Science images through Iberoamérica: one word, one draw, different values

Rocío Ramirez Paulino
Independent researcher
zualc3@gmail.com

Jordi López Forment
Independent researcher
cokezone@gmail.com

Anna Romero Ibáñez
Independent researcher
romero_anna_@hotmail.com

Abstract

In this work we show the results of the spontaneous collection of words and drawings related to science. Four years, four context-categories, two different countries and nearly five hundred words make the total sample. Form high school classes to PCST2012 to Flea and tourist markets and the proper street, we asked to say one word, or to draw one thing related straightaway to science. The results are examined, grouped and discussed here, from a social and educational perspective. Tree categories were assigned in order to classify the type of words, and being related to the context of each collecting site. We also sought for conditionings in the words said by age and by the context of the sites. This is an experiment turned into paper, and the conclusions show beliefs and values that may be exemplified by the results or not; the final idea is to discuss these in the PCST2014 conference.

Introduction

As teachers of secondary school classes with a background in research, we are always looking for new ways of teaching scientific concepts, and to present science in its social context. The nature of science is complex, many times polarized or multifaceted. Thus, when teaching science, all aspects must be considered. The same counts for other types of communication (journalistic, popular, peer-to- peer).

Democratization of scientific knowledge can only happen if each individual, from researchers to teachers to students, begin to see science in different ways. Science should be transmitted as being part of popular culture (**1**); a serious, rigorous, though no less entertaining part.

How is science viewed in different social contexts? Which factors are shaping the way people see science? Many studies have shown that public attitudes towards science are more influenced by each individual's cultural and ideological background than the educational level received (**2**). Science positivism is trembling, if not dying, and facts don't seem to speak for themselves anymore (**3**). Ideally, citizens should have their own founded and unique vision.

Words are powerful. The word science may be as controversial as science itself. They can be used to deliver various types of messages that eventually will predominate in society. Alone and combined, words, images and icons become memes that exponentially reproduce and spread globally. This happens with science, but how?

The hypothesis of this study is that science is being communicated in certain fixed ways, using words and images that auto-reproduce and become viral in society. The way in which science is mostly transmitted to the public reinforces previous concepts (**9**) and this fact interferes with the democratization of science knowledge and a real public engagement that could eventually direct science progress to social inclusion. To test this, we collected words immediately associated with the word science, so as to register the unconscious ideas in mind.

Antecedents

The use of art and expression to enhance comprehension and learning, is gaining attention nowadays (**4, 5**). Moreover, there are plenty of examples of drawings about scientist, science facts and theories (**6, 7, 8**). These are social experiments that intend to represent the imaginaries of students about researchers, and of some researchers about themselves and they research field; they show ideas, conceptions and values that surround science.

With this idea in mind, we began to collect words and drawings associated instantly with science some years ago (**9**). The idea started in my regular science classes at secondary school, in an attempt to sketch the ideas and ideals of the students about science. Later on, it became an experiment and ended as a research project and a way of communicating science to the public. The excuse proved to be a good way to provoke reflection, a kind of game to think about the use and abuse of words.

We can use words to analyze which "science messages" predominate in society and develop strategies in order to maintain or change these messages -and the values they entail that are being communicated.

Main objectives

- Promote a personal questioning of the notion of science, and if possible, prompt thoughtful thinking on the increasing complexity of scientific and technological knowledge.
- Encourage the challenge of individual expression and experimenting with our perceptions, values and beliefs.
- Identify, register and analyze conceptions and notions about science.
- Determine which considerations should be taken into account to improve science communication, from the fact of individual perspectives of the scientific enterprise.

Methodology

We started to collect words and draw in science secondary technical school classes, and soon extended the idea to some science conferences to the general public and

cultural events such as “Pecha Kucha”(**10**). Later, we did the same with attendants to science communication congresses and finally, we went with some science communication fellows to “take” words from the street, flea and tourist markets. We have been collecting words since 2010 and to this point I have near five hundred words.

This collection has certainly being done randomly, since the public differed in age, social status, educational level, country and context. From Montevideo to Barcelona, we asked for one word or one draw related straightaway to science, and sometimes had the chance to keep the conversation going and grab the “association explanation” behind.

In general, we simply used a recorder and some sheets of hard papers for the drawings. In particular, we made different activities, depending on location, the type of public expected and other circumstances such as the time available for the job, etc.

Basically, we used 3 methods for collecting data:

1. Plastic and literary expression workshop in which we asked, what is science? The proposal was: "Give us a drawing or a word. Don't think it! Just express."
This was done on a big sheet of paper (e.g. on a clipboard) also on separate shared out papers, or a booklet. Some words were written on paper, instead of making drawings.

2. Audio - recording workshop - Science is... “Say one word. Don't think it! Just express."

3. Spontaneous street market recordings. In this case the slogan was “Science is... “Say one word. Don't think it! Just express."

Analysis

We collected registered and then grouped the words in order to see how many words were repeated in the sample as a hole. For this mean, we decided to translate the drawings into words and sometimes, very similar words were considered the same (for example study, studying, computer, PC, technology, technological, etc.).

We re-grouped words and images (translates as words) in 3 categories, in order to match possible conditionings: words that expressed feelings (category 1, generally nouns or adjectives, for example, “love”, “passion”, “search”) words that expressed actions or results (category 2, generally verbs or nouns related to actions, for example “study”, “mathematics”, “work”, technology, research) and places, situations or objects (category 3, generally nouns, for example “university”, “computer”, “matrix”, “tubes”).

We looked for the relationships between the most repeated words and the site and context they were said in, as well as the number of words and its repetition for each category. Finally, we matched this numbers between category and site/context.

Results

The type and total numbers for the most registered words is shown in **Table 1** (in Spanish). "The winner word", the most said or drawn, and we believe the most associated with the word science was "knowledge". The second was "laboratory", the third "research", and then "study", "technology" and "experiments" respectively. Other mostly repeated words were "scientific", "glass container", "Einstein" and "nature".

Conocimiento	17		Descubrimiento	5		Física	4		Verde	3
Laboratorio	15		Futuro	5		Método	4		Innovación	3
Investigación	14		Pasión	5		Molécula	4		inventos	3
Estudio	10		Progreso	5		Nada	4		Lentes	3
Tecnología	10		Química	5		Signo de interrogación	4		No se	3
Experimento	8		Vida	5		un hombre con túnica	4		Ojo	3
Científico	7		Avance	4		Átomo	3		ordenador	3
Frascos de vidrio con humo	7		Ciencia	4		Célula	3		PC	3
Einstein	6		Comunicación	4		Conocer	3		Útil	3
Matemática	6		Estrella	4		Cultura	3			
Naturaleza	6		Estudiar	4		Fantama/s	3			
Creatividad	5		Evolución	4		hombre	3			

Table 1 Most registered words (and drawings translated into words) collected and their respective number of repetitions.

We decided to look at the places and therefore the contexts in which these mostly said words were said, as well the percentages of these words in these places related to the total amount of words for that place. This is shown in **Table 2** and **Figure 1** respectively.

	Knowledge	Laboratory	Investigation	Study	Technology
Science events	14		9	6	4
College	2	15	1	3	1
Market			3	1	4
Pecha kucha	1	1	1		1
	17	16	14	10	10

Table 2. List of the 5 most repeated words by site/context.

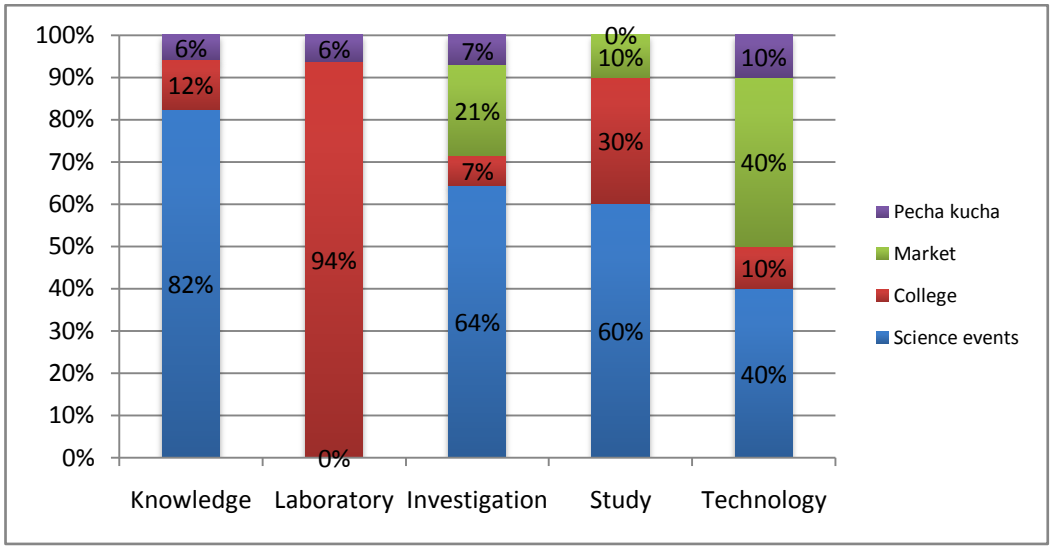

Figure 1. Percentages of words repeated in each site/context in relation to the total words sample.

"Knowledge" was mostly said in scientific events, but this is the context in which the majority of words were collected, so there is a bias in the possible interpretation. The same happened with all the 4 following mostly repeated words, except for "laboratory", which was resulted to be an exclusive word from science classes. Is interesting to note, besides, that the first two most repeated words wasn't said at the market, and laboratory was not said neither in the market nor in any science events.

As for the number of words by category, the third one, which described "places, situations or objects", had clearly the greater amount of words (**Figure 2**).

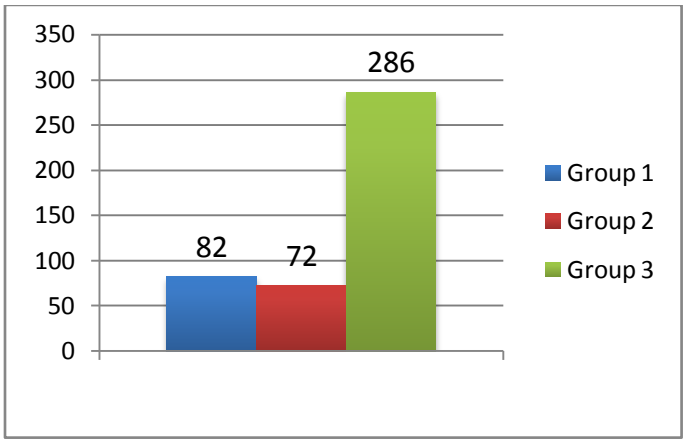

Figure 2. Words grouped by categories: 1_feelings (generally nouns or adjectives, for example, "love", "passion", "search") 2_words that expressed actions or results and 3_ places, situations or objects.

With respect to the numbers of words by site/context, in general, no significant differences were found (**Figure 3**). The exception may be, again, in the education institutional context, in which the percentage of category 1 (feelings) appeared clearly less than in the other contexts.

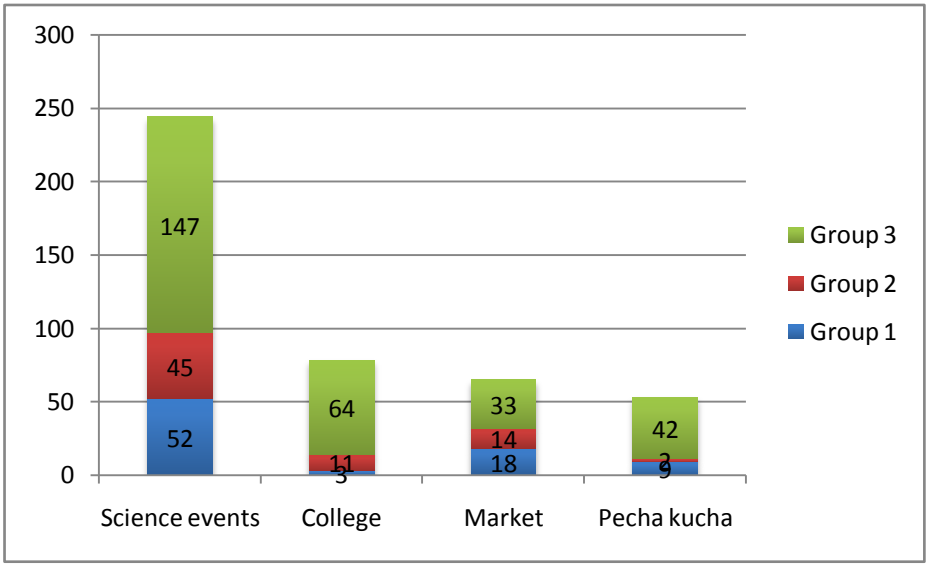

Figure 3. Number of word types by site/context.

Discussion

Analysis of the most repeated words can be made in different ways. Here I will refer to our personal beliefs and values, and the way we see people visualizing science according to the results.

At first, we were a bit surprised to realize that knowledge was the commonest word, because it was "the logical word". For us, science is a way of getting to know the world; it has certain rules and parameters of course, but basically, the aim of science is knowledge. But then, when looking at the percentage of knowledge words in each site/context, related to the percentage of knowledge words in all sites, science events had the greater amount. In this type of events, public is already familiar with the science world and its ultimate end. Laboratory, on the contrary, is an ambiguous term and is certainly related to the neat and meticulous, unreal image of scientists in society.

The word laboratory, besides, appeared almost only in the educational, "college" context. This could reflect a less adventurous, sentimental, "open" mind in children. We dear to say, it is probably the result of the institutional, school context that may have influenced children's state of mind, directing thought and associations to established ideas. Probably the children take and keep "science institutionalized ideas". In addition we should say that young students tend to copy their partners when drawing in the same booklet or board, due to being lazy or even shyness.

As for the other 3 most repeated words, "technology", "study" and "research", they corroborate the idea of a fixed association with the word science. Indeed, the same happens with some, if not the most of the rest of most repeated words, such as "scientist", "glass containers with smoke", "Einstein", "mathematics", and even "nature". Nature, though not shown in the results, was mostly said by children. Again, "natural sciences" is a traditional name for biology and other sciences commonly used at school, which could indicate the "institutionalized association" mentioned before.

The 3 arbitrary groups that we assigned for the words indicate a clear predomination of the third category, probably the more abstract one, and at the same time, inclusive. Experiments, objects, materials, places, seem to be related to science as components of some kind of cold, hard, objective, even "superior" activity, made in some particular, strange, distant place. This is not new for the student's image of science and

confirms previous works in the subject of public perceptions of science and scientist (**11, 12, 13**).

Again, in the educational, institutional context, the percentage of category 1 words (feelings) appeared clearly less than in the others, probably indicating a lack of free association, or a holistic, more mature view of science.

Finally, these results may be compared to the tree patterns found by Gordon Gauchat who has predicted various outcomes for public attitudes toward science. He says "Us citizens see science: (1) as an abstract method (e.g., replication, empirical, or unbiased); (2) as a cultural location (e.g., takes place in a university or is practiced by highly credentialed individuals); and (3) as one form of knowledge among other types such as commonsense and religious tradition (**14**)."

Conclusion

Behind one word, we can see unique conceptions about science. The results of this experience show some trends of what, we could say, the general public have in mind when considering the word science. Words are powerful but at the same time, can be installed in people's minds and create fixed ideas and imaginaries, that many times are distorted. This seems to happen especially at school, where young students don't have a complete, "real" idea of the universe comprised by science.

I strongly believe that science communication for social inclusion and public engagement must start with a shake in educational standing (**15, 16**). Asking for words, drawings or even other kind of representations, and discussing the associations behind, is a good way of communicating and researching effectiveness of this task at the same time. Moreover, today there is a bloom of science videos in which, combining drawings and words, science is communicated and new forms of education are tested. This is a great profitable tool for the future, and a vast field for research in science communication.

References

(1) Van Riper, A. (2002) "Science in popular culture: a reference guide." Westport, Greenwood.

(2) Kahan, D. M. "The Cultural Cognition Project". April, 2014. Available at: http://www.culturalcognition.net/blog/2012/5/27/climate-change-polarization-fast-and-slow.html Yale Law School. Accessed on April, 2014.

(3) Grant, W. J. "What science communicators can learn from listening to people?" on "The conversation" blog. Available at: http://theconversation.com/what-science-communicators-can-learn-from-listening-to-people-25087 Accessed on April, 2014.

(4) STEM to STEAM project. Available at: http://stemtosteam.org/ Accessed on 2014.

(5) The Art of Science Learning. Available at: http://www.artofsciencelearning.org/ Accessed on April, 2014.

(6) Curtis, D. J., N. Reid, and G. Ballard (2012). "Communicating ecology through art: what scientists think." Ecology and Society 17(2): 3. Available at: http://www.ecologyandsociety.org/vol17/iss2/art3/

(7) Ede, Siân, (2002) "Science and the contemporary visual arts." Public Understanding of Science, January, 11 pp 65–78.

(8) Jones, Tim (2009) "Tiles in a worldwide sci-art mosaic explore what science means to writers, scientist, school children and others" on SEED Magazine, December. Available at: http://seedmagazine.com/content/article/surreal_science/ Accessed on April, 2014.

(9) Ramirez Paulino, R. 2012. "Science Express, an enjoyable triad. Expression, Perception and Communication of Science." Public Communication of Science and Technology (PCST annual meeting) Florence, Italy.

(10) Ramírez, Paulino, R. "Creatividad y Conocimiento. Una historia de retroalimentación positiva." PECHA KUCHA Night 3, Montevideo. Available at: http://pechakuchamontevideo.org/rocio-ramirez-i-ciencia/ Accessed on April, 2014.

(11) The "Draw a scientist" competition http://www.sarepta.org/tegnekonk/english.cfm?si=1

(12) Who is the scientist? Seventh graders describe before and after visiting the Fermilab. http://ed.fnal.gov/projects/scientists/ Accessed Oct. 12.11

(13) SAS- project: "Science and Scientists" Cross-cultural evidence and perspectives on pupils' interests, experiences and perceptions. http://folk.uio.no/sveinsj/SASweb.htm#_Toc483975189 Accessed Oct. 12.11

(14) Gordon Gauchat (2012) "Politicization of Science in the Public Sphere: A Study of Public Trust in the United States, 1974 to 2010". American Sociological Review 77(2) 167 –187 (quote at p83) Available at: http://www.asanet.org/images/journals/docs/pdf/asr/Apr12ASRFeature.pdf Accessed on April, 2014.

(15) Dos Santos, C. A. (2013) "Ciência para a erradicação da pobreza" Ciência Hoje online. March, 3. 1. 2013. Available at: http://cienciahoje.uol.com.br/colunas/do-laboratorio-para-a-fabrica/ciencia-para-a-erradicacao-da-pobreza. Accessed on April, 2014.

(16) Quintanilla, M. (2006) "Equidad y calidad de la educación científica en América Latina. Algunas reflexiones para un debate sobre los modelos de formación inicial y continua de los profesores de ciencia" on "Proyecto: ConCiencias para la sostenibilidad, Construyendo ciudadanía a través de la educación científica" UNESCO. pp. 17-37.