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SOCIAL CONSTRUCTIONS OF SCIENCE IN STUDENTS OF HIGHER EDUCATION

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Abstract: What is science for students of a professional career? This simple phrase entails a great deal of study in details, similarities, differences between the various scientific disciplines, gender, semester, particular context, etc. We start from this questioning to delve into the social representations of science in 297 students belonging to 6 centers of the Network of the University of Guadalajara, Mexico. For this, a free association exercise was used, whose analysis was done through the qualitative thematic content analysis technique. Among the findings, it stands out that the vast majority of students, regardless of their affiliation center, see science as that set of knowledge systematized and verified through experimentation; that is, there is a homogeneous social representation of science among young students, which is not surprising, since previous studies have reached the same conclusion. This gives rise to reaffirm that an education in science is necessary, there is not a single way of understanding and doing science, because the contributions of the different scientific disciplines are lost, leading to inaccurate conceptions.
Keywords: Students, science, social representations.

INTRODUCTION

At the local, national and international level, it is read, commented, and manifested, in its different expressions, that science is one of the pillars of development, of the well-being of a country, as well as of citizenship in general. And we don't doubt it. It is seen, above all, in the first world countries in which the largest budget is invested in science, technology and science education, in addition to the fact that they are the ones with the largest number of researchers. In our context, a developing country, it is known that what is allocated to science, technology and innovation is scarce, well below what is recommended by the OECD (Organization for Economic Cooperation and Development), since it does not reach or to half of one percent, which is the minimum recommended by said body.

If we add to the above the fact that science education programs are not enough -for multiple reasons-, then a vision with an unfortunate omen is completed: science is seen with little interest in schools, in communities, in institutions. It does not mean that the attempt is not made, because there is dissemination of science in different spheres of public and private life, but not enough to reach the goals established in public policies on science and technology.

In the IES (Higher Education Institutions), in the field of science there is dependence on the CONACYT (National Council of Science and Technology) who finances scholarships, academic exchanges, stays, support for research projects, scientific journals, among others. But given the conditions of the number of students, teachers and low budget, in most cases financial resources are insufficient for all these items, and one scientific discipline is prioritized over another, or applied science is encouraged. above the basic. So, we are left with the general support that the federal and state governments provide to public universities, for which training scientists and conducting research are not priorities.

In turn, in each professional career, department, institute, clinic, research center, etc., the guidelines established by their own university must be followed, whether in study programs, research projects or others. All these mediations contribute to the construction of science, which is being forged or reinforced day by day, not only in students, but also in teachers, as well as in institutional managers.

How does this affect our students in a closer way with respect to their conception

of science? Why undergraduate or graduate students, in particular? Because they are the boys who are forging themselves into a profession, and their social representations of science could motivate them or prevent them from pursuing a career in which scientific research is involved. Also, because students are, in a certain way, a glimpse of what happens in their academic environment, so it is worth asking, what is science for them? Will their social representations of science allow them to continue with a postgraduate degree, delve into research, be members of a scientific community?

In this way, by making known their social representations of science, we will be realizing the needs that as teachers and researchers we must correct to fill absences or fallacies regarding science and what it implies; but above all, realize how the students are learning it through their stay at the university.

THEORETICAL FUNDAMENTALS

The way in which science has been "institutionalized" in people begins from an early age (Berger and Luckmann, 1968, have named this "primary institutionalization"), influenced first by the family (types of toys that are bought from children, books that are read at home and what is discussed or commented on, trips to museums, theme parks, technological and scientific devices at home, etc.); To this are added the programs about science or scientists that are shown, mainly, through television (on its multiple screens or through *streaming*), or certain movies with scientific or science fiction themes, and that they are also seen at home on any electronic device. Subsequently, it is the school (from basic to higher education, called "secondary institutionalization", according, also, to the authors Berger and Luckmann, 1968) in which these conceptions are reinforced, emerging ideas, conscious or not conscious of what it is. science and what it represents.

All of the above is usually called "lateral social determinations" (as designated by the creator of the theory of social representations, Serge Moscovici in 1961), which are properly cognitive and expressive aspects (which belong to medium and micro levels), while "core social determinations" are the socioeconomic and historical conditions of a society (macro level). For example, with respect to the latter, living in Mexico is not the same as living in any other country; there would therefore be those differences in the dynamics that influence how social representations of science are constructed in a particular context. It must be stated that the participating students, inserted in a public university, are mediated by public policies on science and technology, both from the university and from the local and national government, which in turn follow international policies regarding innovation. scientific and technological. And this affects, like it or not, in certain social representations of science, of scientific activity, as well as the image of the scientist.

The theory of Social Representations (SR from now on), whose progenitor was Serge Moscovici, is an excellent epistemic theoretical foundation to account for what students think, imagine, believe, feel, perceive and know about science. According to the author, "social representation is a particular modality of knowledge, whose function is the elaboration of behaviors and communication between individuals" (1979, p. 17).

For example, when a person has the ability to classify, evaluate and explain a fact or an object, it is because they have a SR of the phenomenon or the object; therefore, SRs are considered cognitive systems made up of stereotypes, opinions, values, images, norms and beliefs that circulate in a community, country or nation, and that guide practices.

So, if students have a social representation of science, they will act accordingly (Moscovici, 1979; Abric, 2001). This theory mainly refers to common sense knowledge, and its objectives are to communicate, keep up to date and feel within the social environment. Now, the knowledge that is possessed of the object can be of scientific origin or of common sense; more what matters is that one feeds the other and that knowledge is transformed into that feedback and finally we see how it is represented socially.

SR, being a cognitive system, correspond to an act of thought in which a person relates to an object through various mechanisms; and that object is replaced by a symbol, that is, the object is symbolically represented in the mind of the individual (Moscovici, 1979). It must be noted that SRs are not only individual mental products, but also symbolic constructions that are created and recreated in the course of questions, interactions and social exchanges; for the same reason, they do not have a static character nor do they determine individual representation, since SR is both a constituted and constitutive thought of societies (Jodelet, 2000, 1986; Banchs, 1986). That is, SRs are constructed and operated socially, giving meaning to the construction of a daily reality, shared and structured by social groups (Moscovici, 1979).

SRs, being characterized as operational entities for understanding, communication and daily practice, are linked to the language and social practices of a certain social group. Abric (2001, p. 13) mentions that social representation is "a functional vision of the world that allows the individual or the group to give meaning to their behavior, and understand reality through their own system of references." Moscovici (1979; 2000) had already pointed it out, a social representation is a preparation for action, as a guide that guides behavior; it is a way of capturing the world, adjusted in its foundations and in its consequences according to the micro and macro social context. For this very reason, SRs play an elemental role in the practices and dynamics of social relations.

By giving an account of the social representations of science that students have, we will be revealing their "feeling" towards science, and their possible insertion in the world of research.

ACHIEVEMENT OF THE PURPOSES

This study is part of another with greater scope. For now, some essential results regarding the meanings given to science and the implications behind it are shown in this paper. It is a descriptive approach, in which the most essential aspects of what science represents -in general terms- are detailed for undergraduate students, in which certain comparisons are made by disciplinary fields.

Participants. The 6 thematic centers of the Network of the University of Guadalajara were included because they are geographically established in the Metropolitan Area of Guadalajara, and because of the access to them. Of these 6 thematic centers (CUAAD, CUCBA, CUCEA, CUCEI, CUCS and CUCSH)[1], 297 students participated, on average 50 per university center, with a very even participation of men and women. Within each center, students from different careers collaborated, which makes the sample (non-probabilistic, by quotas) heterogeneous, that is, a mosaic of various scientific disciplines, so that the findings, we can assert, are not biased by the different areas studied and represented by the students. The field study was carried out, mainly, in June 2015 -in that period

1. CUAAD= university center of art, architecture and design. CUCBA= university center of biological and agricultural sciences. CUCEA= university center of administrative economic sciences. CUCEI= university center of exact sciences and engineering. CUCS= university center of health sciences. CUCSH= university center of social sciences and humanities.

students from different careers in specific courses coincide-, and it was also carried out in the month of December of that same year.

Tools in the production of information. For this work, only one instrument is reported (two were applied), elaborated personally, previously validated (theoretical triangulation and by researchers close to the subject): an exercise of associative questions composed of 18 sentences for students to complete, same that were oriented to know the opinions of science, of the scientist, of scientific activity, and the main means or sources by which the students considered that they were influenced. Although in this report only one answer of the associative question exercise is taken up, all of them are closely associated with those of the questionnaire, since various readings of both tools were given to have a better understanding of the corpus.

Information processing. One of the ideal procedures to analyze students' beliefs, opinions, perceptions, images, stereotypes, that is, the social representations of science, is through content analysis, since this technique allows revealing both the voices in on and in off. There are different ways of classifying content analysis, and in this case the thematic was used since the expressions were classified by their units of meaning (whether they were individual words, short sequences of words or entire paragraphs). By doing the above and relating it to the theory, he became aware of the social representations that science students have. On the other hand, previous categories emanating from personal studies were also used (Domínguez, 2012), which account for the same topic, but on a smaller population scale.

In the interpretation of the material, through open coding, according to Flick (2004), the following was done::

1. An initial reading as recognition of the corpus, an exploratory review of each of the answers by student, generally identifying similarities between the answers.

2. A system of codes and categories was developed, applying open coding (which tries to express data and phenomena in the form of concepts) consisting of:

- Segmentation of the data, that is, the expressions were classified by their units of meaning (whether they were individual words, short sequences of words or entire paragraphs).
- The segments were grouped taking as a parameter the relevance with respect to the research questions, and they were codified, a process that consisted of assigning annotations and concepts (Barthes, 2001, calls this process "making codes") to the groups of segments.
- These codes had to represent the content in a striking way and, above all, offer help in remembering the category reference. Some of the names of the codes and categories were given in relation to the meaning that the student gave to the answers; even, the name of the codes were appropriated from some name cited by the students themselves (*in vivo* codes). Others were created by the author of this research, as a way to make sense of it and to be able to group the answers that adhered to these codes and categories.
- The result of the open coding of the associative responses was a list of codes for each response, which were complemented with "code notes", generated to explain and define the content of the codes, in addition to a series of annotations with observations. about the material and thoughts relevant to the substantiation of the questions and objectives.

FINDINGS

The main result is stated -and what lies behind it-, according to the title of this work. before the question *"If someone (some friend, relative, colleague, or any other person) asks you what is science? you would reply that....."*, The answers were varied in text, but keeping similar conceptions, as we can see with the following statements by the students assigned to the different university centers.

On the part of art, architecture and design (CUAAD) it was commented: "It is the part of the study that is in charge of responding to phenomena through scientific and quantitative methods", "Science is the method to give an answer to any subject without margin of error ", "What studies the demonstrative methods and based on research carried out and verified", "It is the research or the knowledge that comes out of experiments", "Practice that leads us to know new things, discover, etc.", "It is the matter that includes everything that surrounds us, nature, physics, chemistry", "They are a set of methods and knowledge applied to an end", etc.

The students of biological and agricultural sciences (CUCBA) said: "It is the one in charge of carrying out research through the scientific method", "It is the set of knowledge of a specific topic", "It is what studies all beings alive", "It is the one that studies life physically, chemically", "It is the event that man generates through research, activities and that can be verified in its entirety", "It is the detailed study based on tests and experiments carried out", "All phenomena, chemical transformations of living beings", "Science is the closest thing to the truth, it gives us the tools to discover, measure and evaluate phenomena or events", etc.

On the part of administrative economics (CUCEA) the following was said: "It is the way in which with the investigation you resolve doubts or questions about a topic of interest, there you investigate, tests are made, hypotheses are made and you give answers", "It is an area of research or activity aimed at answering questions and controversies", "Science is the way in which the study of something specific by qualified professionals in nature is called", "Science is what is used to do research to discover something, create something, verify theories or find a cure for some disease", "something verifiable, knowledge supported by facts by wise people on the subject", "Science is responsible for the great discoveries of humanity in its different branches", etc.

Students of exact sciences and engineering (CUCEI) said that: "It is the study of the universe and its composition, in addition to the interactions and manifestations with all its components", "A discipline in which knowledge of mathematics, physics, chemistry, among others", "It is the study of the behavior of elements", "It is the set of objective and verifiable knowledge about a subject", "Science is something innovative or some way of helping us through technologies that will help humanity through discoveries ", "It is something exact and verifiable", "Science is a way of learning from the real world through a systematic methodology that seeks verification", "It is a study about the rules that govern the physical world, it has many branches" , "Something that can be studied, that you can experience and that gives you some knowledge", "A set of applied knowledge to develop and investigate new things useful for humanity", etc.

Health sciences students (CUCS) commented: "It is the method that seeks to know the truth through experimentation and reasoning", "Science is all the knowledge acquired through a scientific method (observing, inferring, experimenting). verify)", "It is a set of knowledge on a specific topic which can be understood and verified

through the scientific method", "it is a method to answer questions that intrigue the human being", "Science is a set of knowledge grouped in different areas, which are universal and objective", "It is an activity where you carry out experiments to discover new things", "The study of experimentation through physics", etc.

And finally, the students of social sciences and humanities (CUCSH) pointed out that: "Science is the objective and rational explanation of what exists or what happens", "A positive discipline that seeks to explain everything but is not absolute truth and seeks to theorize", "It is the one in charge of studying various aspects of the world, society, nature, mathematics, all depending on the branch (universe)", "The one in charge of analyzing and investigating phenomena diverse, whether social or scientific", "It is that branch that is in charge of studying the why of things and discovering new theories", "Something that studies some part of society in order to improve something of it", "Method to quantify, prioritize and study nature and give meaning to reality", "It is the sum of methods, strategies and forms to obtain an answer to a question in a verifiable way", etc.

The above statements are a reflection of the opinions of the students, as representative as possible, of each thematic university center; With this issue, we want to show the variety of discourses with which science is associated, and that the similarities exceed the differences (there are, for example, the students of agricultural biology relate science to aspects of living beings; those of science exact and engineering with questions of physics, mathematics, and forgive the redundancy, with the accuracy of science).

In the analysis of the information emanated by the students, 3 main codes were distinguished, each one with its categories. Thus, 1. PURPOSE was named, as the why of science, in which the adjectives, descriptions and extensions of the why of science fit. 2. PROCEDURES: the methods were classified, the how, through which the purpose of science is achieved, either through specific procedures, or the scientific method in general. 3. The COGNITIVE PROCESSES involved in a) "abstract" were distinguished as those that imply an analysis by means of the study of something, or an activity;

b)"concrete" as the processes already constituted, as the set of knowledge, as a discipline.

According to the responses with higher frequencies according to the aforementioned codes, the students gave more relevance to the abstract processes involved in science. The second place was made up of the purpose of science. Thirdly, another of the processes, but this time the concrete one, which has referred to an already constituted knowledge. In fourth and last place, there are the "how", that is, the methods to achieve the purpose of science.

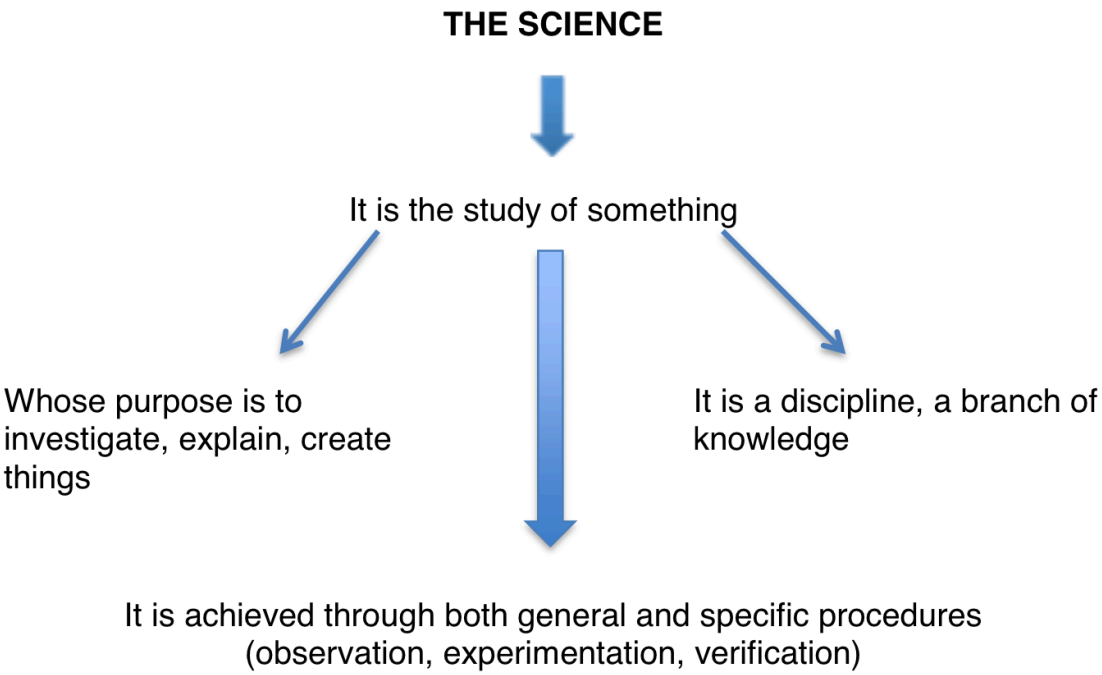
The following table shows this finding, which is important to show, because this allows us to get closer to the meanings given to science by students.

It was necessary to use this way of showing the frequencies of the responses, because that way the different categories are detailed for each code, and thus show the different ways of understanding science by students. It is not an easy task, but with multiple readings it was possible to simplify the 297 responses, that is, for each of the students.

On the other hand, the following scheme tries to make present the two processes that are fundamental to account for social representations, namely the **objectification** and the **anchorage** (Moscovici, 1979). The **objectification** is defined as an image and structure-forming operation, that is, the intervention of the social is taken as an "agency" (image) and as a "form" (structure)

CODES AND CATEGORIES	CUAAD	CUCBA	CUCEA	CUCEI	CUCS	CUCSH	Total
PURPOSE (for what -adjectivize, describe, expand-)							
Purpose 1: specific knowledge	1	0	7	2	2	3	15
Purpose 2: understand, understand	0	4	2	2	2	4	14
Purpose 3: investigate, analyze, explain	10	7	7	12	3	8	47
Purpose 4: charity	0	0	3	2	0	2	7
Purpose 5: create new things (technology, innovation)	0	5	6	6	2	3	22
PROCEDURE (methods used -how, through what-)							
Procedure 1: specific (analysis, description, observation, verification, experimentation...)	3	3	4	4	13	6	33
Procedure 2: scientific method (in general)	1	3	0	3	5	1	13
Procedure 3: qualitative method	1	0	0	0	0	0	1
Procedure 4: established process (unspecified)	8	3	9	4	6	5	35
ABSTRACT PROCESSES (they describe science in an abstract way, which implies analysis by means)							
Process 1: study of something	18	18	18	12	13	10	89
Process 2: Activity	8	7	6	3	3	5	32
Process 3: It is an event	0	2	1	0	0	0	3
Process 4: as a whole (magic)	0	0	0	1	1	0	2
CONCRETE PROCESSES (more concrete thoughts, as something already constituted, the result of)							
Result 1: set of verifiable knowledge	7	7	7	4	5	2	33
Result 2: discipline, branch of knowledge	6	5	17	6	2	6	42
Result 3: It is a matter, art	3	0	0	3	3	5	14
Outcome 4: rationale, justification of/in theories	8	2	6	2	0	1	19
TOTAL CATEGORIES							421

Table 1. Codes and categories in the construction of the meanings of science in university students.



Scheme 1. Social representations of science in student informants.

of knowledge related to the object of a representation, in this science case; it is to make the abstract concrete. For his part, the **anchorage** refers to the meaning given to said image or structure. Then, through this scheme both processes are exemplified, since by giving form to abstract notions (science), a material texture is given to ideas, and therefore this structure is loaded with meanings that allow them to be communicable through of language, as is the case of the textual responses already made visible previously.

Using the diagram above, the **figurative core** (Moscovici, 1979), in which the answers of the students of the 6 thematic centers are verified, in an abbreviated way. In this nucleus, both objectivation and anchoring are synthesized, that is, the central idea of science. It was seen that a homogeneous concept of science prevails, very similar for almost all the informants, and that it corresponds to a typification that Moscovici makes of social representations (homogeneous, emancipated and controversial); in the study of this work, it coincides with the homogeneous social representations of science.

It also refers us to the primary and secondary institutionalization of science, of which Berger and Luckmann have illustrated, very close to the lateral and central determinations of Moscovici's speech. In other words, these social representations come from various sources (family, school, media, etc.), but they also subscribe to the concept of managed science in scientific public policy discourses; It has been observed that the natural and exact sciences are valued more than the social sciences.

What are the voices in off, that is, the tacit, the unspoken in the students' responses?

- Science oriented towards the natural and formal sciences; little vision of the social sciences (it is the study of something, not of someone or a group).
- In the process of conducting research, qualitative logic is almost invisible.
- A way of seeing science in an imposed way, through different mediations, oriented more theoretically than practically.
- Science is taught and learned, not by doing, but memorizing certain standardized concepts of science, as in textbooks.

In summary, we observe a figurative nucleus, a central idea in the way of conceptualizing science among most students, regardless of the center of affiliation: they consider that science is only one, an almost exclusive way of understanding science. science, and more than an activity, they consider it as a body of knowledge that has been tested through experimentation; Of course there are definitions far from the first on a smaller scale, but that general imaginary of science prevails. Even in the university centers less attached to the natural and formal sciences, such as the social sciences and humanities, the administrative economic sciences and to a certain extent the art, architecture and design, this idea prevails.

COLOPHON

The foregoing is a brief analysis of how science is conceived among the informant students, namely, mostly homogeneous social representations of science, which have been formed through their daily lives, reformulated in the school and academic environment, reinforced by the different media, family, friends, partner, etc., are factors found in various studies (Domínguez, 2012; Belmonte and Guillamón, 2008; De Cheveigné and Verón, 1996; among many others). The complements, that is, what is behind science, the image of the scientist between men and women, the activities carried out by researchers or scientists, both in general and

in particular, are essential aspects, which although they are not touched in this work -it was not the objective-, they are reported in other works (Hidalgo, 2015; Cheryan, Plaut, Handron and Hudson, 2013; Domínguez, 2011; for example). For now, this background gives us room to understand that, based on these social representations, teachers as well as popularizers and communicators of science, must venture into these conceptions, many of them loaded with inaccurate images, to show how a polyhedron the different faces of science, understood as one more profession in which students can develop and exploit the creativity that exists in them.

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