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THE ROLE OF CARBON DIOXIDE IN "GLOBAL WARMING" AND ITS APPROACH IN CHEMISTRY TEXTBOOKS

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ABSTRACT

This work aimed to investigate the approaches given to the hypotheses that describe climate controllers, especially the warming theory, by Brazilian Chemistry textbooks for high school, from the beginning of the twenty-first century. We start from the assumption that the concept of CO2's role in global climate change is mostly based on theoretical data and fragments of information derived from computer climate models. In parallel, several empirical studies have pointed to the natural and cyclical character of climatic phenomena that have occurred throughout history. It was proposed, therefore, to confront these works with the content available in some of the main textbooks used in Brazil in the early 2000s, for High School, using *Discursive Textual Analysis*. According to the results, all the collections analyzed opted for unilateral warming approaches, derived from the IPCC (*Intergovernmental Panel on Climate Change*) reports, that is, without a comprehensive description of antagonistic and natural hypotheses about current climate change.

Keywords: Global warming. Environmental chemistry. Textbook.

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INTRODUCTION

It is a consensus among researchers in the field of Education that textbooks in Brazil play a fundamental role in the production, circulation and appropriation of scientific knowledge for the school environment (LAJOLO, 1996). This is intensified mainly from the National Textbook Program (PNLD), and the National Book Program for High School (PNLEM), in force since 1996 and 2004, respectively.

Often, and in part due to the systematic use of the textbook by teachers, a portion of the contents provided in this material is rigorously followed and, consequently, ends up determining the curricular components and directing the various teaching strategies used in classrooms (SÁ, 2006).

From this perspective, and after the National Curriculum Parameters for High School (PCNEM) considered both environmental issues and the relationship of human beings with their social environment as essential for the formation of citizens (BRASIL, 1999a), discourses of alarming characteristics, in relation to the warming character of carbon dioxide (CO2), have been intensifying in science classrooms. Within the scope of the PCNEM proposals, the greenhouse effect and its consequences is a theme that can be widely developed using an interdisciplinary approach and integrating various areas of knowledge. Because it is also an issue that can interfere in environmental conditions and in the life of human beings, it is important to correctly understand its dimension, its causes and consequences. In this sense, the media and the authors of didactic or paradidactic texts should be widely charged regarding the quality of information about the chemistry of the atmosphere, especially regarding the responsibility or not of human action, its possible interference and intensification, and how this can be avoided, if at all.

Despite these discourses, the full understanding of the dynamics and variables that govern the control of the planet's global temperature is still the subject of controversy in the academic world. Currently, at least two theories are known around the theme of "global warming". On the one hand, we can mention the theory that relates the increase in the global average temperature to anthropogenic CO2 emissions. This is known as the "warming theory" and its diffusers are called "warming". On the other hand, the theory that defends the idea that the increase in the global average temperature in the twentieth century has natural variables as its main cause (SPENCER, 2008). Its advocates are generally known to warmers as "skeptics."

The warming theory is based on the fact that, in the period of the economic boom, after the Second World War, the increase in the levels of CO2 released by human action into the atmosphere coincided with a period of increase in the global average temperature.

This process was called "global warming". The cause of this warming has been attributed to the increase in anthropogenic CO2 emissions, due to its classification as a greenhouse gas. From this event, in 1988, a climate modeling unit was established that established the basis for a new international committee called the United Nations Intergovernmental Panel on Climate Change (IPCC), with the objective of assessing the climate consequences caused by human action.

Since then, the IPCC has been publishing reports widely defended and disseminated by non-governmental organizations, environmental movements and sensationalist media, with results coming from computer climate models. For many scientists, this is a premature hypothesis based on theoretical data from computational software that is still not very precise (WUNSCH, 2006) to the detriment of less alarming empirical results (CHRISTY and SPENCER, 2003).

According to Carl Wunsch, from the *Massachusetts Institute of Technology* (MIT), these *software* are inaccurate due to the large number of variables that influence the average global temperature, such as solar action, cathode rays, and aerosols (WUNSCH, 2006). In addition, according to the *Danish National Space Center* (DNSC), climate models consider only small solar variations to the detriment of important variables, such as the effect exerted by cathode rays on clouds (WUNSCH, 2006; SVENSMARK, 1998). Lindzen (2008), also from MIT, points out major flaws in the consideration of the distribution of clouds in these models, an important factor with a broad and proven influence on the final results.

Roy Spencer (2008), a meteorologist at NASA (National Aeronautics and Space Administration*),* believes that climate models demonstrate unrealistic sensitivity to greenhouse gases, generating deviations in the data obtained. In addition, most of the IPCC's data collection stations are located in (or close to) urban areas, suffering a direct effect of the so-called heat islands. Since 70 to 75 percent of the earth's surface is covered by oceans, collector stations should be located, for the most part, in ocean zones.

These variables play an important role with regard to climate change and, therefore, it is necessary to understand and consider all of them in the process of obtaining more reliable results (WUNSCH, 2006). However, despite current technological advances, the scarce scientific knowledge regarding these variables generates low credibility of the data from these climate models and, consequently, from the theory of natural global warming.

We know that every hypothesis can only be validated by comparing data derived from its theoretical predictions with experimental results. A theory remains valid only as long as there is no experimental data to contradict it. Therefore, since numerous empirical

studies demonstrate natural influences on the maintenance of global temperature (SPENCER, 2008; FRIIS-CHRISTENSEN and LASSEN, 1991; SVENSMARK, 2000; LINDZEN, 2009), the articulated relationship between global temperature and atmospheric CO2 concentration, defended by warmers, that is, the hypothesis of anthropogenic global warming, cannot be considered a scientifically established fact.

Evaluating the numerous criticisms of the data presented by the IPCC and admitting that anthropogenic influence is not the main cause of the warming observed in the twentieth century, a group of scientists met under the direction of Fred Singer, professor of Environmental Sciences at the University of Virginia (USA), to create a panel that presents conclusions regarding natural actions on the global climate. This was named the Non-Governmental Panel on Climate Change (NIPCC). According to Singer (2008),

> We do not currently have any convincing evidence or concrete observations of significant climate change, from causes other than natural causes. (SINGER, 2008, p. 03).

Singer, like other scientists, believes that anthropogenic CO2 emissions do not play a significant role in global warming. The fact is that, as mentioned earlier, there are at least two distinct lines of thought around the issues that address the control of the global average temperature. From the perspective of science education, Santos and Schnetzler (2003) believe that arguments that can help in the conservation and preservation of life and the environment should be present both in textbooks and in classroom discussions, as long as they are part of an ideology free of secondary interests. Capra (1999) states that "teaching ecological knowledge, which is also ancestral wisdom, will be the most important role of education" in the twenty-first century. However, only strongly consolidated theories should permeate the school environment. Contents with unilateral views, arranged in high school books, often have an irrefutable character and are accepted as absolute truths. In this way, issues not yet fully understood at the scientific level end up, over time, becoming paradigms when present in the approach of these school materials.

The main problem is the fact that the vast majority of public and private schools (and their students) are influenced by the action of sensationalist media that reinforce and share the warming view defended by the IPCC, even though this issue is still a controversial scientific topic. For Chauí (2000) it is the means of communication that:

> [...] end up making the search for truth so difficult, because everyone believes that they are receiving, in various and different ways, scientific, philosophical, political, artistic information and that such information is true. (CHAUÍ, 2000, p. 113)

On the other hand, new facts emerge every day, related to fraud in warming data, as in the case of the famous graph scandal entitled *hockey stick* [3] (McINTYRE and McKITRICK, 2003; McKITRICK, 2005).

As such contents, even under contestation by the academic environment and lacking concrete scientific evidence, are often treated as consolidated theories, we understand that a critical analysis is necessary in relation to the approaches aimed at the supposed effect of CO2 on global warming present in Brazilian Chemistry textbooks, intended for high school. Under this assumption, this work analyzed six collections of Chemistry textbooks, widely used in High School, with emphasis on the chapters that address the so-called "Environmental Chemistry", prioritizing the approaches on the theme "global warming".

METHODOLOGICAL PATH

TEXTBOOKS

From the pedagogical point of view, books in general and Chemistry textbooks in particular, exert a direct influence on the sociocultural behavior of students regarding global changes, especially in relation to the planet's climate and the theme "global warming". Usually, these books introduce a theoretical model for the phenomenon of the greenhouse effect and bring discussions loaded with environmental pessimism regarding the action of the main gases directly linked to this effect. Depending on the type of approach used, textbooks can be excellent tools for the formation of critical citizens in relation to such content, favoring debate in the classroom and/or in society. They can also influence the pure and simple, unquestioned acceptance of the warming hypothesis and take its acceptance as a "scientific truth".

Textual Analysis

We analyzed the didactic approaches of eight collections of Brazilian authors (*SANTOS & MOL; TITO & CANTO; FONSECA; LISBON; MORTIMER & MACHADO; FELTRE; USBERCO & SALVADOR; BIANCHI, ALBRECHT & DALTAMIR),* all of which are widely used in high school and the first five included in the PNLD 2012, in the area of Chemistry, on the theme of global warming, with emphasis on the chapters that address the so-called Environmental Chemistry.

We used the *Discursive Textual Analysis* (DTA) of Moraes and Galiazzi (2008), to categorize the excerpts extracted from the chapters investigated, relating them to the

[3] Michael Mann's (2012) "hockey stick" graph served for *warmers to* "prove" that the concentrations of CO2 in the atmosphere have risen enormously due to anthropogenic action and to establish the correlation between these increasing concentrations and the increase in global temperature.

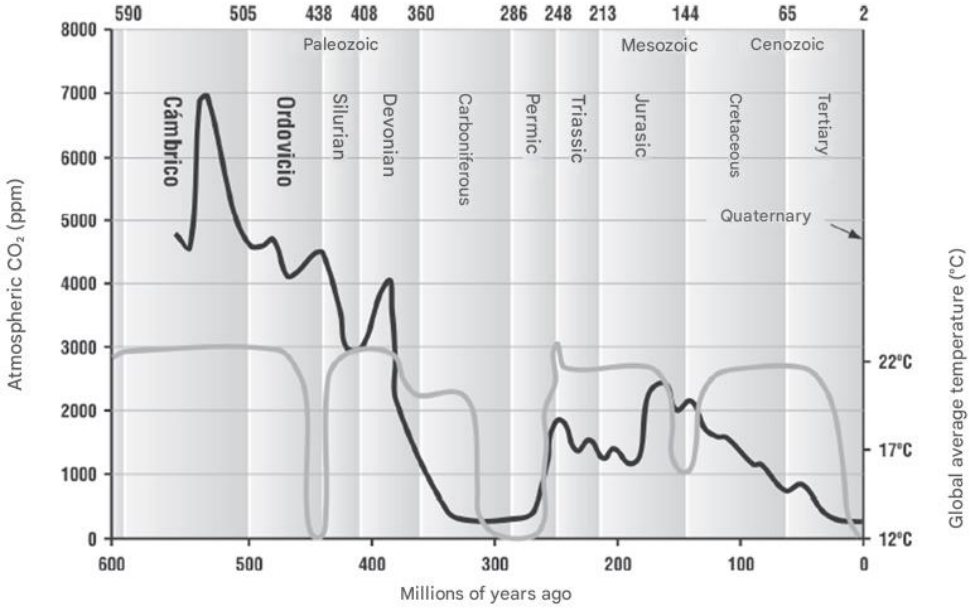
defense/dissemination of the warming hypothesis or the non-presentation of the other climatic hypotheses. The definition of the categories emerged during the process of "deconstruction" of the selected excerpts, or "statements", defined as our units of analysis. DTA can be understood as a process of deconstruction, followed by reconstruction, of a set of linguistic and/or discursive materials, producing from there new understandings about the phenomena and discourses investigated (idem, 2008). A textual analysis involves identifying and isolating utterances and producing texts, integrating description and interpretation, using the constructed system of categories as the basis of its elaboration. The set of texts submitted for analysis is usually called a *corpus* and represents, according to its authors, "a multiplicity of voices manifesting themselves about the phenomenon investigated". Thus, starting from the chapters we investigated, we extracted the "statements" that referred to environmental chemistry, delimited by passages where the positions justified or refuted a specific opinion of the authors on the subject (on the effect of greenhouse gases, the increase in the planet's temperature and all possible causal variables). It is necessary to make it very clear that an isolated "statement" does not normally constitute an argument or an opinion, unless it is inserted in a discourse and submitted to a certain context, which led us to the careful certification of each chapter, with regard to its objectives and expectations of learning about chemical knowledge and atmospheric phenomena related to the global balance of the planet.

RESULTS AND DISCUSSIONS

CO2 AS A CLIMATE "VILLAIN"

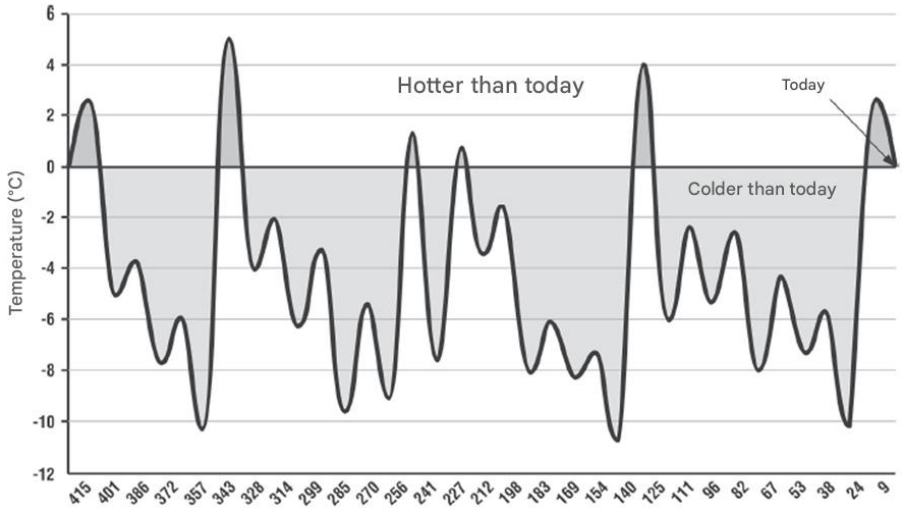
One of the ways to investigate the role of CO2 in modulating the global climate is to look at climate changes that have occurred in the past and build a parallel with variations in CO2 levels during the same period. Thus, we observed that the climate in the past was not stable, but was constantly varied, practically in temperature cycles. In the periods observed in Figure 01, the variation in global temperature over the last 550 million years does not show a direct relationship with the amount of atmospheric CO2. In the Cambrian period, for example, the average temperature of the planet was around 22 $^{\circ}$C in a period of time when atmospheric CO2 concentrations were extremely high (approximately 7,000 ppm or parts per million). These data suggest that other variables play a significant role in maintaining global temperature.

Figure 01. Natural variations in temperatures and concentrations of carbon dioxide (CO2) over the last 550 million years. (Source: FAEC, available at: www.mitosyfraudes.org)



Periodic variations are notable when we analyze temperatures in shorter time intervals. Temperature measurements of the last 415,000 years, recorded in the ice profile of the *Vostok site*, are presented in Figure 02.

Figure 02. Climatic periods of the last 415,000 years, recorded in the ice profile of the *Vostok site* (Source: Salamatin, et al., 1998)

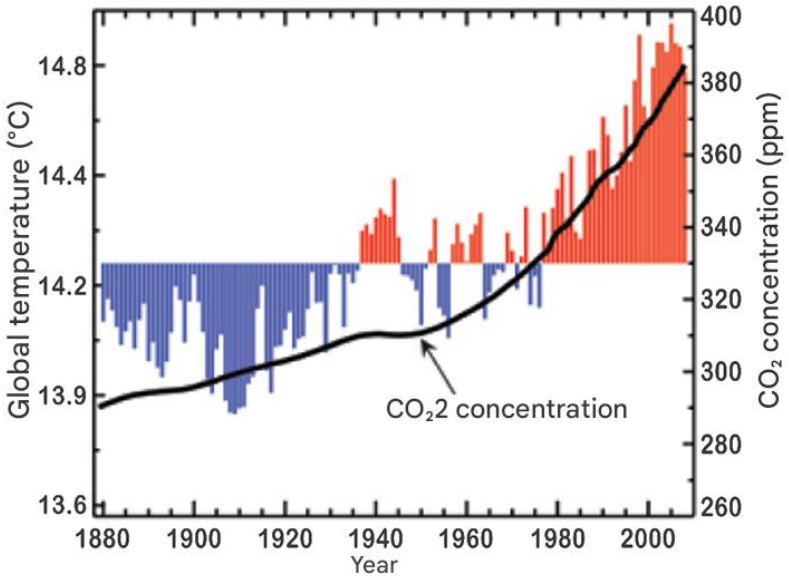


Therefore, throughout the history of the planet, there are known hot and cold periods prior to the industrial revolution that do not show direct relationships between CO2 concentration and temperature. In the twentieth century, the behavior of these two variables was no different. The average global warming in the twentieth century was not presented as a function of the increase in atmospheric CO2 concentrations throughout its extension

(Figure 03). In the period between 1947-1976 there was also a significant decrease in the global average temperature (approximately 0.2°C). However, anthropogenic CO2 emissions increased considerably due to industrial growth after the period of the Second World War. Before 1947, anthropogenic CO2 emissions were limited to about 6% of today's. Due to this decrease in temperature, in 1972, at the Stockholm Conference, limits on carbon emissions were discussed where parts of the speeches related CO2 emissions to the decrease in global temperature. The periods of global average warming in the twentieth century occurred between 1910 and 1947 and from 1976 to 1995.

Regarding the second period, Jhon Christy and Roy Spencer (2004) from the *University of Alabama* showed that data from the *Microwave Scanning Unit* (MSU) instruments aboard satellites (after 1979) indicate global warming of 0.076°C per decade, against 0.16 ° C

Figure 03. The interface between the blue and red lines represents the global average temperature in the twentieth century.



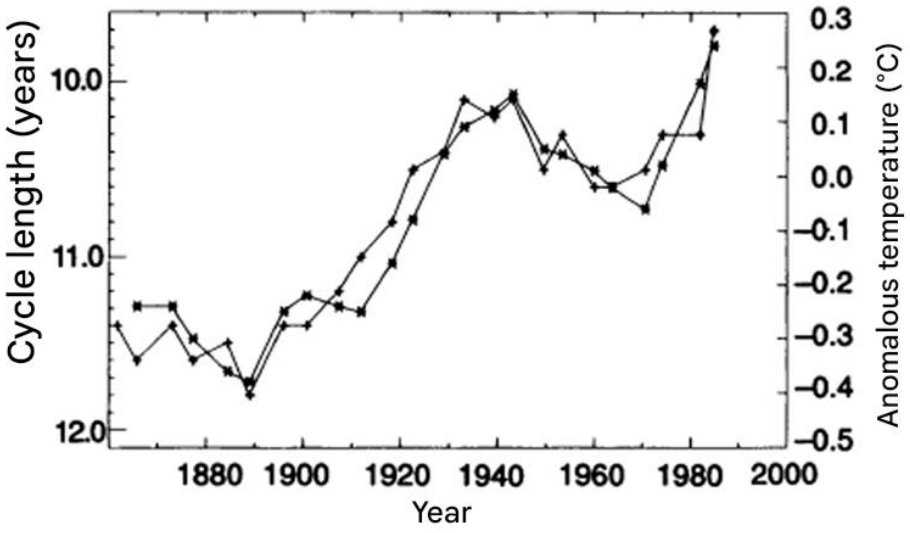
In the measurements of terrestrial thermometers. An even smaller variation was also found for the southern hemisphere, of 0.052°C per decade. Satellite measurements seem to be more reliable due to the large areas covered, which include the oceans, while terrestrial thermometers respond to local temperatures (radius of approximately 150 meters).

Studies carried out by Monte Hieb and Harrison Hieb (2006) also suggest that more than 97% of total CO2 emissions have natural causes. From this perspective, if the entire world production of CO2 by human action were completely paralyzed, the change in the concentration of CO2 in the atmosphere would be practically negligible. However, with the

return of the increase in global temperature, from 1976 onwards, climatology was transformed into an instrument for the installation and foundation of the "theory of global warming" and a climate modeling unit was established that culminated in the emergence of a new international committee called the Intergovernmental Panel on Climate Change (IPCC). From the IPCC reports, the cause of the global average warming was attributed to the increase in anthropogenic CO2 emissions, due to its classification as a greenhouse gas.

On the other hand, less alarming empirical data are often seen in the scientific community. In 1991, Friis-Christensen and Lassen suggested that the concentration of CO2 in the atmosphere has no direct relationship with the average global temperature of the last 130 years and that, instead, the global temperature is strongly influenced by the length of solar cycles as seen in Figure 04. We can see in the figure that the duration of solar cycles is very well related to the global average temperature, including the drop in temperatures from 1940 to 1975, which is not observed in relation to the global average temperature versus atmospheric CO2 concentration.

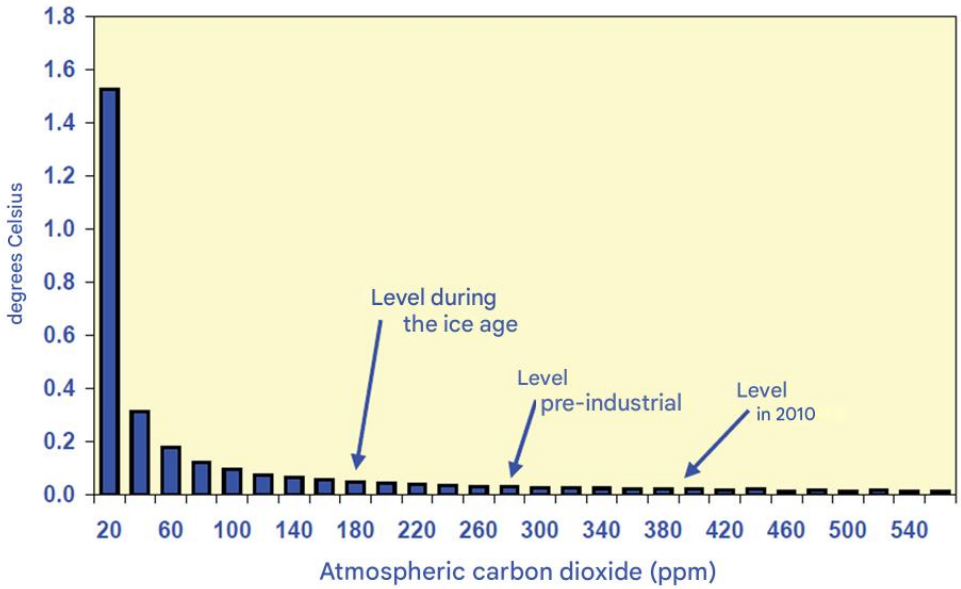
Figure 04. Variation in the length of the solar cycle from the years 1860 to 2000 (adapted from FRIIS-CHRISTENSEN and LASSEN, 1991).



In addition, John Christy and Roy Spencer, meteorologists at NASA, demonstrated through satellite data that events such as *El Niño* and *La Niña* have a direct influence on the global average temperature. Seitz (2008) also states that "*the IPCC is pre-programmed to produce reports that support the hypothesis of anthropogenic warming and the control of greenhouse gases, as proposed in the Global Climate Treaty*".

Another researcher, Archibald (2010), using a graph generated by MODTRAN[4] (Figure 05), maintained by the *University of Chicago*, suggests that the warming effect of carbon dioxide is strongly logarithmic. Thus, he proposes that the first 20 ppm of CO2 concentration has a greater effect than the next 400 ppm. Therefore, from 388 ppm (in 2010), a 100 ppm crement would produce only 0.1 degrees Celsius of warming, that is, a very small effect.

FIGURE 05. The logarithmic warming effect of atmospheric carbon dioxide.



As if that were not enough, in recent years, scandals involving data produced by *warmers* have become increasingly common. In the famous scandal that became known as "climategate", in December 2009, numerous frauds and tampering with data and research methods were proven in which, over a period of more than a decade, *e-mails* exchanged between *warmers* were inadvertently made available on the internet (FELÍCIO and ONÇA, 2010). Other scandals can also be cited, such as the farce of the graph known as the "Hockey Stick" (MCINTYRE and MCKITRICK, 2003) and the thaw in the Himalayas (RAINA, 2009). Unfortunately, news like this is not sufficiently disseminated and the population in general has been bombarded daily by *warming discourses* in which "climotologia" moves towards a single paradigm. The media has a prominent role in the dissemination of this trend and an example of this is the exposure of "evidence" about the loss of ice in the Arctic during the twentieth century, caused indirectly by anthropogenic

[4] MODTRAN (MODerate Resolution Atmospheric TRANsmission) is a software designed to model the propagation of electromagnetic radiation in the atmosphere. It was developed in the USA and is used to generate, interpret and encode graphs and spectral signals of atmospheric radiation. (Authors' note)

CO2 emissions. Comiso and Nishio (2008), however, showed that in the period between 1978 and 2006 the extent of ice in the Antarctic Sea received a significant positive increase of 0.9 + 0.2% per decade.

CLIMATE CONTROLLERS IN BRAZILIAN CHEMISTRY TEXTBOOKS

All the books investigated, published in the first decade of the twenty-first century, without exception, state that CO2 emissions by human action are largely responsible for global warming in the twentieth century, as we can see in the excerpts (statements) available in Chart 01. These statements show that the theory of the intensification of the greenhouse effect by anthropogenic actions is the priority approach present in all the examples analyzed.

Thus, even with several published and available empirical data, which suggest that the hypothesis of anthropogenic global warming (defended by the IPCC) is mistaken, the books researched mention only and only this hypothesis, completely ignoring the various experimental studies that indicate a natural contribution to global warming in the twentieth century (authored by scientists who are members of the NIPCC). Thus, the textbooks analyzed expose the theme in a unilateral way, since there is no scientific consensus on the causes of the warming of the planet in the twentieth century.

Contrary to the warming defense present in these collections, we believe that the textbook should have, as a sociocultural function, the opening and proposition of discussions about the various existing theories about a given content, while there is no scientific consensus on the subject. In this way, it would provide students with the development and refinement of critical thinking about subjects of socio-scientific interest. They should not, therefore, contemplate and defend single lines of thought while there are controversies in the scientific community on a given topic.

The alarmist focus is more pronounced in the collections: "*Citizen Chemistry*" (SANTOS and MOL) and "*Being a Protagonist*" (LISBOA) that discuss future catastrophes resulting from the increase in anthropogenic CO2 emissions. The "*Citizen Chemistry*" collection (SANTOS and MOL), influenced by IPCC data, suggests possible cuts in CO2 emissions and, consequently, great parsimony in the use of fossil fuels as a primary alternative to control this "unbridled warming". Contrary to the catastrophic discourse spread by the media about climate cataclysms due to the increase in the global average temperature, any basic Meteorology manual mentions that temperature increases result in a more homogeneous global climate between the poles and, thus, fewer devastating natural effects such as hurricanes and cyclones, for example. Strongly combating carbon

emissions in the name of unproven hypotheses means, especially for developing countries, giving up cheaper and more efficient energy techniques. This would be alarming, causing an increase in misery and social problems, such as the loss of civil rights and the emergence of endless bureaucracies (FELICIO and ONÇA, 2010). According to Lino (2007), the great articulation carried out by the Intergovernmental Panel on Climate Change (IPCC) of the United Nations, under the supervision of "warming" pseudoscientists with the intention of relating the small variation in the Earth's temperature in the last century to human action, is only linked to the attempt to curb the development of emerging countries, such as Brazil (LINO et al, 2007).

> [...] The objective of taxing carbon dioxide emissions is not, therefore, the salvation of the planet, but the creation of an inevitable payment tax [...] (ONÇA, 2012)

What we do know is that, in addition to greenhouse gases, the climate is influenced by several factors such as solar cycles (FRIIS-CHRISTENSEN and LASSEN, 1991), cosmic rays (SVENSMARK, 1998), the average temperature of the oceans and the geothermal activity of the planet (WUNSCH, 2006) which, together, result in varied and wide-ranging phenomena such as droughts or storms. In these, human action may have a much smaller influence than that advocated by the IPCC.

Table 01. Excerpts that relate anthropogenic CO2 emissions to global warming in the twentieth century, extracted from the collections of Chemistry textbooks investigated.

AUTHOR(S)	EDITION YEAR	Excerpts that relate anthropogenic CO2 emissions to global warming in the twentieth century

AINTS & MOL	**2010 (PNLD)**	[...] Carbon dioxide (CO2) [...] is the gas that contributes most to the greenhouse effect. (v. 01, p. 128). [...] The average global temperature increased by 0.74 ºC in the period from 1906 to 2005. [...] Intergovernmental Panel on Climate Change says there is no doubt that warming is being caused by human actions [...] (v. 01, p. 129).
FELTRE	**2004**	[...] the amount of CO2 in the atmosphere has increased very rapidly due to the population explosion, accelerated industrial development, deforestation and burning of forests [...] (v. 01, p. 332). [...] As a consequence, the greenhouse effect has been intensifying, as greater amounts of CO2 in the atmosphere increasingly retain infrared radiation reflected by the Earth (v. 01, chap. 13, p. 333).
TITO & CANTO	**2006 (PNLD)**	The production of CO2 in the burning of fuels and in the fires has caused an increase in the concentration of this gas in the atmosphere. As a consequence, the so-called greenhouse effect intensifies, which tends to cause an increase in the planet's average temperature. (v. 01, chap. 24, p. 422).

LISBON	**2010 (PNLD)**	Conducting several studies has led scientists to establish a relationship between the amount of carbon dioxide released into the atmosphere and the planet's average temperatures. The increase in the amount of this oxide is pointed out as responsible for the increase in the average temperature of the oceans and the air layer near the Earth's surface [...] (LISBON, v. 01, chap. 16, p. 298). Since the Industrial Revolution, the amount of CO2 in the atmosphere has increased by 31%. [...] (v. 01, chap. 16, p. 309).
FOSTER	**2001 (PNLD)**	[...] human activity, especially the burning of fossil fuels, has released a huge amount of gases into the atmosphere [...] this could enhance the natural "greenhouse effect", causing an increase in the average temperature of the planet, which would also be catastrophic [...] (v. 01, 2001, p. 206). [...] an increase of one or two degrees would cause enormous disruption to agriculture [...] more pessimistic predictions concerning the melting of icebergs in Antarctica and the colossal number of floods it would cause. (v. 01, 2001, p. 206).
USBERCO & SALVADOR	**2002**	[...] the concentration of CO2 in the atmosphere has increased [...] which may cause the melting of the ice of the polar caps [...] which would flood several coastal regions (v. único, p. 183). [...] CO2 is the main responsible for the greenhouse effect, contributing approximately 55% of this phenomenon [...] (v. sole, p. 183).
MORTIMER & AXE	**2002 (PNLD)**	[...] the increase in the concentration of CO2 in the atmosphere, resulting from the large-scale burning of **fossil fuels**, is clearly associated with the increase in the greenhouse effect (see only, p. 231).
BIANCHI, ALBRECHT & DALTAMIR	**2005**	[...] the CO2 content in the atmosphere has increased [...] and this fact is the main responsible for the so-called **greenhouse effect**. (v. sole, p. 233).

FINAL CONSIDERATIONS

The hypothesis of intensification of the greenhouse effect by anthropogenic actions is addressed in all the specimens analyzed unilaterally. All the books state that CO2 emissions by human action are largely responsible for global warming in the twentieth century. There are no discussions in any of the books investigated about research results that demonstrate a natural contribution to the maintenance of the global average temperature or any other theories.

The approaches employed by the analyzed collections could result in the tacit and direct acceptance of the warming hypothesis, in addition to not encouraging critical debates on the theme in the classroom or discussions that allow students to build/broaden their conceptual horizons in relation to the theme "global warming". We understand that knowledge of the existence and, especially, access to other scientific hypotheses on any topic is important for the critical and cognitive development of students, in addition to being a way of encouraging the search for scientific information regardless of those proposed in the didactic materials.

In view of the emerging paradigm, it seems clear to us that it is also the mission of textbooks to present, in a coherent and neutral way, contemporary scientific controversies and to make available to the science student the "modus operandi" of those who are involved in it, recognizing the transience of discussions, theories and paradigms. In this way, textbooks also have the role of showing that scientists and researchers confront their work supported by uncertainty and controversy, attenuating the distance between subject and Science. In addition

> [...] addressing a controversial socio-scientific theme offers a possibility for subjects to rescue their uniqueness divided by the knowledge taught in the modern school [...] (BARBOSA, 2010, p. 74).

In the face of scientific controversies, textbooks should be committed to education to the extent that they provide their readers with problem situations and exempt themselves from the commitment to transmit absolute truths. This does not break with the function of the textbook with regard to the production, circulation, appropriation and transposition of scientific knowledge already consolidated to the school environment, but also encompasses the incorporation of different hypotheses that surround and underlie the same theme. Quoting Marilena Chauí,

> [...] Uncertainty is different from ignorance because, in uncertainty, we discover that we are ignorant, that our beliefs and opinions do not seem to account for reality [...] (CHAUÍ, 2000, p. 111)

The purpose of this investigation evidently does not exhaust the controversy about the hypotheses and theories related to the supposed "global warming", but, on the contrary, it can serve as a starting point for new discussions and debate of ideas in the field of Science Education.

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