SOCIAL REPRESENTATION FACED TO SCIENCE AND TECHNOLOGICAL DEVELOPMENT, ITS REGULATORY POLICIES AND IMPACT ON EDUCATION

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Abstract

Aim: Our study moves from a background knowledge which considers essential the interrelation of various policies/ reforms (governmental, educational, etc.) - with the research in the field of science and education. Therefore we will explore the literature inspired by the Social Representations Theory (SRT) in order to investigate: a) to what extent the dissemination of knowledge and science popularisation affect and are affected by socio-cultural resources in different cultural contexts and according to various decades from 1952 to 2016; b) how the science and technological development influence social representations.

Data sources and Methodology: Extracted from more than 10.000 scientific texts - filed in the specialised repositories of the *SoReCom"A.S.de Rosa"@-library* - we have selected the sources strictly related to education, science, social representations and communication. They have been analysed using the Grid for meta-theoretical analysis specifically developed by de Rosa (version 2014). The abstracts and the key words of the selected corpus have been submitted to analyses (supported by the software Iramuteq).

Exploratory hypotheses: Moving from the assumption that education and communication of science deals with the government, economic, cultural, educational and other policies - thus orienting also research interests of social scientists -, we expect differences in the process of the dissemination the literature on social representations of education and science in different geo-cultural contexts. We also expect that the developments of new technologies lead to crucial changes in the transmission of science and societal issues to the public, arising polemical representations when the impact of technology and science introduces new hot objects (like genetically modified foods) interfering with the traditional nature-society relation and destabilising hegemonic representation.

Keywords: education, science policy, Social Representations Theory, meta-theoretical analysis, *So.Re.Com "A.S. de Rosa" @-Library.*

1   INTRODUCTION

Born in 1994 from a systematic analysis of a personal bibliographic inventory, initially including almost 500 references in the field of Social Representations and Communication [1], an on-going multi-year project aimed at an empirical meta-theoretical analysis [2], [3], [4], [5], [6] of the whole literature on Social Representations currently has reached almost 10,000 publications. Guided by the main goal of evaluating the impact of the scientific production driven by the Social Representations theory in the social arena faced with social demand [7], the aim is to take stock of the scientific field developed in more than 50 years by conducting an empirical meta-theoretical analysis of the literature on Social Representations, mapping the development of different paradigms, the related research methods, the thematic areas and their impact on the various applied fields within the multi-generational community of scientists and across different geo-cultural contexts.

The present study is a part of EC-funded project (ITN-People MSCA-IDP 2013, no. 6072799 http://www.europhd.eu/SoReComJointIDP) on Social Representations and Communication, within the framework of the European/International Joint PhD in this supra-disciplinary field [8]. The whole project is articulated in three main foci: 1. Paradigmatic approaches to the theory (structural, socio-dynamic, dialogical, narrative, anthropological, modelling); 2. Thematic Research Domains (science, education, economy, marketing, environment, health, community, politics, identity, minority influence, also taking into account the taxonomy: polemic, hegemonic, emancipated social representations) and

3. geo-cultural areas of the theory production and dissemination (Europe, Latin America, North America, Africa, Asia and Oceania).

The research line "*Education, Science, Social Representations and Communication*" is one of 13 foci inserted into a common framework aimed at evaluating the worldwide dissemination of the scientific production driven by the Social Representations theory. This focus has been a core interest of the theory since the beginning; indeed, "Moscovici's choice of psychoanalysis (as both a theory and a therapeutic practice) – an object of knowledge/ experience much discussed in France during the 1950s – was prompted by his intent to study the transformations, the similarities and/ or differences between expert knowledge and everyday knowledge, between science and common sense, between 'reified universes' and 'consensual universes' with their specific modes of operation (processes) and functions in the broader symbolic system of social relations and ideological positions mediated by communication systems" [6], [55], [56], [57]. The Theory has been introduced more than fifty years ago in Europe; since then it has been disseminated in different geo-cultural contexts being applied in various scientific fields [5], [9], [10], [11], [12], [13], [14], [15].

Some of the research questions at the genesis of the research program became evident while reading and meta-theoretically analysing the publications on social representations, science, communication and education. For example it became an empirical evidence that there is a striking difference in the number of publications on specific thematic focus in different geo-cultural contexts. Why do some topics arise hot debates among the public while others remain untouched? What stands behind the fact that some thematic fields are more covered in the media? Does the cultural context have anything to do with it? These are just some of the questions we will have to answer, while interviewing our data and meta-data not only on the basis of reader's impression, but by a systemic empirical analysis of the sources.

2   METHODOLOGY

The selection of the corpus was preceded by a very careful double quality control of the bibliographic data of more than 10.000 scientific texts. Firstly, total of 10.902 publications present in the *So.Re.Com "A.S. de Rosa" @-Library* [16], [17], [18], [19] were identified as referring to "Social representation and communication", "Communication" or to "Social sciences and other related fields". Secondly, 9743 texts referring specifically to Social representations and communication were distributed to 13 Early Stage Researchers (ESRs) who analyze the publications using the *Grid for meta-theoretical analysis of literature on Social representations* designed in 1994 by de Rosa (last version February 2014) [20].

For this contribution we have selected a corpus including 655 texts (articles, books, book chapters, conference presentations, manuscript, master theses, PhD thesis, other reports, stand alone web documents, university reports) strictly related to education, science, social representations and communication. The abstracts and the key words of the abovementioned corpus have been selected as sources of the statistical analysis, (deleting Not Recognised Forms, Numbers and Articles) conducted by the Descending Hierarchical Cluster Analysis and the Correspondence factorial analysis supported by the software Iramuteq [21].

3   RESULTS

The analysis has been stable following the lemmatization process. The number of the Forms should be less than 50% (in this corpus after the lemmatization it is 34.03%), while the number of the occurrences less than 20% (in our corpus after the lemmatization it is 1.82%), as illustrated in the Zipf Diagram (Fig. 1).
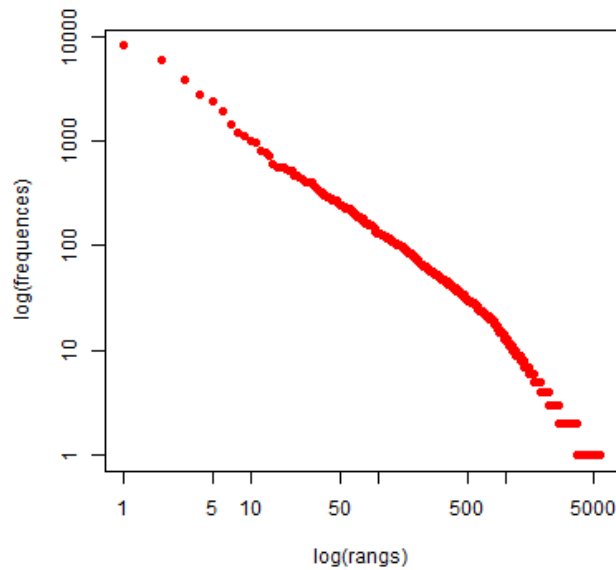
Fig. 1. Zipf Diagram

The significant distribution of the words in the Descending Hierarchical Cluster (DHC) Dendrogram (Fig. 2) has originated 3 Clusters, which we have identified and named as follows:

1   Education, professionalization, and their context and target/actors;

2   Communication, science, system of knowledge production and transmission;

3   Social representations and common-sense knowledge: the raw of social psychology.
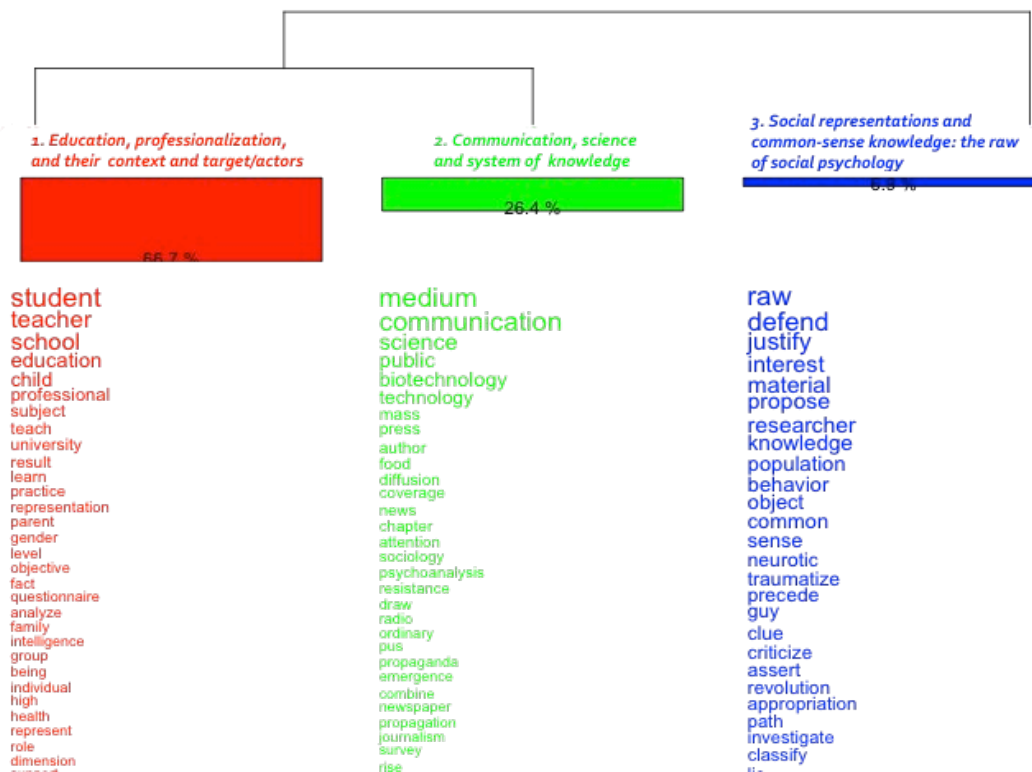

Fig. 2. Descending Hierarchical Cluster (DHC) Dendrogram

Cluster 1 (Fig. 2) interpreted as **Education, Professionalization and their contexts and target/actors** appears to be more salient (66.7%). It refers to:

- the different levels and **institutional contexts for knowledge socialization** (*school, university, family*) and target/ actors (*child, student, teacher, parent*) of education;

- also as **professionalization** (*professional, practice, learn)* especially in the sector of *health.*

The significant positioning on the cluster 1 of the illustrative variables (Fig. 2b.) shows:

- the dissemination of the Social Representations theory in **Latin America** and the specific interest for the area of Education by authors from **Argentina, Mexico, Venezuela, Colombia,** and in some cases also by European authors from Sweden, Spain and France and from Asia;

- the resource type is especially based on **articles** (in some cases also present in the bibliometric data bases **Scimago-Scopus and Thompson & Reuters) and conference presentations;**

- **in Spanish and French** *as language of publication;*

- **over two decades 1990-1999** and **2000-2009.**

Cluster 2 (Fig. 2), interpreted as **Communication, science and system of knowledge transmission** is focused on **science communication,** starting from Moscovici's seminal work on **psychoanalysis** to the more recent studies on the public understanding of the science and **technology** *like in* **biotechnology, biogenetic modified foods, impact with new technologies.** Fundamental is, for the semantic organisation of the cluster, the interest for **the system of knowledge production** (*survey, chapter, author, sociology)* **and transmission involving medium (mass media, press, news, radio, newspaper, journalism)** addressed to the **public** and stimulating **several processes** (*emergence, attention, coverage, resistance)* *and the* **three canonical system of communication** (*diffusion, propagation, propaganda*).

The significant positioning on the cluster 2 of the illustrative variables (Fig. 3b.) shows:

- that communication and the dynamic of expert knowledge and common sense (as core interest of the Social Representations theory) is significantly related to literature produced in **Europe** in particular by authors from **United Kingdom, Italy, Portugal, Germany, Norway, Austria, Denmark,** but also authors from **Cuba**;

- resource type refers mainly to Book chapter, Books and University Reports;

- publications in some case included in the bibliometric data base Thompson & Reuter-WoS;

- it is interesting to note that the years of publication for this cluster cover transversally all four decades since the 1960-1969, 1970-1979, 1980-1989 until 2000-2009 with the unique exception of the last one since 2010.

Cluster 3, interpreted as **Social representations and common-sense knowledge: the raw of social psychology**, refers to**:**

- **social representations and common sense knowledge as the raw of social psychology** (quoting consistently one of the Moscovici's expressions during an interview given to Markova: "the common sense popular knowledge should be the **raw** material of social psychology");

- the process of the *knowledge appropriation* by the *population* in the interface of knowledge produced by *researchers to investigate, classify, assert, criticise, defend, justify, interest, propose.*

The positioning of the significant *"illustrative Variables"* on the cluster 3 (Fig. 3b.) reveals:

- once more the large dissemination of the Social Representation theory in **Latin America**;

- in this case in particular by authors from **Brazil**;

- through **books** as resource type;

- published especially in the **last decade since 2010.**

The figures 3a and 3b bellow illustrate the main results of the Correspondence factorial analysis regarding respectively the role of the active and illustrative variables.

- Fig. 3a. illustrates the organization of the factorial space by the active contribution of the distribution of three Classes: **Cluster 1** *Education, professionalization, and their context and target/actors;* **Cluster 2** *Communication, science and system of knowledge transmission;* **Cluster 3** *Social representations and common-sense knowledge: the raw of social psychology*.

- Fig. 3b. shows the positioning on the factorial space of the "**Illustrative variables**" (our meta-data) as function of their significant relation with three clusters emerged by analyzing our data
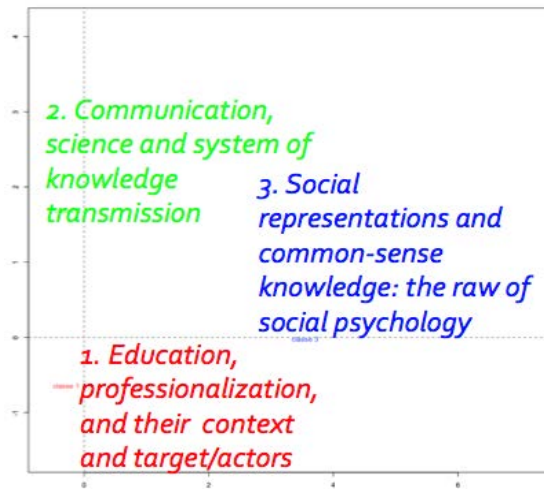

Fig. 3a. Correspondence factorial analysis: three clusters produced by the active variables
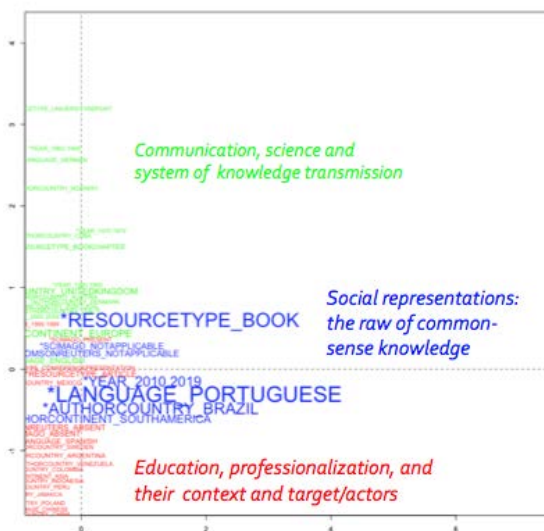

Fig. 3b. Correspondence factorial analysis: the positioning of the "illustrative variables"

4   DISCUSSION

The results of the data analysis show the crucial role that different socio-and geo-cultural contexts play in the dissemination of knowledge and science popularisation. In particular, in accordance with our exploratory hypotheses – based on the assumption that the education and communication of science deals with the government, economic, cultural, educational and other policies, thus orienting also research interests of social scientists - we found out differences in the process of the dissemination the literature on social representations of education and science in different geo-cultural contexts, clearly differentiating the European and Latin American contexts in which the literature on social representations has been produced and disseminated over more than five decades [5], [9], [10], [11], [12], [13], [14], [15], [22], [23], [24].

For example, according to the empirical results people in **Latin America** seem to be more concerned with the issues in the system of education and professionalization in the domains of education and health, rather than with the science popularisation. We may refer here to some exemplary contributions in the research field of *Social Representations and Education* from authors from Latin America (from Argentina [28], [29], [30], [31], [32], [33] and from Brazil [25], [26], [27] just to mention

some of the authors from two Latin American countries, but many other authors and Latin American countries, like Mexico, Venezuela, Colombia resulted among the significant illustrative variables positioned on the cluster 1, could be mentioned here).

On the other side of the Atlantic in **Europe** the publications deal mostly with some hot issues of *Science* (like biotechnology, GM food, cloning, organ donation, etc.) and the *way it is **communicated** and perceived by lay people* [34], [35], [36], [37], [38], [39], [40], [41], [42], [43], [44], [45], [46], [47]. It should be noted that the questions on Education are raised also by the academics from Europe (see for example: [47], [48], [49], [50], [51], [52], [53], etc.), but these papers do not prevail significantly among the others as the papers on Science and Communication do.

If we move from the above presented empirical results detected from our meta-theoretical analysis of the literature in the field of Education, Science and Communication to the scenario about the policies in the field of education, we may find interesting input in the paper "*Multilatinas & Education*", a chapter of the statistical report analyzing "*Corporate Social Investments in Education in Latin America & the Caribbean*". The authors of this paper, J.W. van Fleet and G. Sanchez Zinny [54], state that - despite the increased government financial support for education in Latin America (Fig. 4) - numerous indicators demonstrate a drastic need for improved educational quality. The lack of the quality of education and the need for the qualified specialists arise more and more questions in the Latin American countries. One of the main issues among social scientists and professionals is then how to reply to the policies oriented to increased financial support for education with best educational practices.
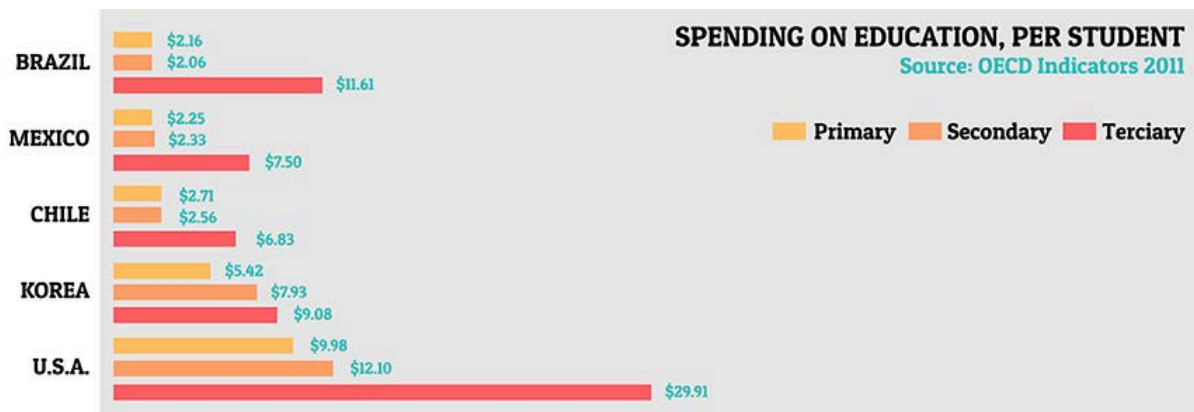

Fig. 4: The government's investments into education in Latin America & the Caribbean.
Source: OECD Indicators 2011

From the European side, the number of science graduates in the EU is increasing (See Fig. 6), which is in line with EU's declared intention to become the world's most competitive science-based economy, promoting excellence in education and skills development. As a result, this system intends to ensure a sufficient supply of (post)graduates in science, technology, engineering and mathematics. Figure 5 shows a growing number of EU students graduating from tertiary education in science and technology.
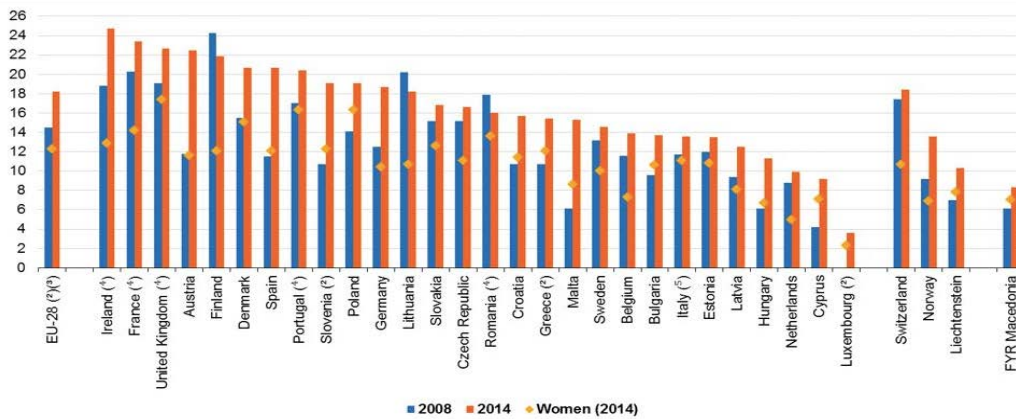
(¹) 2008 data based on ISCED97; 2014 data based on ISCED 2011. Full title of the 2014 indicator 'Graduates in tertiary education, in science, math., computing, engineering, manufacturing, construction'.

(²) 2013 data (instead of 2014).

(³) Definition differs (2013).

(⁴) 2014 data are provisional and/or estimates.

(⁵) Definition differs (2008).

Fig. 5: Tertiary graduates in science and technology by country, 2008 and 2014 (¹)
(Graduates per 1 000 inhabitants aged 20 to 29 years)
Source: Eurostat online data codes (tps00188) and(educ_uoe_grad04)

5 CONCLUSIVE REMARKS

The concurrent reflexion on the empirical findings detected trough the meta-theoretical analysis and on the governmental policies in the double continental scenarios of Latino America and Europe shows the dynamic between the research foci chosen by the social scientists working inspired by the theory of social representations and specific public issues and governmental policies, guided by societal interests and people's needs living in distinct geo-cultural societal contexts. Although the preliminary results based on the meta-theoretical analysis need to be worked out to get a more in-depth vision about the scientific dissemination of the literature on social representations and communication (looking at the relevance of the papers, their impact, high quoting rate, the collaborative research networking among authors [15], etc.) nevertheless these preliminary results are interesting in detecting the evident geo-cultural impact that concurs to the convergence of research interest and the agenda of the publications by the academics working in the field of social representations, sensitive to the societal issues, like education and science.

If the interest of social scientists for the social representations in the education domain does not only concerns the scholastic transmission of knowledge in different institutional settings for multiple generational levels (children, adolescents, university students), but also addresses the professionalization of knowledge in different sectors of highly societal relevance (especially health); in the field of science it deeply deals with polemical representations mobilising the citizens' concern for the impact of technology and science introducing new hot and unfamiliar objects (like genetically modified foods, organ donation, etc.), that interferes with the traditional nature-society relation and destabilises hegemonic representations. It is a matter of facts that more and more people get involved in the knowledge construction and even revolts against experts and resistance are often the case nowadays leading to unexpected consequences of the policies.

In both domains (education and science) it is crucial to investigate the role played by the development of new technologies in the transmission and accessibility of the "*reified knowledge*" for studying in which way the communication systems available in different societal contexts, but at the same time with processes of knowledge construction and transmission operating at global scale, influence the popularisation of expert knowledge among lay people in the contemporary societies and even if and in which way may influence them. [55], [56], [57].

Future researches should consider even more the imaginary dimension and the iconic vehicles of social representations, science and technology, since images offer a much deeper insight, examining different perspectives which cannot be expressed in words [58].

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