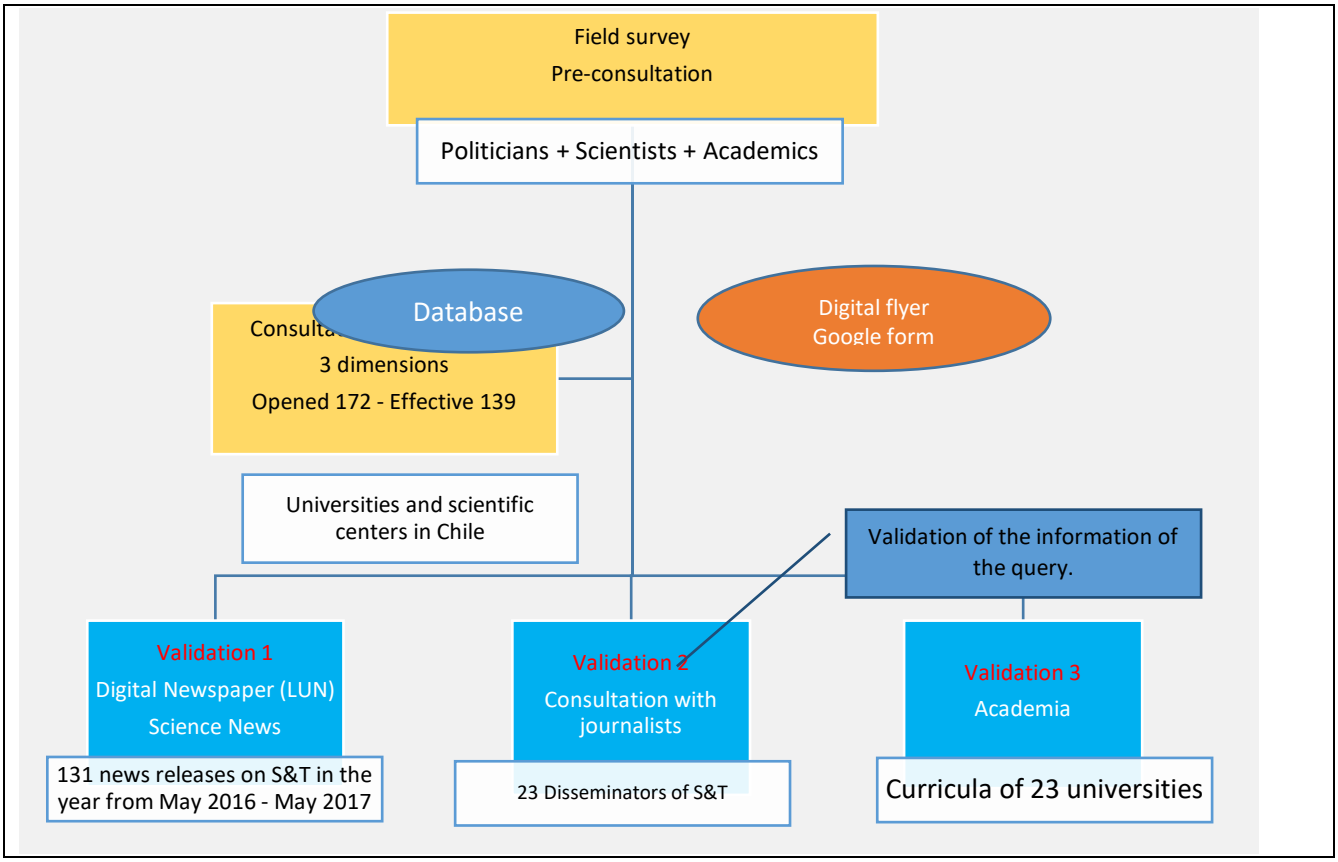

Figure 1: Methodological Model. Preliminary survey, construction of database, *digital Flyer* , consultation with researchers and validation of the results which consists of three stages of analysis:1) Case Study of a digital newspaper. *"Las Ultimas Noticias"*; 2) Consultation with scientific journalists

belonging to the Chilean association of science journalists, ACHIPEC and Centro Milenio centers 3) Verification of the curriculum of the Career of Journalism in the 100% of universities that teach the programs (prepared by the authors).

The analysis of this study aims to explore and present the breakdown in levels of data collected for the understanding of the information, which has a descriptive value and is not necessarily transferable to the entire population of Chilean scientists and journalists. On the other hand, as pointed out by Cleveland and McGill (1984), the perception of the graphic instruments as conventional diagrams or tables do not measure or record a comprehensive or systematic description of the subject as they yield quantitative information to describe the phenomenon, but not the keys that are particular to each individual or the variability of each specialty or study group.

Some of the obstacles found in this research included how to gain access to the e-mail addresses of all of the scientists and journalists. In the case of search institutional or consolidated responses, this was not possible as a means of consultation. Another variable was to avoid the condition of *spam or* junk mail. The online response rate of this tool is varied and is generally low , largely depending on the quality of the e-mail accounts (Arney et al (Arney et al,

3. Results

3.1. Scientists: Distribution and Areas of Research

The number of effective responses received were n=139 of 172 clicks to open the query (response rate 81%). 30 women and 109 men, country total. (Chart 1).

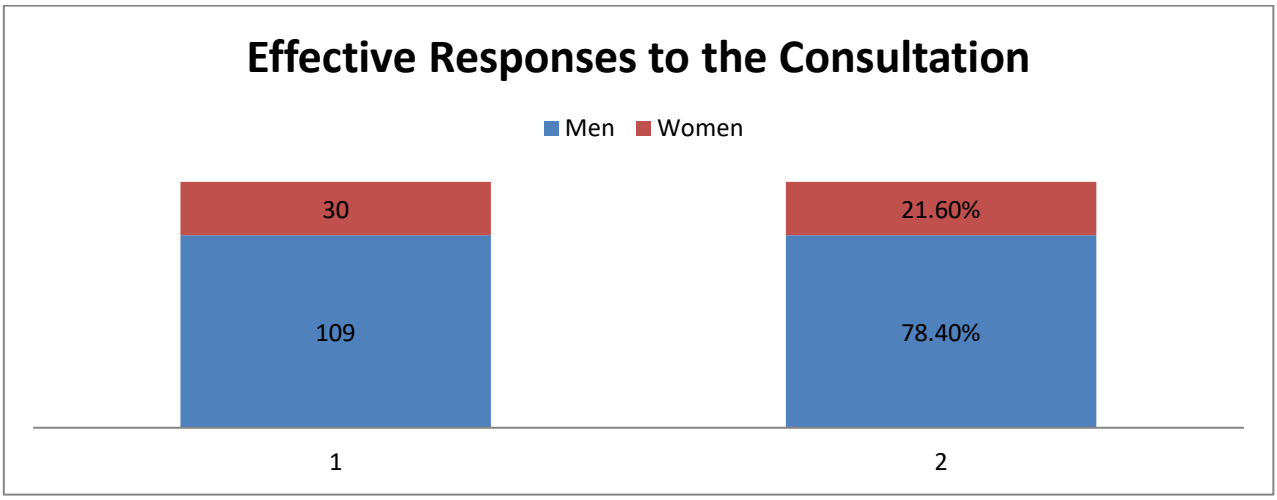

Chart 1: Total number of replies received by gender. The overall figures were: 1,250 queries sent; unopened 598; bounced 42; opened 610; clicked 172; answered 139. (Prepared by the authors).

According to the data collected, participation was mainly concentrated in the city of Santiago or Metropolitan Region, followed by Valparaíso and Concepción. These three cities represent 88.5% of the responses. Other locations such as the Region of Aysén, Los Lagos, Talca, La Serena, Antofagasta contributed with 11.5% in the column of other regions (Table 1 and Chart 2).

Research Centers			
Region	**University**	**%**	**% Accumulated**
Santiago	Univ. of Chile	21.58%	21.58%
	Univ. Católica de Chile	20.86%	**42.45%**
	Univ. Andrés Bello	7.91%	50.36%
	Other Centers or Univ.	2.88%	53.24%
	Univ. de Santiago	2.16%	55.40%
	Univ. Mayor	2.16%	**57.55%**
Valparaíso	Univ. Valparaíso	9.35%	66.91%
	Univ. Católica de Valparaíso	5.76%	72.66%
	Other Centers or Univ.	2.88%	75.54%
	Univ. Sta. Maria	1.44%	76.98%
Concepción	Univ. de Concepción	11.51%	**88.49%**
Others	Research Centers or Univ.	5.76%	94.24%
	Univ. Talca	2.88%	97.12%
	Univ. de la Serena	2.16%	99.28%
	Univ. Antofagasta	0.72%	100.00%
Total	**13**	**100.00%**	

Table 1: University centers that are home to the researchers consulted. The two universities in the Metropolitan Region, that is, the University of Chile and the Catholic University, concentrated the 42.45 per cent of the replies received. (Prepared by the authors).

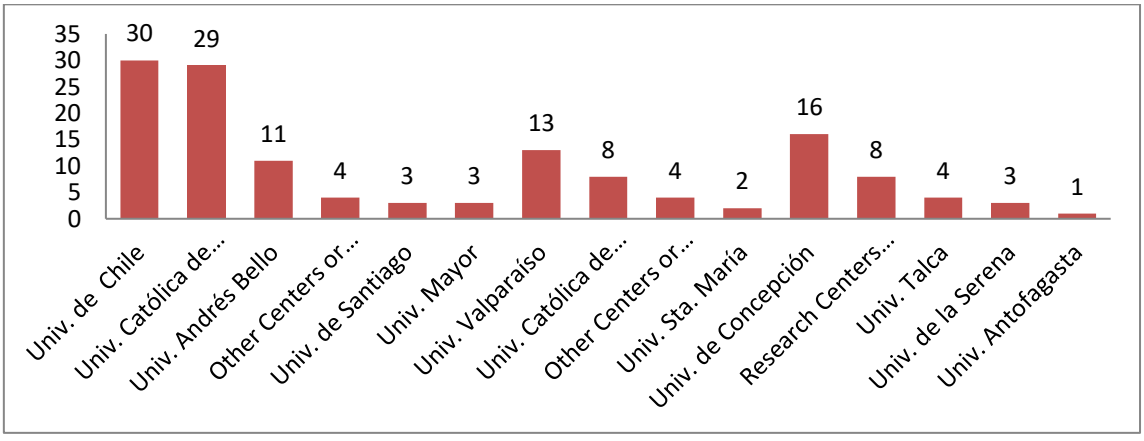

Chart 2: (Prepared by the authors).

Of the areas of research, Biological Sciences, Biochemistry, Chemistry and Marine Sciences, contributed 35.3% of the information, the largest of all prospected areas. (Chart 3).

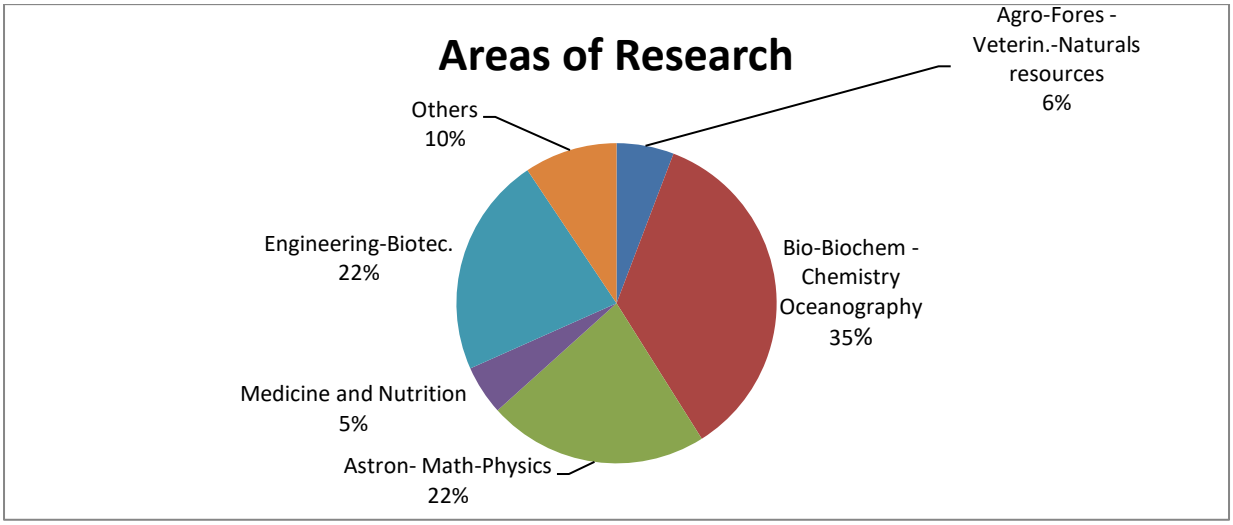

Chart 3: Research Areas and their distribution in the regions with the highest population of the country.(Prepared by the authors).

3.2. Dimensions of the Query

3.2.1. Dimensión: Scientists and Society

Scientists and Society			
Questions	**Options**	**No.**	**%**
Does the University research center have Public Relations (PR) services available to you?	Yes	78	56.1%
	No	45	32.4%
	Does not know	16	11.5%
Do you participate in outreach activities outside your research center?	Schools	96	41.6%
	Universities	58	25.1%
	Others	26	11.3%
	None	23	10.0%
	Municipalities	20	8.7%
	Companies	8	3.5%
Has the institution you work in asked you to generate communications or dissemination releases?	Yes	80	57.6%
	No	59	42.4%
Is it related to State agencies that request scientific information on a regular basis?	Yes	49	35.3%
	No	90	64.7%
Have you been asked to participate in the design of public policies for communicating	Yes	13	9.4%
	No	126	90.6%

science and technology to the community?	Does not know	0	0.0%
Have you assessed strategic plans of	Yes	6	4.3%
scientific communication implemented	No	131	94.2%
by public organisms?	Does not know	2	1.5%
Do you consider that in Chile there are duly implemented	Yes	10	7.2%
public policies in communication of science	No	110	79.1%
and technologies?	Does not know	19	13.7%

Table 4: (Prepared by the authors).

We asked about by the presence of PR within the universities or research centers (56.1%). All in all, this service also does not reflect a total coverage, as 32.4% lack or are not aware of this added value (11.5%). In 57.6% of cases, the entities have requested researchers to engaged in dissemination and 42.4% of the centers have not expressed interest in dissemination practices outside the facilities. This value is in line with 32.4% and 11.5% of those who indicate that they not have or are not aware of communications services within their institutions, respectively. We do not know if there were effects or about the communication efforts in the media through PR for publishing science news or to coordinate the participation of academics in outreach activities, since 90% of the respondents indicate that they participate in this type of activity, especially in schools (41.6%), followed by universities, with the 25.1 per cent, as the natural spaces of disclosure. Engagement with municipalities or at a neighborhood level is low (8.7%) and in companies it is even more so, with 3.5%. Clearly, this dimension shows the precarious participation of researchers outside the academic world. The great majority of researchers (90.6%) point out that they have never participated in the design of a public policy (PP) in S&T communication or in the assessment (94.2%) of strategic plans in the same direction. In short, close to 79.1% consider that there is no adequately implemented PP in S&T, 7.2% consider that they do exist and 13.7% does not know (Table 4).

3.2.2. Dimension: Scientists and the Media

Scientists and the Media			
Questions	**Options**	**No.**	**%**
Have you ever been interviewed	Yes	117	84.2%
by communications media?	No	22	15.8%
In the last twelve months, how many times have you appeared in the media?	1 to 2 times	52	37.4%
	None	51	36.7%
	3 to 5 times	28	20.1%

	More than 6 times	8	5.8%
In average, how long have you appeard in the media on TV and/or radio (In minutes)in the last 12 months?	Never	84	60.4%
	Over 10 minutes	24	17.3%
	1 to 2 minutes	10	7.2%
	3 to 5 minutes	8	5.8%
	Under 1 minute	7	5.0%
	5 to 10 minutes	6	4.3%
In the programs in which you have participated, what kind of participation was it?	Interviews	71	36.8%
	Reports	40	20.7%
	Tecnical Adviser	9	4.7%
	Cited	28	14.5%
	Other	3	1.6%
	Never	42	21.8%
What time was your participation aired?	Never	55	39.6%
	Other	31	22.3%
	Evening news	20	14.4%
	Morning Programs	19	13.7%
	Afternoon news	14	10.1%
Have you appeared in?	Newspapers	66	25.2%
	Radio	48	18.3%
	Open TV	44	16.8%
	Journals	28	10.7%
	Social networks	26	9.9%
	Never	24	9.2%
	Cable TV	23	8.8%
	Does not know	3	1.1%
Do you use social networks as a support in disseminating science and technology? Indicate the media	Facebook	58	29.1%
	Never	46	23.1%
	Websites	44	22.1%
	Twitter	28	14.1%
	YouTube	17	8.5%
	Other	3	1.5%
	Blog	3	1.5%
	Instagram	0	0.0%
	Press	47	33.8%
	Never	47	33.8%

Of your own research, in which mass media have you had dissemination?	TV	18	12.9%
	Radio	18	12.9%
	Social networks	9	6.5%
What do you think is the main reason for not being present in the media?	Not interested	47	33.8%
	Not approached by media and journalists	38	27.3%
	Does not apply	19	13.7%
	Does not know S&T journalists	16	11.5%
	Does not know	12	8.6%
	Others	7	5.0%

Table 5. (Prepared by the authors).

The dimension of scientists and the media (Table 5) shows inorganic and reactive presence of researchers, however, the media is not absent. 84.2% indicate having had an interview with some media at least once. If this data transfered to the last twelve months, the presence drops to 63.3%, dispersed between those who appear once or twice in a year and those who have appeared more than six times in the same period. 36.7% of the researchers have never had media presence during the last year. If we narrow the dissemination to radio and television, in the same period of follow-up, 60.4% do not have any participation, while the remaining 36.6% have a wide range, from those who have been in the media less than a minute to those with more than 10 minutes in the past 12 months.

Regarding the type of media participation, the interview is the gender at the top the list of formats with 36.8%, followed by reports, with 20.7% with the reports; other types of participation include that as technical advisor, with 4.7% and by citation, with 14.5%. The schedule is not a significant variable because its distribution is similar between the various possible spaces of morning programs (13.7%), afternoon news (10.1%) and evening news (14.4%). 39.6% declares not having appeared and 22.3% at other unspecified times. This is consistent with media practices of obtaining citations or interviews as a wildcard, to be circulated when the space or time is feasible. Regarding media employees, the newspaper (25.2%) is the leading instrument for scientists to disseminate, followed by radio with 18.2%, then open television, with 16.8%, journals, with 10.7% and social networks (9.9%). Private television has low presence, with 9.9%. The prevalence of transferring scientific activity onto the pages of a journal could be explained due to the greater demand of audiovisual resources and increased production for television, which increases the costs of elaborating a piece of communication. In the written press, on the other hand, the author of the research himself can manage the publication of the science news. In relation to the use of social networks for the purpose of dissemination, Facebook is the most widely used (29.1%), followed by websites, with 22.1%. Further behind are Twitter (14.1%), and Youtube (8.5%); blogs have a very low penetration as a channel for dissemination (1.5%). On the other hand, 23.1% does not use digital tools for contact with citizens.

3.2.3. Dimension: Science and Technology in the Media

In connection to the presence of the research scientists' own research, 33.8% indicates having presence through the press, followed by television and radio with 12.9%, respectively, followed further down

by social networks, with 6.5%. 33.8% do not have media presence with their own research and development. These figures warn that scientists do not always relate to the media due to their own research, a space that provides the experience and specific knowledge of their area, but they extend their role as an expert in other areas and not necessarily that of their field of research.

Science and Technology in the Media			
Questions	**Options**	**No.**	**%**
How do you consider the use of scientific language of journalists in general?	Insufficient for the requirement of the public	112	80.6%
	Suitable for the programming and the public	25	18.0%
	Does not know	2	1.4%
	Correctly and clearly	0	0.0%
In your opinion, who should produce scientific communication in the different media?	Specialized journalists	89	64.0%
	Renown scientists	36	25.9%
	Others	10	7.2%
	Indifferent	2	1.4%
	Does not know	2	1.4%
	Actors	0	0.0%
	Well known entertainers	0	0.0%
How do you value the dissemination or communication of science and technlology in mass media in Chile?	Bad (1,1-3,9)	82	59.0%
	Regular (4,0 - 4,9)	39	28.1%
	Is inexistent (1.0)	15	10.8%
	Good (5.0 - 5.9)	2	1.4%
	Does not know	1	0.7%
	Very good (6.0 - 7.0)	0	0.0%

Table 6 (Prepared by the authors).

In the final question of this dimension, 33.8% of the researchers consider that there is no interest of the media for dissemination; 27.3% point out the lack of contacts with the media and journalists, and another 11.5% express a lack of contacts with journalists specialized in the sector of S&T. These last two referents denote poor management of dissemination to help install S&T as a product for the media, and through their condition as private companies, media require programming or an editorial offer that is marketable to potential advertisers.

In the last dimension (Table 6) an interesting finding was that scientists considered (80.6%) that the language used by journalists is inadequate for the needs of the public. Although the statement is ambiguous, it installs dissatisfaction because the criticism can be directed toward various fields: conceptualization, use of inappropriate definitions, lack or absence of rigor with the source or considering knowledge that is extemporaneous or still unconfirmed as valid. On the other hand, what

the population requires with regard to dissemination is a broad question that must be addressed with other methodologies, perhaps with curricular elements and also as dissemination itself. 18% considered the language appropriate for the programming and the public and a 1.4% did not know. It should be noted that 10% of the respondents considered that journalists used correct and clear language. However, the researchers themselves (64%) are the ones who point out that the dissemination should be made preferably by journalists and 25.9%, by renowned scientists; 7.2%, by other professionals and only a very small fraction (1.4%) is indifferent or does not know, respectively. The final diagnosis of the researchers is that the dissemination of S&T in the Chilean media, 59.0% considers it poor, 28.1%, considers it regular and and 10.8% considers it non-existent. Finally, 1.4% considered it good and 0.7% did not know.

3.3. Validation Analysis
3.3.1. Digital Media

After consulting with the scientists, another section of this analysis was to verify the grasp of science in the media and note the degree of validity of the observations. To this end, we used a case study that we consider representative for our purposes. For this we use the newspaper *"Las Ultimas Noticias"* in digital format**,** a morning newspaper belonging to a large Chilean media conglomerate.

Data Collected in the Digital Media per 12 Month Periods				
News on S&T	**Sections**	**Topics**	**Associated Publicity**	**References**
131	The day Employment and Education Society Free Time SMEs Others	S&T Environment Health Events Business Education	Yes= 32 news (24.4%) No= 99 news (75.6%)	Without=47(35.9%) With=84(64.1%)

Table 7: Global Summary of the records collected between May 2016 and May 2017. It is noted that 75.6% of S&T news is unrelated to publicity (Prepared by the authors).

We reviewed and measured the corpus of one year, between 9 May 2016 and 9 May 2017, and we saw a total of 131 notes related to S&T (Table 7), i.e., one news story about every three days with a publication percentage of 35.9% during the year, with variable centimeter-column sizes and graphics in the development of the publication.

With regard to the formal aspects of the publications, *Las Últimas Noticias* does not respond to a classical editorializing approach that aims to spacially locate S&T news in particular or recurring sections; rather it publishes items in various sections such as: "Employment and Education," "Society" or "The Day", among others, and in the respective thematic emphasis of the notes that are related to S&T: environment, health or promotion of the sciences, etc. This observation is evidence that S&T is a global phenomenon and that its presence is recognized in different areas of society, which are

impossible to restrict to a specific thematic concept. On the contrary, they participate in various dimensions of the culture. Also, we interviewed journalist authors of some of the news and asked them who their target was or what type of public the publications in S&T were addressed to. The responses were inconsistent, without a clear specification of the reader. It is likely that they do not have a clear profile of the type of audience for this section, making it impossible to generate a specific demand of scientific or technology topics.

The data provided by Parodi et al. (2007) ten years ago no longer seems to give an account of the current scenario of the written media with regard to the communication of science. Although we do not have empirical information in comparative terms, we can say that *Las Últimas Noticias*, a tabloid characterized by "facts related to entertainment and the private lives of public figures" (Parodi et al, 2007: 349), is currently a media that shows consecutive evidence of S&T dissemination. Other media (printed and digital) that circulate in Chile as are the daily newspapers La Tercera and El Mercurio, both with S%T sections, such as "Trends" or "Life, Science, Technology," respectively, in addition to supplements of entrepreneurship and innovation to address issues of dissemination with emphasis on target public or consumers of each media.

3.3.1.2. News and its Publication in Digital Media Vis a Vis

In 45 (34.3%) of these news on S&T mentioned the scientists behind the research. That is to say, scientists have a degree of nominal and visual media exposure in this media. In continuing with the inquiry, we individually contacted the researchers to find out know how the news reached the publication. Thirteen responses were obtained: (a) five interviewees stated that the media contacted them; (b) five other explained the opposite process, i.e. they contacted the media, giving account of their research; (c) one interviewee explained that it was through an independent journalist who was interested in his research; and (d) two interviewees did not answer the question. This rapprochement, which is the search for S&T news from the media and the positioning of this morning newspaper among researchers as a legitimate channel of scientific dissemination carries implicit degrees of mutual collaboration.

3.3.1.3. On the Quality of the Publication

On the other hand, we asked the scientists who appeared in these publications, for their opinion about the quality of the publications, considering that in general it was high-level research. Although this data is not statistically significant, we can say that the respondents were satisfied with the translation exercise implemented by the media. Three of them stated inconformity with regard to the exercise. This record is interesting because detecting the reason for the satisfaction with the publication could be related to the authorship of the article - if it is issued by the author himself or it is decoded by the journalist or an external communications agency--because in this case study, the data collected denotes a fusion in managing the article publication. This statement requires further analysis which should be compared based on the extension, use of infographics, author participation, section, opportunity and other editorial codes.

3.3.2. Consultation with Journalists and Communicators (n=23)

This validation model was to consult journalists and communicators ascribed as disseminators of sciences who are members of ACHIPEC (Chilean Association of Scientific Journalists), of Milenium scientific centers and other local public and private media related to science and technology. The total number of recipients of the consultation was of 87 professionals including journalists and communicators. However, 23 accessed the query. In the design of the descriptive query, seven mirror

questions (in blue) were asked, to contrast the collected records with that of scientists in a credible manner. The format of Google form, digital communication and database construction was similar to the one used in the consultation to researchers, as was the response rate (71.9% response rate).The overall figures are as follows: 87 queries sent: 28 queries were not clicked;4 queries bounced and 55 queries clicked (of wich 32 were clicked,yet not responded and only 23 were responded).

3.3.2.1. The Selected Target

The journalists and communicators described in the *target* were of diverse vocational training and had a direct relationship with those ascribed to this quality of communicator (scientific), but which are not necessarily trained as journalists. That is, they members university foundations or research centers and their work is focused on S&T outreach activities, public relations or extension and not strictly in addressing the information in the form of news, interviews or reports scientists with coverage in some mass media. Identifying a specific profile of a S&T communicator is a persisting barrier or obstacle for a normal citizen since this discipline is not represented in the media like other areas of journalism. The consultation was done including journalists (12), researchers (6), teachers (2) and other professionals (3) with different levels of training: (3) PhD, (7) master, (5) with certification, (3) with post-degree training, and two without graduate training. The overall figures were: 87 queries sent; unopened 28; bounced 4; opened 55; clicked 32; answered 23. (Prepared by the authors).

3.3.2.2. The Query (see table 8)

In relation with the creation of articles published by journalists in S&T, most of the respondents (65.2%) considers it an act of their own research and further development, however, there are also publications that come (17.4%) from universities or research centers, not specifying whether they are sent by the same researcher or through external agencies of communication. 17.3% does not know or uses other channels to obtain the note. In consulting the researchers regarding the support network , 100% of the communicators indicate that they have one. However, (60.9%) states that scientists are not always accessible and 39.1% considers that they are always accessible. This information is contradictory because it reveals the lack of seamless interaction between scientists and journalists, which is supported by the self-criticism of the communicators in indicating that the publications (65.2%) in S&T are written in inadequate language for the needs of the public, as we have said in our central consultation. The expression is ambiguous but it expresses dissatisfaction not only of researchers to the communicators, but also of the communicators within their work. However, scientists are more categorical in this query. Their evaluation of this item is over 80%. 8.7% of the communicators state that they use clear and correct vocabulary, whereas scientists rate this option with 0.0%. An interesting fact is that one out of every two communicators (52.2%) considers that their work environment has an editorial strategy in S&T, while 34.8% says that they do not have one; 8.7% says that a strategy is seen sometimes, and 4.3% does not know. In pratice, this perception exposes difficulties the media have in developing dissemination of S&T with a permanent editorial plan.

With regard to participation in the design or evaluation of the PP, communicators are virtually absent, with predominant values similar to those of the scientists, with over 90% in the absence of participation and 80% of poorly implemented PP for both groups.

The greatest difference are related to the *ethos* of each activity, such as, for example, who should communicate about S&T, and both agree in that it must be a journalist, however, scientists perceive, in 25.9% of the cases, that they are the ones who should carry out the dissemination, while journalists assigned 0.0% to this work in the hands of the researchers. However, the presence of other

professionals to contribute to the participation and building audiences enriches the creative framework of dissemination, amplifying the reception of the different publics coexisting in society. That is to say, the focus should also be placed on the receiver.

Journalists and Communicators of S&T (n=23)				
Questions	Options	No.	%	% Scientists
In relation to the articles or scientific notes that you publish?	Researches and Develops	15	65.2%	
	Sent by Univ and Centers	4	17.4%	
	Others	3	13.0%	
	Does not know	1	4.3%	
	Are purchased by agencies	0	0.0%	
Do you have a professional network of scientists and/or technologists who can collaborate and clarify concepts for the dissemination of a news story of your authorship?	Yes	23	100.0%	
	No	0	0.0%	
	Does not know	0	0.0%	
Do you consider that scientists are accessible when their specialized knowledge is required?	Sometimes	14	60.9%	
	Yes	9	39.1%	
	No	0	0.0%	
	Does not know	0	0.0%	
How do you consider the use of scientific language of journalists in general?	Insufficient for the requirement of the public	15	65.2%	80.6%
	Suitable for the programming and the public	6	26.1%	18.0%
	Correctly and clearly	2	8.7%	0.0%
	Does not know	0	0.0%	1.4%
Does the media you work with have a S&T editorial strategy?	Yes	12	52.2%	
	No	8	34.8%	
	Sometimes	2	8.7%	
	Does not know	1	4.3%	
	Specialized journalists	17	73.9%	64.0%
	Others	3	13.0%	7.2%
	Indifferent	3	13.0%	1.4%

Who should undertake scientific communication in the different media?	Renown scientists	0	0.0%	25.9%
	Does not know	0	0.0%	1.4%
	Actors	0	0.0%	0.0%
	Well known entertainers	0	0.0%	0.0%
Have State Agencies, in your capacity of scientific communicator asked you to participate in the design of public policies of S&T communication for the community?	No	21	91.3%	90.6%
	Yes	2	8.7%	9.4%
	Does not know	0	0.0%	0%
Have you assessed strategic plans of scientific communication implemented by public organisms?	No	21	91.3%	94.2%
	Yes	2	8.7%	4.3%
	Does not know	0	0.0%	1.4%
Do you consider that in Chile there are duly implemented public policies in science and technology communication?	No	18	78.3%	79.1%
	Does not know	4	17.4%	13.7%
	Yes	1	4.3%	7.2%
How do you rate science and technology dissemination or communication in mass media in Chile?	Regular (4,0 - 4,9)	12	**52.2%**	**28.1%**
	Bad (1,1-3,9)	7	**30.4%**	**59.0%**
	Good (5.0 - 5.9)	4	**17.4%**	**1.4%**
	Is inexistent (1.0)	0	0.0%	10.8%
	Does not know	0	0.0%	0.7%
	Very good (6.0 - 7.0)	0	0.0%	0.0%

Table 8: The greatest imbalances between both groups are marked in red. (Prepared by the authors)

The final diagnosis of communicators *vs* researchers provides some differences in relation to the dissemination of S&T in Chile. While the 17.4% of the journalists valued this as good, only 1.4% of the scientists agreed. The option of bad was true for 30.4% of the communicators, while for scientists, the option was almost double (59.0%). However, the answers do not give this value to the journalist. Both groups also criticize the media for their lack of interest in dissemination and the lack of a simple, entertaining and rigorous format.

Thus, we may ascertain that the central axes of the query to the scientists agree with the predominant trends of statements obtained from the journalists. Low participation in the design of outreach strategies with State agencies, perception of inconveniences with the dissemination of S&T in terms

of the language of the communicator and what the public needs and an assessment of bad to regular in relation to the dissemination of S&T in the media in Chile.

3.3.3. University Curricula

In the third place, we analyzed the totality of the curricula - obtained from the web sites- published in the 23 universities that have career formation program of Journalism in Chile (see Table 9 and Figure 4), with an average of 51.5 Courses per program. It is verified that less than 1% (0.93%) reflect disciplines of natural sciences in the formation of future journalists. That is to say, it is not enough for the construction of a complete course of this knowledge throughout the formation period of the communicator. Almost all of the local universities (private and public), do not have courses in natural sciences or exact sciences, except 4 institutions of higher education. On the other hand, we note 6.58% of training linked to research in the social sciences, such as economics and business, social anthropology, market research, marketing, research seminars, among others. These findings are eloquent and could explain, in part, the apprehensions of scientists toward journalists in pointing out that there is lack of rigor in the language or referred to the low rating of the dissemination of S&T in general. The lack of curricular training or weak moments of contact between the communicator and the scientific activity, inhibit the discovery of vocational interests, given that the exercise of the profession is insufficient to develop rigorous self-study in science, as well as in other disciplines. It is worth mentioning that graduate programs or specialization in the career formation of Journalism in Chile do not have specialized courses related to health, environment or technologies, to name a few aspects. The specialization courses of the future communicators have turned to corporate and strategic communications, marketing, social networking and politics. In this direction, the digital communication courses are linked to the design of websites, blogs, applications, managing social networking or other communication formats, but with an emphasis on productive and operational aspects. However, information technologies (ICT) and audiovisual communication are an excellent platform to delve into the scientific and technological culture of these tools that journalists acquire throughout their education, which may enable them as experts in these disciplines.

Journalism and Science Courses in the 2017 Curriculum in Chile				
Universities	**No. of Courses Average**	**Science Courses Nat. Tot**	**Exact Sciences Tot.**	**Research Seminars**
Public (10)	53 (Total=526)	4	2	40
Private (13)	51 (Total = 659)	2	3	38
23	**51.5 (1,185/23)**	**0.51 % (6)**	**0.42% (5)**	**6.58% (78)**

Table 9: The Exact Sciences courses are reflected in statistical courses while the courses in Natural Sciences disciplines are those of environment and ecology. The research seminars in Social Sciences cover anthropology, market research, marketing, economics or investigative journalism, among others. (Prepared by the authors).

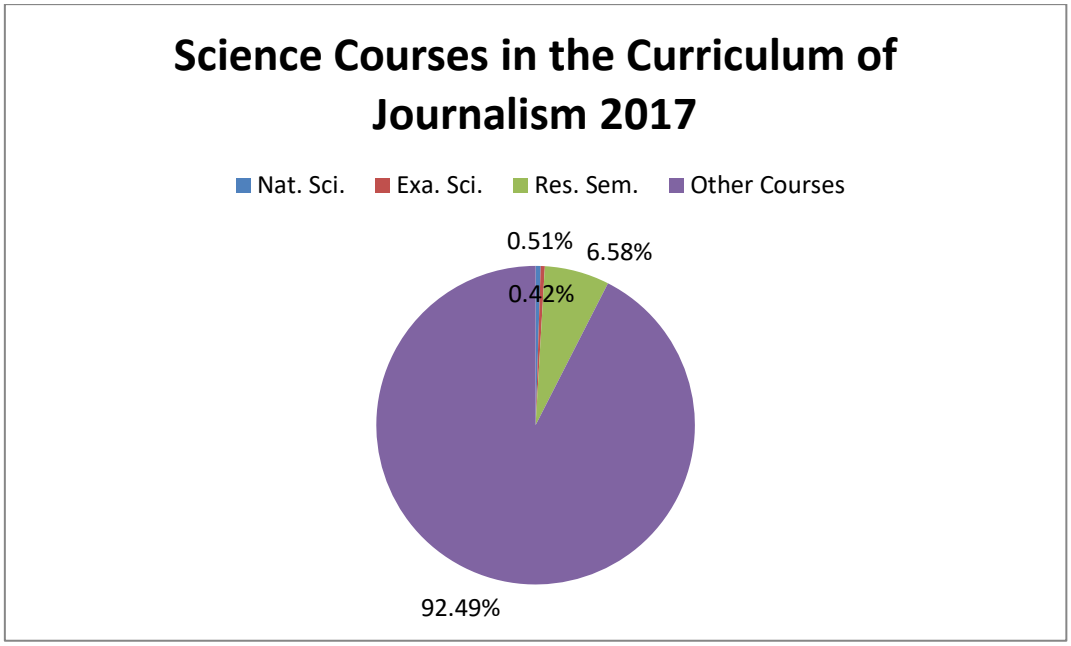

Chart 4: (Prepared by the authors).

4. Discussion and Conclusions

The analysis of the data collected in the query shows an irregular participation of researchers or of the dissemination of S&T, especially by the poor presence of scientists on TV and radio during the last year. This coincides with the low dissemination of their own research in these media. Written press maintains a higher degree of presence, similar to the case study (Validation 1), which gives an account of an average of one publication of S&T every three days during the period collected. We believe that this participation is reactive and inorganic matter and that it increases the invisibility of scientific publications in the media. It is paradoxical if we consider that "…the reflection of S&T in the media - or should be - the Great News, the daily explanation of the universe, the instrument of participation of the people…" (Calvo, 2002). The two models of validation (1 and 2) show the participation of communication agencies as catalysts for dissemination of S&T, but it not fully used by the researchers.

Even though we might be tempted to interpret this data in the light of the social representations (Jodelet, 2003), our approach does not seek to make psychology of the investigation mechanism, but rather to observe the phenomenon from the point of view of communications and specifically from dissemination. Negotiating their expertise on the one hand (Callon, Lascoume & Barthe, 2001) and their argumentative positioning (Breton, 2006) on the other, scientists would reproduce a pattern of their own practices in the field of communication (Bourdieu, 1976), mobilizing their dominant symbolic capital in the face of a lack of spaces for disseminating. However, the processes of mediatization (Lundby, 2009) and convergence (Jenkins, 2006) experienced by the media at present also have an impact on the publication of the S&T. In this context, publishing in the media can be understood from pragmatic sociology (Chateauraynaud, 2013), where the practices and discourses are considered elements to understand the positioning of the scientists in the media scene. That is to say, the fact that the scientists consulted consider science dissemination "bad" in Chile, not only has to do with the quality of science journalism or the lack of PP on the dissemination of S&T, but also with

how to critical discourse and autonomous practices of scientists in the field of communication are reproduced.

This study-although preliminary - give us lights of some underlying indicators in the absence of effective PP in disseminating S&T. According to Daza & Arboleda (2007) the current paradigm of the dissemination has features of commodification, because it only measures success in terms of the readings or how much the communication products are heard or seen. Media is a critical space in dissemination because it is the natural scenery that citizens use to be informed of the progress of scientific knowledge, thus its importance in the creation of collective imagination of citizens regarding science. Then, if the citizenry has an image of the S&T reduced to concepts without understanding qualities or assumptions of scientific knowledge or how it is generated through scientific inquiry, the isolated and de-contextualized image will turn S&T into knowledge that is not applicable and that does not have relevant meanings (Schwartz & Crowford 2006, cited by González et al, 2009). In this sense, the practice of dissemination and/or the communication of the S&T deserves special attention with objectives that transcend. Its relevance is evident due to the educational potential implicit in its nature. The design of PP of this knowledge has the imperative of providing space for objectives and strategies in outreach activities to solidify (Mogollón, 2015).

We believe that the incorporation of press and public relations (press offices), as done by Centros Milenium[(2)] that are home to researchers from different Chilean universities focused on a line of research is an excellent initiative that must be replicated in the faculties of basic and applied sciences with more active participation of scientists and journalists, because they are part of the line of contact with the primary source of information. This enables strengthening the interaction of the teams without the apprehensions of the *ethos* of each profession (Reed, 2001), thus preventing scientists from being faced with an overload of functions, by having to explain everything that the journalist was not able to do, but with the risk not contextualizing the dissemination through simple synthetic language. On the other hand, this synergy could contribute to less recurrent weakness in the rigor of specialized communication in S&T by journalists, without falling into ambiguities or general statements that result in lack of treatment or the context of the news (Moreno, 2008) and to mitigate the lack of training of the communicator, as noted in the Validation Model 3 (Table 9). This role more active and leading role of the journalist also involves an individual and collective responsibility, which is to uncover and demystify codes of the realm of science (Nieto, 2002).

Researchers may consider more intensive use of social networks as an option for dissemination. These technologies are fast and do not involve complex logistics and broad coverage. Given that scientific literacy requires general knowledge of the basic principles of current science and also of digital culture or of information technologies, use the electronic texts, access to a web site or to know the fundamentals of audiovisual communication are essential concepts of the S&T and enable cushioning the effects of the technocratic and immediacy supremacy on the understanding of the phenomena, especially in Latin America (Lopez & Parker, 2009).

Finally, we note that defining the standard of the presence of news or publication on S&T in the media cannot be understood only as a statistic , and the context of competition cannot be ignored, even with other cultural goods, by a scarce resource such as the page of a newspaper or the minutes on television or radio. This means that, in general, they are in the hands of companies and individuals. Therefore, to assume the social responsibility of PP in dissemination of S&T is a condition of mutual agreement between the private sector, the public and the citizenship.

Thus, it becomes essential to develop a master plan of PP with indicators or KPIs (*key performance indicators*), which can measure the activity of dissemination of the S&T in all public and private media in the country. For example:

1. Consider the extension of the publications.
2. Ranking of the scientific disciplines in the media and evaluation of the asymmetry of their airing.
3. Develop indicators of traceability to the origin of the dissemination, according to first hand agencies, local press, international or citizenship dissemination.
4. Register how recycled versus original the information published in the media is.
5. The presence of frequent and potential sponsors in radio, television, print media and social networks.
6. Detection of interaction spaces between scientists, journalists and the community.

All this information could contribute to the configuration of PP of dissemination in science, technology and innovation from the State, from CONICYT or of the future ministry of science and technology, promoting at the same time meeting points of contact between governmental and private institutions, such as the pharmaceutical industry, agriculture, forestry, mining or technological, among others. This would prevent the re-publication of resources and amplify a national coverage plan that points to the civil society in its entirety.

5. Notes

1 Case study (Validation 1): For the purposes of this analysis, all publications incurring in scientific-technological advances, innovations, discoveries or revisions are considered science news. Presence of scientists, promotion of the S&T or that the same newspaper defined with this character. The objective was to channel a wide range of news and to be able to stratify the observations.

2 Millenium Centers are research centers made up of Institutes or Nuclei whose lines of action have as their goal the development of research in scientific and technological research in Chile. The Millennium Science Initiative is currently financing a total of 36 research centers which cover a wide range of areas of knowledge such as the Natural Sciences and Social Sciences (http://www.iniciativamilenio.cl/centros-milenio/, downloaded on June 22, 2017).

6. References

Aerny, N, Domínguez-Berjón, Mª, Astray ,J, Esteban-Vasallo, M, Blanco L, &López, Mª. (2012):"Tasas de respuesta a tres estudios de opinión realizados mediante cuestionarios en línea en el ámbito sanitario". *Gaceta Sanitaria*, 26(5), pp. 477-479. https://dx.doi.org/10.1016/j.gaceta.2011.10.016

Alarco, J. Jhonnel, & Álvarez-Andrade, Esmilsinia V.(2012). Google Docs: una alternativa de encuestas online. Educación Médica, 15(1), 9-10. Recuperado en 28 de julio de 2017, de http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1575-18132012000100004&lng=es&tlng=es.

Alcíbar, M. (2002):"Cómo construyen los medios de comunicación la imagen pública de la tecno-ciencia". Congreso Internacional *La Ciencia ante el público. Cultura Humanista y Desarrollo*

Tecnológico. Sección II: Percepción pública de la ciencia y la tecnología. España: Universidad de Salamanca. pp. 3-20.

Arzubiaga, J. (2000):"Políticas públicas y regiones: Un análisis crítico". *Revista de Ciencias Sociales* (Chile), (10), pp. 73-86.

Barthe, Y., Callon, M., & Lascoumes, P. (2014). *Agir dans un monde incertain. Essai sur la démocratie technique*. París, Le Seuil.

Bourdieu, P. (1976):"Le champ scientifique". *Actes de la recherche en sciences sociales*, *2*(2), pp. 88-104.París.

Breton,P. (2006): *L'argumentation dans la communication* (p. XXX). París, La Découverte.

Calvo, M. (2002):"El periodismo del tercer milenio. Problemas de la divulgación científica en Iberoamérica".*Interciencia*, 27(2), pp. 57-61.

Camiñas,T. (2002): "La divulgación científica desde las instituciones públicas", en Comunicación y Divulgación de la Ciencia, *Revista Comunicar, Revista Científica de Comunicación y Educación*, nº 19, pp.71-76.

Cantabrana,B,Diez, B. & Hidalgo, A. (2015):"Percepción por los estudiantes de la divulgación científica en la prensa y de su contribución a la cultura científica". *FEM: Revista de la Fundación Educación Médica*, 18(1), pp. 47-53.

Carrillo,A. (2013):"La democracia como política pública: Oportunidades para el fortalecimiento democrático". *Revista de Estudios Sociales*, (47), pp. 25-38.

Chateauraynaud, F. (2011):*Argumenter dans une champ de forces. Essai de balistique sociologique, Paris, Petra*.

Cleveland, W. and McGill, R. (1984):"Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods". *Journal of the American Statistical Association,* 79(387), pp. 531-554.

Daza, S. & Arboleda, T. (2007):"Comunicación pública de la ciencia y la tecnología en Colombia: ¿políticas para la democratización del conocimiento? Public Communication of Science and Technology in Colombia: ¿Policies for the Democratization of Knowledge?" *Signo y Pensamiento*, (50), pp. 100-125.

Departamento de Estudios y Gestión Estratégica (2016): Resumen Ejecutivo Encuesta Nacional de Percepción Social de la Ciencia y Tecnología 2016. 16 de agosto, de 2016, CONICYT. [Disponible en: http://www.conicyt.cl/wp-content/uploads/2014/07/resumen-ejecutivo-encuesta-nacional-de-percepcion-social_web.pdf]

González Weil, C. et al. (2009): "La educación científica como apoyo a la movilidad social: desafíos en torno al rol del profesor secundario en la implementación de la indagación científica como enfoque pedagógico". *Estudios Pedagógicos* (Valdivia), 35, (1), pp. 63-78.

Jenkins, H. (2006). *Convergence culture: Where old and new media collide*. New York University Press.

Jodelet,D.(2003):*Les représentations sociales,* «Pages de début », Presses Universitaires de France, « Sociologie d'aujourd'hui », (7e Ed.), pp. 1-4.

Jurdant, B. (2009) : *Les problèmes théoriques de la vulgarisation scientifique*. Archives contemporaines.

Kruege, RA, Casey, M.A. (2000):*Focus groups: A practical guide for applied research*. 3th Edition. Thousand Oaks.

López, F. & Parker , C. (2009):"Alfabetismo científico, misión de la universidad y ciudadanía: ideas para su construcción en los países en vías de desarrollo". *Avaliação: Revista da Avaliação da Educação Superior*, *14*(2).Avaliação, Campinas; Sorocaba, SP, v. 14, n. 2, pp. 253-266.

Lundby, K.(Ed.). (2009):*Mediatization: concept, changes, consequences*. Peter Lang.

Martínez-Salgado C. (2012):"El muestreo en investigación cualitativa. Principios básicos y algunas controversias".*Ciência &Saúde Coletiva*, 17(3): pp. 613-619.

Minayo MCS, Assis SG, Deslandes SF, Souza ER.(2003):"Possibilidades e dificultades nas relações entre ciencias sociais e epidemiologia". *Cien Saude Colet*, 8(1): pp. 97-107.

Mogollón, G. (2015):"Discurso de divulgación científica y tecnológica: de la definición al análisis crítico". *Revista de la Facultad de Ingeniería*, Universidad Central de Venezuela, 30(1), pp. 15-26.

Moreno, C. (2008):"Los usos sociales del periodismo científico y de la divulgación: El caso de la controversia sobre el riesgo o la inocuidad de las antenas de telefonía móvil". *Revista Iberoamericana de Ciencia, Tecnología y Sociedad*, 4(10), pp. 197-212.

Morse J. (1995) "The significance of saturation".*Qual Health* Res, 5(2): pp. 147-149.

Nieto Olarte, M. (2002):"El público y las políticas de ciencia y tecnología". *Interciencia*, 27(2), pp. 80-83.].

Parodi, G., & Ferrari, S. (2016):"El discurso de la ciencia y la tecnología en la prensa escrita chilena: aproximación al corpus DICIPE-2004". *DELTA: Documentação e Estudos em Linguística Teórica e Aplicada*, *23*(2).

Pickering, A. (Ed.). (1992). *Science as practice and culture*. University of Chicago Press.

Reed, R (2001). "(Un-) Professional discourse? Journalists and scientists stories about science in the media". *Journalism Vol 2* (*3*): pp. 279-298.

Sandelowski, M. (2000). "Whatever happened to qualitative description? "*Res Nurs Health*23:pp. 334-40.

Trench, B. (2008). "Towards an analytical framework of science communication models". *Communicating science in social contexts*, pp. 119-135.

Wynne, B. (2006):"Public engagement as a means of restoring public trust in science–hitting the notes, but missing the music?" *Public Health Genomics*, *9*(3), pp. 211-220.

How to cite this article in bibliographies / References

J Tabja Salgado, C Broitman Rojas, A Camiñas Hernández (2017): "Perception of Scientists and Journalists on the Dissemination of Science and Technology Issues in Chile". *Revista Latina de Comunicación Social*, 72, pp. 1.107 to 1.130.
http://www.revistalatinacs.org/072paper/1210/60en.html
DOI: 10.4185/RLCS-2017-1210en

Article received on 25 July 2017. Accepted on 26 September.
Published on 3 October 2017.