The content of students' representations about climate change: A case study of national pedagogical university, Mexico

Raúl Calixto Flores *

National Pedagogic University, Mexico

Abstract

The aim of this article is to describe the main results of research on social representations of climate change in a sample of 105 students from the National Pedagogical University, Mexico. The research corresponds to an exploratory study in which the procedural approach of social representation; the methodological perspective, privileged the use of qualitative techniques, through many instruments: associative letters, based on the free association of words from an inductor term, the subjects express the words freely. A questionnaire with open and closed questions and qualitative interviews, based on the presentation of images related to climate change. The results show that college students have social representations of climate change with hegemonic content, emancipated and controversial. Hegemonic relate mainly to the effects and with the educational alternatives; content emancipated incorporate issues related causes; and controversial contain with emotional issues related to this phenomenon.

Keywords: Environmental Education; Content; Social Representation; Students

* Corresponding author. *E-mail address:* rcalixto@upn.mx

1. Introduction

Climate change is one of the problems that attracts most of the attention of researchers from different areas of knowledge. Intensive human activities that threaten the natural cycles of the planet are the main cause of their origin, alterations that manifest in multiple forms. Before this reality, in the educational field, it is a priority to carry out research aimed at describing and understanding the representations that different sectors of society have about the causes, effects and ways of solving the effects of climate change. The research described in the article was developed with a sample of Educational Administration, Indigenous Education, Pedagogy, Educational Psychology and Sociology of Education students of the National Pedagogical University, to describe the social representation of climate change.

2. Development

Unlike decades ago, the effects of climate change are multiplying and the humanity is reaching a no return point, that is, environmental alterations are giving rise to irreversible effects on the planet, which disrupt the physicochemical and atmospheric cycles, which in turn alter the climates and put at risk the survival of thousands of life forms.

In this regard, Lovelock (2007) mentions that the planet is already in such a situation that all efforts to reduce the effects of climate change will not succeed. On the other hand, Randers (2012) argues that in the second half of the twenty-first century, the planet will have a severe environmental crisis and sustainable routes will no longer be available to humanity.

2.1. Social representations

Social representations focus their attention on common sense knowledge, referring to large plots of reality, such as the physical world, the world of life or the social world, or very limited aspects as a professional specific practice.

Social representations are considered the genesis of social knowledge within a cultural and interaction framework, in which the media contribute to its conformation. In this research, social representation is considered as a form of knowledge of common and practical sense that allows to obtain a functional view of the world. It comprises a series of notions, that allow to identify the individual or group vision, that the subject has about a certain object. Social representations are oriented towards communication, understanding and mastery of the material and social environment. They are constructions of subjects on an object, but never reproductions of that object. These representations give sense to reality and they are a bridge with the practice.

Social representations comprise something that is presented and something that is taking something else's place, so they play an important role in communication. They function as a link between the representative and the represented and they are in everyday language of the subjects.

Nowadays, the social representation of climate change has become a line of educational research, contributing to enrich the proposals of environmental education.

> *The use of social representations as a tool for analysis in applied social research allows us to reveal cognitive constructs about the environment and, in part, explain the behaviors associated with these constructs* (D`Amato, 2012, p. 46).

The social representation of climate change has been identified in many sectors of the population, as documented by Jovchelovitch, S. (2001); Meira, P.A. (2002, 2009, 2012); Urbina, J. (2006); Leiserowitz, A. (2007); BBC, 2007; Meira, P.A. And Arto, M. (2008); Leiserowitz, A., Maibach, C., Roser, R. (2010); Meira, P.A., Arto, M. (2013); Meira, P.A. Arto M., Heras, F. and Montero, P. (2011); among others. BBC World, surveying 22,000 people in 21 countries in 2007, reveals a high percentage of people who consider human activity as a significant cause of climate change: 77% in Canada; 71% in the United States; 94%, in Mexico; 88% in Brazil; 85% in Chile; 93% in Spain; 92% in Italy; 89% in France; 87% in Germany; 79% in Russia; 78% in Great Britain; 70% in Turkey; 66% in Egypt; 72% in Nigeria; 72% in Kenya; 91% in South Korea; 87% in China; 81 in Australia; 76% in the Philippines; 71% in Indonesia; 47% in India. The difference of percentages, are explained in study, by the different possibilities of access to the information.

These results show that climate change is a topic of interest, known by a high percentage of the population, in the case of Mexico, the percentage of people associating human activities with climate change, is one of the highest. In Mexico, Urbina (2006) finds that most people (46%) consider knowing "something" about climate change; 36% "very little" and 10% much, and the lowest percentage 7% says they know "a lot". In this case, the author attributes, as a factor of these differences, the subjects' schooling, since that determines the differentiated possibilities in the access to the information related to the climate change. These results lead to consider university students as a population that can more easily access to information on climate change, because they are better informed than the "common people".

The investigation of social representation of climate change in higher education institutions provides elements to understand if environmental education has promoted in students the generation of environmentally friendly behaviors. Social representation of climate change has been investigated in higher education students, by Boyes, E., and Stanisstreet, M. (1992), Dove (1996); Meira, (2012); Meira and Arto (2014); Rebich and Gautier (2005); Rebich, Deustc and Gautier (2006); Cabecinhas, Lázaro and Carvalho (2008); Gautier, Deutsch and Rebich (2006); Padilla (2010); González-Gaudiano and Maldonado (2012); Correa (2012); Jaspal, Nerlich and Cinnirella, (2014) and Terrón and Bahena (2015), among others. Table 1 shows some of the main results of the mentioned researches.

In this set of research we observe different aspects of social representation of climate change in university students, that is to say, climate change, have become part of the common sense knowledge in this sector of the population. With these representations, students dialogue, explain and come to make decisions in their daily lives regarding climate change.

Table 1. Preliminary research on the social representation of climate change in the university population

RESEARCH	RESULTS
Dove, 1996; Rebich and Gautier, 2005; Meira 2012; Terrón and Bahena, 2015.	Ignorance or lack of clarity on the problem of climate change.
Dove, 1996; Meira, 2012.	They find relationships between the greenhouse effect and depletion of the ozone layer.
Rebich and Gautier, 2005.	Students consider climate change as a result of the ozone hole.
Boyes, E., and Stanisstreet, M., 1992; Dove, 1996; Rebich and Gautier, 2005; Meira, 2012; Terrón and Bahena, 2015.	They identify a strong association between the existence of the ozone hole and climate change.
Rebich and Gautier; 2005; Meira and Arto; 2013; Ramírez, 2014.	The identification of the greenhouse effect as a consequence of human activities, but not as a natural phenomenon, predominates.
Meira and Arto, 2014.	There is a lack of awareness of the natural causes of climate change.
Gautier, Deutsch, & Rebich, 2006; Correa, 2012	Students are unaware of the causes of greenhouse gases.
Jaspal, R. Nerlich, B and Cinnirella, M., 2014.	They identify a relationship between the processes of identity and the determination of the social representations of climate change
Boyes, E., and Stanisstreet, M. 1992; Padilla, 2010; Correa 2012; Meira and Arto, 2014, Ramírez, 2014	They recognize confusion in the associations between the causes and effects of climate change.
González-Gaudiano and Maldonado, 2012; Montoya, E. and Acevedo, E., 2013; Moscardo, G., 2013; Jaspal, Nerlich and Cinnirella, 2014; Ramírez, 2014.	They find barriers and dispositions to act before climate change.
Cabecinhas, Lázaro Carvalho, 2008.	They identify a high level of concern and the risks to the possible effects of climate change.

2.2. Objectives and method

The research corresponds to an exploratory study in which the procedural approach of social representation (Banchs, 2000), developed by Jodelet (2000) in close proximity to the original proposal of Moscovici (1979), is favored. Qualitative data are handled since it is interesting to discover the non-manifest meanings of the students' experience.

The research is framed in the field of environmental education with the next objectives:

- To identify the components of the social representation of climate change.
- To characterize the present contents in the social representation of climate change.

The methodological perspective, privileged the use of qualitative techniques (Martínez, 2004), through many instruments: associative letters, based on the free association of words from an inductor term, the

subjects express the words freely (Abric, 1994). A questionnaire with open and closed questions (Meira, 2003). And qualitative interviews, based on the presentation of images related to climate change (Dowdall and Golden, 1989; Abric, 1994).

The associative charter, covered four levels of association from the inductor term: "climate change". The questionnaire consisted on ten questions, eight closed and two open, on the general aspects of climate change: origin, causes and consequences. The interview script, included four generating questions, based on the presentation of images related to climate change (these images were previously selected by 20 Pedagogy students of the National Pedagogical University and 20 Architecture students of the The Autonomous National University of Mexico). The instruments used were previously piloted with a sample of 20 Pedagogy students of the National Autonomous University of Mexico. The definitive application was made in a staggered way, first the associative letter, then the questionnaire and finally the interview. The instruments used facilitated the dialogue and gave the possibility of the emergence of new questions. The categories emerged from the organization and systematization of information.

The research was carried out at the National Pedagogical University, Ajusco unit, located in the south of Mexico City, where five undergraduate degrees are offered: Administration of Education (AE), Indigenous education (IE), Pedagogy (Pg) and Educational Psychology (EP). This research addressed the social representation of climate change present in a sample of students from each of the undergraduate degrees. The sample was selective up to 21 students per degree, based on three insights: to be enrolled in the fifth or seventh semester, to express interest in participating in the study and to show availability of time. The results obtained are not generalizable, but give the pattern to identify the characteristics of the social representation of climate change, in the university population. In the "AE" degree, 10 women and 11 men participated. In the "IE" degree there were 14 women and 7 men. In the "Pg" degree 18 women and 3 men corresponded. In the "EP" degree 7 women and 14 men participated. And in the "SE" degree there were 10 women and 11 men.

3. Results

The results are organized in three sections: Information Sources, Contents of the Social Representation of Climate Change. In the results presentation, the acronyms of each degree are used, noting the percentages of the answers. Some of the answers are transcribed textually, identifying the student with a number.

3.1. Information sources

The main information sources on climate change, referred by students, are the documentaries on the internet and the use of social networks such as Facebook and Twitter (91.42%), by teachers (85.71%), books (80.95%), radio messages and programs (77.14%), television documentaries (76.19%) and campaigns by many means of communication, such as spectaculars and subway ads, among others (76.19%).

In the university sphere, the internet has gradually become the main resource for obtaining information on several topics, including climate change. But it was also, and unexpectedly found that students have obtained information on climate change through talks or comments from their teachers, although it is not included on the educational programs. The students report that they know the messages and campaigns of many institutions and organizations related to climate change, such as the Secretary of Environment and Natural Resources, Semarnat (72.38%), Greenpeace (63.08%) and the National Institute of Ecology and Climate Change (58.57%). Other students have obtained information on climate change through the dissemination of the United Nations Decade for Education for Sustainable Development programs (52.38 %) and the United Nations Environment Program (51.42 %).

In the last year, prior to this study (2015), the National Pedagogical University developed several activities around environmental education and climate change. But only 19.04% of students affirm that they have ever participated in an Interinstitutional Seminar on Environmental Education, an annual seminar that includes five sessions, aimed at teachers and undergraduate and postgraduate students. A smaller number of students (12.38%) have heard some information about climate change, the talks organized by the Student Support Center and / or the "Ecological" or "Reforestation" days organized by some members of the University community. An information source indicated by 44.76% students, corresponds to the films, such as "2012", "WALL • E", "Happy feet", "Armagedon", "Tornado", "Perfect Storm", "The Lorax", "When fate reaches us", "End of the world" and "The day after tomorrow".

This last film was seen by 22.85% of the students, data that reflect the importance of the films in the conformation of the representations. In the investigation, the prevalence of the taste of the students for commercial cinema was observed, although, often, the contained information does not correspond to the reality. Students do not refer obtaining information through the development of content and / or topics related to environmental education or climate change, in any of the subjects that they study at the University. The absence of this source of information should be addressed in the short-term due to the many challenges related to climate change, sustainability or environmental education that students will face when they complete their university training.

3.2. Content of the representations

- Rodríguez and García (2007), return to the proposal of Moscovici (1988) to delimit the contents of the representations in hegemonic, emancipated and controversial. Hegemonic contents are the most shared, they are made visible through affirmative and descriptive statements, and are assumed as natural. There is a greater consensus in them.

- Emancipated contents refer to beliefs and values that support subgroups, which are shared at a given time, and of which there is no consensus in the group in general.

- Controversial contents include contents that emerge, and that can be part of the other types of contents, in terms of recognition, acceptance and legitimacy. The referred contents are present in the students' representations. It is necessary to consider that the presence of emancipated and controversial contents can gradually change according to the information disseminated mainly by

the different media, while the hegemonic contents, are more rooted in the figurative nucleus of the representations, and are more difficult to change.

But we also observe the absence of a series of relevant contents to understand the problem of climate change, which are not yet incorporated in the daily language of students. The characterization of the contents allows to identify the sense and meaning that the students print to the climate change and to the environmental education. Unlike the structural approach, in this research the associative chart was not used to define cognitive and structural processes, it was used to identify the basic conformation of the figurative nucleus of the representations.

In the development of the associative letters the students of each degree used a variable number of different words: "AE" 234 words; "IE" 255 words; "Pg" 222 words; "EP" 299 words and; "SE" 220 words. The number of words used, besides indicating that the students have information about the CC, allows to analyze the different associations made and to identify the words that correspond to certain types of contents.

The five words most used by students of the five degrees in the development of associative letters were: pollution (41.90%), heat (32.38%), water (30.47%), rain (27.61%) and cold (27.61%); but according to the degree, the order was different and other words were included.

Table 2. Most used words

Administration of Education	Indigenous Education	Pedagogy	Educational Psychology	Sociology of Education
Pollution (52.38%) Death (47.61%) Garbage (33.33%) Water (28.57%) Rain (28.57%).	Heat (61.90%) Water (52.38%) Cold (52.38%) Rain (42.85%) Pollution (38.09%).	Pollution (90.47%) Water (71.42%) Heat (61.90%) Death (42.85%) People (42.85%).	Rain (66.66%) Floods (57.14%), Cold (47.61%) Diseases (42.85%) Heat (42.85%).	Heat (57.14%) Garbage (38.09%) Cold (38.09%) Death (38.09%) Pollution (28.57%)

In the results of the associative charts, a clear relationship between pollution and climate change was observed. Words with an emotional component, such as sadness and fear, also emerged. By analyzing the valid associations of the words used by the students of each degree, it is possible to identify the conformation of the social representations of climate change. Associations such as pollution-heat-rubbish; Water-rain-flood; Diseases-death-people, are the most frequent in the five degrees. These associations are part of the hegemonic contents that are shared by most of the students of the five degrees. Associations such as rain-water-animals in the "AE" degree; Heat-plants-climate in the "IE" degree; Rain-people-water, in the "Pg" degree; Heat-danger-animals, in the "PE" degree in; Cold-plants-destruction, in the "SE" degree, contain emancipated contents, which correspond to those shared in the subgroups and of which there is no consensus in the group in general.

And the associations: death-drought-sadness; Temperature-climate-fear; Extinction-disinterest-sadness; Impotence-tragedy-life; Change-unconscious-corruption, which are less frecuent, but are present in the five

degrees, correspond to the controversial contents, which are characterized as emerging and controversial content. In the many associative charts made by the students, we can observe the predominance of hegemonic contents related to the effects of climate change. In the emancipated contents, which exist in a smaller proportion, confusions prevail in the links between the causes and effects of the climate change and the incorporation of emotional aspects in the controversial contents, which are still less. To exemplify, each of the contents are transcribed in a textual form, some of the answers of the students derived from the qualitative interview, from the observation of images related to climate change.

3.3. Hegemonic contents

... I feel uncomfortable for not being able to do anything before what is happening, there is an environmental imbalance, in some places there is excess heat and drought, and in other places the intense rains that cause flooding, the worst is that the only ones affected area the people who inhabit these places...(Se/13).

The most common associations students employ are observing the effects of climate change. In the five undergraduate students, contents of the effects of climate change are identified for the natural environment as well as for human societies. More than 90% recognize that climate change contributes to increasing problems in the supply of drinking water, hurricanes and tornados, loss of biodiversity, droughts, sea level, desertification, reduction of agricultural potential and the incidence of forest fires. In this paper, we present the results of the study of the hegemonic contents, which coincides with the representations identified in the students of other universities (Boyes, E., and Stanisstreet, M., 1992, Dove 1996, Rebich and Gautier, 2005, Meira, 2012, Terrón and Bahena, 2015).

3.4. Emancipated contents

It also incorporates elements that associate causes with effects of climate change.

... every time we become poorer, without economy, without nature, as a reflection of what we are losing ... everything is over, the water is over, animals are extinct ... we have no future (EP / 17).

In the students' responses, the incorporation of more global aspects is observed, some relationships between the causes and effects of climate change are established. The origin of the climatic change obeys to natural processes and mainly to the human actions of different forms, nevertheless still some students, attribute the origin only to natural causes, confusion that persists in the students of the National Pedagogical University.

In the emancipated contents of the undergraduate students, there are confusions regarding the origin of the climate change, 42.85% of students do not identify the causes of the origin of climate change. Most of undergraduates in Administration of Education, Pedagogy and Sociology of Education, consider that climate change is caused only by human activities (71.42%).

In the Indigenous Education degree, different positions are observed. For 42.85% of students the origin of climate change is due to natural causes and 38.09% to human activities cause. Some students recognize gases emitted by volcanic eruptions, fires of large tracts of forests and forests, processes of respiration and decomposition of animals and plants, on Earth and in the oceans as causes of climate change. A greater number of students recognize as causes of climate change, the excessive use of fossil fuels, the excessive clearing of tree areas, aquifers, rivers, lakes, seas and oceans pollution, depletion of fertile soils and, to a lesser extent, the increase in beef consumption. Boyes and Stanisstreet (1992) and Meira and Arto (2013) also reported similar data.

3.5. Controversial content

Some of the expressions of students are associated with some emotion. The emotions are inherent to climate change and gradually become part of the representations.

> *... knowing about climate change causes me sadness, anguish, fear, a feeling that in this way we are going to destroy ourselves,, there is no way out* (Pg / 9).

Social representation is linked to different emotions generated by observing behaviors that are not conducive to the environment. Emotional expressions can be part of the other types of content.

> *... due to over-exploitation of natural resources, we face consequences such as reforestation, extreme droughts, exploitation of groundwater, pollution of rivers due to industry and misuse of natural resources* (AE/ 3).

The students express a concern for the current and future conditions of the planet, but also agree that a lack of credibility prevails in the actions carried out in this regard. Undoubtedly, emotions are fundamental contents of representations. They are not reduced to instinctive reactions or responses, they are complex components, including psychological and physiological aspects, which are observed in valuable behaviors. According to Gutierrez (2013):

> *"... emotions are inseparable from all human subjective production, in this sense they are constituents of the social representations themselves"* (p.28).

Emotions, seen from this perspective, form a counterpart of the controversial contents of social representation, since they are difficult to apprehend, and have a close relationship with the attitudes that students have:

> *"... what is happening on our planet is only a consequence of what That we have provoked by our unconsciousness, what will happen in the future? ... the same "*(EP / 20).

Awareness raising through education is one of the ways that students recognize as relevant to influence climate change.

3.6. Absence of contents

A high number of students are unaware of important aspects of climate change; 79% of the students do not have information related to "carbon sinks" and 80.96% on "carbon emissions trading". It is unknown to many students that promoting carbon sinks and trading carbon emissions are strategies that are instrumental in promoting the sustainability of the planet and thereby mitigate the effects of climate change.

The 46.67% of students are concerned about greenhouse gases, only 14.28% can identify carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, hydrochlorofluorocarbons and hydrofluorocarbons as part of these gases, and 34.29% of students fail to explain how the greenhouse effect occurs. When asked about the Kyoto Protocol, 41.90% of students have some information. Regarding the Intergovernmental Panel on Climate Change, 34.28% of the students identify the functions of this organization; 42.85% of students recognize the importance of the "Earth Charter"; 20.95% of the students identify the actions carried out by the "Mario Molina Center" and 11.42%, recognized the "ecological footprint" as a strategy to identify the environmental impact of human activities. But no student made mention of the "water footprint" or the "carbon footprint". Other aspects that students know little about are international agreements, strategies and programs, internationally and nationally to mitigate the effects of climate change, so that only 18.09% of students have information about the Convention United Nations Framework Convention on Climate Change.

4. Conclusion

The planet is in a crisis of "no return" (Kates, 2007), that is, the effects of climate change are irreversible, however society does not perceive these effects because no collective experience is present. In this sense, environmental education contributes to making visible, what is not observed in society and attacks against environmental rights, and therefore, against life. As a conclusion, a series of reflections on the main results obtained are presented: the information sources and the contents of the representations. Information Sources. Research confirms the importance of the media in shaping social representation (Boyce and Lewis, 2009. The information sources used by students of the National Pedagogical University are also mentioned in other studies (Correa, 2012 and Terrón and Bahena, 2015).

The closest aspects of students' everyday life are taken up by students, using the internet and watching commercial films. As well as the comments and discussions of their teachers. In a study by Leiserowitz (2004) on the film "A Day After", he finds that this film had a significant impact on the perception of the risk of climate change. This film was the most talked about by students.

On the other hand, the influence of the teachers through informal talks was very revealing in the conformation of the representations. However, it is necessary to bring future education professionals closer to a new horizon of studies that articulate the environment with culture and society through addressing climate change and its inclusion in the curricula.

Contents of the representation. The results obtained, identify the existence of representations of climate change in students of the National Pedagogical University, but also, the absence of content on various topics,

which may be part of educational programs. The social representation of climate change, can not be physically impaired, but we can recognize its effects, which constitute the social representation of the students of the National Pedagogical University, the main hegemonic contents. In this sense, the media and higher education institutions can generate actions to make a global problem visible to the general population, which Meira (2009) describes as delocalized in time and space and too abstract. In the research with the students of the National Pedagogical University, a greater proportion of contents are identified on the consequences of climate change than on its causes, as well as the results obtained by González-Gaudiano and Maldonado (2012).

Students are ignorant about a lot of topics, such as greenhouse gases, among other contents that are confusing for most of them, results that coincide with the findings of Reusswig and Meyer (2014), Terrón and Bahena (2015). In addition, students of the National Pedagogical University show ignorance about aspects related to environmental policy and management, "carbon trading" and "carbon sinks", results similar to those reported by Meira and Arto (2014), and Laws and Programs of Climate Change in Mexico. One more aspect of coincidence with the works of Meira and Arto (2014), is the one related to the emotions and evaluations of negative character and pessimistic images, aspects similar to those obtained with the students of the National Pedagogical University. These results coincide in several aspects with the reports of other investigations of the social representation of climate change in the university population. But they also bring new elements to understand the dynamics in the components of social representation, and the importance of taking into account emotional factors as part of the controversial contents. The results of the study are not generalizable, they show a limited panoramic of the existing representations in a specific sample.

Finally, it is necessary to consider that the results of research based on the theory of social representation can be used for the elaboration of intervention projects oriented to the formation of a common vision of the subjects, on many subjects; Meira (2012) points out that these projects can present an unrealistic vision of climate change, which requires a sustainable environmental education, which theoretically supports these projects and provides information with scientific content, and strategies that promote development of environmental attitudes and values.

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