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INVESTIGACIÓN/RESEARCH

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TEACHING STRATEGIES IN THE VENEZUELAN CHEMISTRY TEXTBOOKS FOR TEACHING THE BASIC CONCEPTS OF MEASUREMENT, MATTER AND ENERGY

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ABSTRACT

This article mainly aims to determine the teaching strategies used in Venezuelan Chemistry textbooks to teach the basic concepts of measurement, matter and energy. The approach to the textbooks is based on content analysis as a technique for interpreting texts, taking into account data records. We rely on the textual or visual reading as a tool for gathering information, reading that unlike common reading should be done following a specific method for obtaining specific findings from each science that can somehow compromise the effectiveness of the textbook as a curricular tool both for students and for teachers. The findings allow the determination of various teaching strategies such as: contextualization, presentation of information, explicit, reciprocal teaching and targeting.

KEYWORDS: Textbook - Teaching Strategies - Teaching of Chemistry - Concepts - Content Analysis.

ESTRATEGIAS DIDÁCTICAS EN LOS TEXTOS ESCOLARES VENEZOLANOS DE QUÍMICA PARA LA ENSEÑANZA DE LOS CONCEPTOS BÁSICOS DE MEDICIÓN, MATERIA Y ENERGÍA

RESUMEN

El presente artículo tiene por objetivo fundamental determinar las estrategias didácticas que emplean los textos escolares venezolanos de Química para la enseñanza de los conceptos básicos de medición, materia y energía. La aproximación que se hizo a los textos escolares tiene como base el Análisis de Contenido como una

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técnica de interpretación de textos, tomando en cuenta registros de datos. Nos basamos en la lectura textual o visual como instrumento de recogida de información, lectura que a diferencia de la lectura común debe realizarse siguiendo un método específico obteniendo hallazgos específicos desde cada ciencia que de alguna manera pueden comprometer la eficacia del texto escolar como instrumento curricular tanto para el alumno como para el docente. Los hallazgos permiten la determinación de diversas estrategias didácticas como lo son: contextualización, presentación de la Información, eenseñanza explícita, recíproca y focalización.

PALABRAS CLAVE: Texto Escolar – Estrategias didácticas – Enseñanza de Química – Conceptos – Análisis de contenido

1. INTRODUCTION

When we approach chemistry textbooks used at the level of Venezuelan secondary education, we found that the concepts of *measurement* and *matter* belong to the initial contents of the subject. Later, the concept of *energy* appears and connects to the predicted concepts. When the official programs of chemistry designed by the Ministry of Popular Power for Education are reviewed, it is found out that the three concepts reappear and their approach is deepened at higher levels of study, then giving explicitly its importance, so reviewing the teaching strategies through which their teaching is intended is relevant.

To achieve the proposed objective when starting this piece of research, we conceived the following structure: first the concepts presented in the *specialized reference books* (LEC) of chemistry commonly used in higher education not only in Venezuela but also in Latin America and Europe are taken as reference; then there is a description of the corpus of texts for analysis, going from there to handling the concepts of *measurement, matter* and *energy* in the Venezuelan chemistry textbook, Finally, there is a description of the teaching strategies observed by analyzing content of textbooks focused on teaching the concepts of *measurement, matter* and *energy*.

2. OBJECTIVES OF THE STUDY

The general objective is: to determine the teaching strategies used by Venezuelan chemistry textbooks for teaching the basics of *measurement, matter* and *energy*.

The specific objectives are focused on:

- Setting the attributes that make up the concepts of measurement, matter and energy based on the definitions in the specialized reference chemistry books.
- Describing the general characteristics and handling of the concepts of measurement, matter and energy in the corpus of textbooks.
- Describing the commonly applied teaching strategies for teaching contents through textbooks.

3. METHODOLOGY

3.1 Content Analysis

It is a procedure that allows us to analyze and quantify the materials of human communication. In general, it is possible to make a detailed and in-depth analysis of the content of a communication: oral, iconic, gestural, marked gestural language code, etc., and whatever the number of people involved in communication, and it may employ any instrument for compendium of information such as agendas, diaries, letters, questionnaires, surveys, projective tests, books, advertisements, interviews, radio, television, among others. (Holsti, 1968)

Krippendorff (1980) defines content analysis as *"the technique designed to formulate, based on certain data, reproducible and valid inferences that can be applied to a context".* For this piece of research, content analysis enables understanding of textbooks in the specific context in which they are generated and used. According to Krippendorff (Op.cit), this technique places the researcher in three perspectives regarding reality:

- Data as they communicate to the researcher.
- The context in which data are generated.
- The way the analyst's knowledge requires to divide reality to facilitate its understanding.

Content analysis was then set as an objective, systematic, qualitative and quantitative technique that works with representative materials, marked by the thoroughness and generalization.

3.2. Objectives, universe and documents

Let us start here to locate the first four phases of the procedure for content analysis:

1st phase: determining the objectives to be achieved
2nd phase: definition of the universe to be studied
3rd phase: choice of documents: the body of the units of selected content
4th phase: definition of the central aims pursued by research.

3.3. Analysis units and counting rules

This part is comprised of stages 5, 6 and 7 of content analysis.

5th stage: development of indicators or defining analysis units; they constitute the cores of meaning that will be studied for classification and counting. What follows differs:

a. Generic units: which are the units of generic observation. From there, the material must be studied in a generic unit to measure the frequency of the defined concepts.
b. Units of context: it is the largest body of content and serves to grasp the meaning of the recording unit.
c. Recording units: the smaller section of the text, which refers to a category. They are basic units with a view to codification and frequency counting.

There are no clear criteria for distinguishing recording units, so they can be most varied: messages, characters. Anyway, the interesting meanings whose judgment is marked by the analysis objectives must be encoded.

6th stage: numbering and counting rules: which refers to the way of counting coded recording units. The following rules for enumeration (Kippendorf, 1990) are known:

a. The presence or absence of a certain code
b. The frequency, this is the most used in this type of research and refers to the number of times that a particular code or recording unit appears.
c. The weighted frequency when it is assumed that the presence of a code is more relevant than the other and leads to a weight to be established a priori.
d. The degrees of occurrence of a code and the involvement of a different note, according to mode of expression.
e. Contingency, defined as the presence, at the same time, of two or more codes in a unit of context.
F. The order of presentation of codes
g. The density of the text seen as the sum of the frequencies of all found codes divided by the total sum of all the words and a multiplied by one hundred.
h. Concentration level found, by dividing the number of different codes in the sum of frequencies of all codes by one hundred.

7th stage: comprised of categorization, classification and exploration of the material,

a. Categorization: consisting of the operation of classifying the elements of a set based on certain predefined criteria. Categorization is not a mechanical task, since some terms may not refer to the meanings expressed or manifested at first glance but be strongly nuanced by context.
b. Classification: which consists of an operation of classification and differentiation of the elements of a set based on criteria previously established in a system of categories.
c. Exploration of material: with guidelines established for processing of data by different authors such as Woods (1977), Taylor and Bogdan (1986), Bardin (1986) and Strauss (1988), small differences arise in the development of the process of analytic induction.

Guided by the characteristics of available materials (textbooks), the following steps shall be taken:

a. Development of coding categories: Consisting of a data-classifying process around ideas, themes, and specifically selected concepts which will emerge from reading the material for study. The identification of emerging categories is related not only to analysis of material but also to training and theoretical framework of the research process. Coding corresponds to a transformation of the raw data of the textbook.

   These transformations through decomposition, aggregation and enumeration can lead to a representation of content or expression, capable of enlightening the analyst as to characteristics of the text that can serve as indices or, as conceived by Holsti (1969): *"coding It is the process by which raw data are systematically processed and added into units that allow an accurate description of the characteristics relevant to content".*

It then works according to:

- Recording units: corresponding to the segment of content that needs to be considered as the basic unit with a view to categorizing and counting frequency, in our case, issues, words, sentences.
- Units of context: understood as the segment of the message whose size (greater than the recording unit) is optimal to catch the exact significance of the recording unit. This is for example the phrase to the word, paragraph to the issue.
- Enumeration: Once the work of coding all data and separating data belonging to different categories has been performed, it must be quantified by calculating the frequency. This provides information on the weight of each of the established categories, facilitating the detection of the most outstanding features.

b. Coding: which refers to the assignment of a symbol or code to each category. In a broader sense, coding to analyze qualitative information is a method of classifying information which has three fundamental characteristics (Arroyo, 1998):

- A set of two or more categories to study a phenomenon so that it can be meaningful to the problem to be solved.
- A set of rules or standards to assign the studied phenomena to the different categories. Ie, the operational definition of each of the categories in order to unambiguously assign the codes to the recording units identified in the textbook.

4. DISCUSSION

4.1 THE CONCEPT

Chemistry as a science should make use of units of knowledge, ways of understanding or concepts. In chemistry, many of these concepts are really abstract.

When we say abstract we mean that there is not necessarily a visible, concrete and palpable benchmark for this, as might be the concept of chair or nut. One of the forms of manifestation of this abstraction is demonstrated by the ease or difficulty of expressing this concept with words and keeping intact the characteristics of the *"object"*; in this regard, Ausubel (1976) considers that these abstractions must be preceded by direct empirical experience, therefore, if the concept is not completely and correctly conceived and related to experiences of learning, what underlies it will be a scheme of incomplete or lacking knowledge and communication.

Ausubel continues explaining:

> The simplified and generalized representation of reality, achieved by the existence and use of concepts, makes it possible to invent a language with relatively uniform meaning for all members of a culture, so that communication is facilitated (Vygotsky, 1962). And as important as this is that it makes it possible: a) to establish inclusive and generic constructs in the cognitive structure ... b) to handle, interrelate and reorganize the ideas involved in the generation and testing of hypotheses and, consequently, significant troubleshooting. Establishing equivalences, that is, grouping items of experiences related in categories defined by the attributes of judgment of their members, concepts uniform and simplify the environment and thus facilitate learning through reception, troubleshooting and communication. (Ausubel, op.cit, p.579)

The concept then is been consolidated and understood to the extent that the individual succeeds in establishing relations with situations of daily life, if this does not happen, concepts can be discarded (Pairó, 1995 Catala, 2002; Pinto, 2003).

Then, concept in chemistry in the classroom, with a language proper to science, requires paradigmatic facts, experiences that the teacher and the textbooks as a discursive and pedagogical construction generate cognitive processes in the student, arguments with meaning, with connection between scientific knowledge and school knowledge, between theory and chemical experience, between theory and language to be taught (Mercè Izquierdo, 2004) without changing the attributes of the concept and reality allowing conceptual reality to be similar to an experiential reality.

4.1.1. Composition of the corpus of concepts and selection of LEC

The concepts that are part of the object of this piece of research are: *Measurement, matter* and *energy*. They belong to the Venezuelan level of education of third (3rd) year of Secondary Education (high school). This level of study was chosen because it is the first time that the student meets chemistry as a subject. The subject Nature of the first year of Venezuelan Secondary Education (high school) addresses the concepts of *Measurement*, *Matter* and *Energy* but with explanations related to Physics, not to Chemistry.

We approached the three concepts from language and from chemistry; later from teaching; therefore, their treatment is combined: linguistic meaning and definition in chemistry. For the selection of these concepts, we took into account that:

- They are macro-concepts, ie they involve other groups of concepts derived and dependent on them, which are called micro-concepts. These macro-concepts give rise to other concepts in subsequent issues prescribed in the official syllabus of the subject. They interrelate.
- They are proposed in the Syllabus of the subject in the selected level of education; consequently, they are fundamental in the content of textbooks.
- Their use reappears in the syllabi of the subject at the higher levels of study.

Regarding the L.E.C. chosen to serve as a benchmark as regards the theoretical conception of *Measurement*, *Matter* and *Energy*, we took into account:

- The existence of L.E.C. in digital records of Venezuelan libraries with highest number of students.
- L.E.C. recommended by syllabi of chemistry as a university subject.
- L.E.C. dealing only for the contents of Inorganic Chemistry.
- L.E.C. of theoretical content, with solved problems and proposed exercises.
- L.E.C. of publishing houses with worldwide coverage in at least five countries.
- Existence in Spanish.
- Authors who studied chemistry at recognized doctoral and postdoctoral levels.
- Issues after 1960 (taking into account the eleventh General Conference on Weights and Measures, the atomic model of Dirac and the Venezuelan Official Gazette No. 27919)

From the above criteria, we will take into account mainly the LEC of the authors:

- Darrell Ebbing: Doctor of Chemistry, currently professor at Wayne State University. Several chemistry books published with publishing houses such as McGraw-Hill and Cengage. Translation of the original text by Maria Consuelo Hidalgo, PhD in Chemistry from the Faculty of Sciences of the National Autonomous University of Mexico. This edition was published in 25 countries worldwide.

- Ken Whitten: Professor emeritus at the University of Georgia, BPh from the Berry College, Master of Science from the University of Mississippi and a doctorate from the University of Illinois. He has received many honorary awards in chemistry and Dr. Whitten Award was established in his honor to celebrate his outstanding assistance in teaching at the Chemistry Department at UGA This edition was published in 9 countries worldwide.

- Bruce Mahan: Doctor of Chemistry, professor at the University of California, Berkeley. Many published studies and theoretical contributions in chemistry

and academic reference books with comprehensive coverage. In Venezuela, his work is of compulsory reference for the National School Network (Rena) an educational portal of the Ministry of Popular Power for Science, Technology and Innovation[2].

4.1.2. The concept of *measurement* in L.E.C.

When we review the history of the concept of *Measurement* and, of course, its relationship with number, it is necessary to go to the Egyptian and Greek worlds. *Measurement* appeared as a human need and was related to mass, volume, length and angle. Thales of Miletus, one of the Seven Sages of Greece, developed definitions and principles to apply geometry (geo = earth and metry = measure) for solve everyday problems that had to do with the distribution of land areas; therefore, it is a concept whose management is ancient.

In the modern world, by 1790, the Académie des sciences in France, initially composed of scientists like Pascal, Fourier, Descartes and La Place, among others, upon a proposal by Talleyrand and Prieur, decided to establish a unified system of measurement that was easy to apply, which ended on March 19, 1791 with the definition of the decimal metric system. Hence the meter is its basic unit, defined equal to the ten millionth part of the terrestrial meridian quadrant. Delambre and Méchain were responsible for measuring the arc of the terrestrial meridian that crosses Paris, between Dunkirk and Montjuic Castle in Barcelona, Spain. From its central unit, the meter, all other units such as surface, volume and weight were defined (Hernandez, 1995).

The International Measurement System was established in the Eleventh General Conference on Weights and Measures held in 1960 and was adopted by Venezuela in the Official Gazette No. 27,919 of December 25, 1964, during the government of Raul Leoni. Units of measurement in this system were published in the Extraordinary No. 2,823 of the Gazette as of July 14, 1981.

In the classroom and from personal experience, *measurement* is maybe one of the most abstract concepts to address in a chemistry lesson. Ask a student about his idea of *measurement* entails his looking for a measurement tool such as a ruler to support his explanation. However, rarely do students come near a complete linguistic construction to communicate the attributes of the concept of *Measurement*. We are not casting doubt about their knowing what it is about, but putting the idea into words fails to materialize.

In the dictionary of the Royal Spanish Academy (DRAE 2001) we found an accurate definition of the verb *measure*: *"Compare a quantity to its respective unit, in order to find out how many times the latter is contained in the former."* This infinitive verb leads to its action, *Measurement*.

[2] http://www.rena.edu.ve/index.html

In the chemistry L.E.C. selected for this study, *measurement* is one of the first concepts presented in their agendas; however, although its location shows the importance of knowing the concept and then continuing with the study of chemistry, when you delve into reading most of them not even define it, they just present the measurement system that will be used throughout the explanations and exercises and then go without further ado to management of measurement units and addressing other concepts such as mass, weight, volume and temperature.

To Ebbing (1997) *Measurement* in chemistry is *"... comparing a physical quantity to be measured with a unit of measurement-this is a fixed standard for measurement.".* Kotz and Treichel (2003) present *Measurement* as quantitative observations that facilitate the understanding of a process or chemical reaction.

Also, Hein (1999) introduces *Measurement* as process for obtaining numerical values, both obtained from experimental experience. Chang (2010) and Petrucci, Harwood and Herring (2003) consider *Measurement* to be a process, like Hein (1999), to obtain amounts that may be used to obtain other related quantities, and Petrucci, Harwood and Herring (2003) also express that measure is the product of a number by a unit, an idea that resembles the one presented by Ebbing (1997).

Masterton, Slowinski and Stanitski (1990), within the approach to measurement units, conceive *Measurement* as a particular form, as a necessity "... Chemistry is based on concepts that need the measure of the amounts"; Therefore, it might seem that *Measurement* is excluded from the conceptual corpus but is indispensable for management of other chemical concepts.

Brady and Humiston (1999) consider *Measurement* to be a quantitative observation of a fact or a practical phenomenon, similar to Hein (1999) and Kotz and Treichel (2003). Brown, LeMay and Burstein (1998) when explaining the extensive properties, the consider *Measurement* to be necessary, as do Masterton, Slowinski and Stanitski (1990) but, as a quantitative assessment of matter with a specific unit.

Mahan and Myers (1990); Whitten et.al. (2008) Whitten, Gailey and Davis (1992), Whitten, Davis and Peck (1998), Babor and Ibarz (1973), Barrow (1974), Longo (1975), Nekrasov (1969), Armine (1973), Rosemberg and Epstein (1991), Slabrugh and Parsons (1997), Sorum (1975), Garzón (1990) go straight to work with units of measurement and imply management of the concept of *measurement*.

Kotz and Treichel (2003); Hein (1999); Chang (2010); Masterton, Slowinski and Stanitski (1990), Brady and Humiston (1999) and Brown, LeMay and Burstein (1998) stop to address the concept in the first theme of the work, most of these being located in the content of the book in the paragraphs of chemistry and chemical measurements or foundations (units of measurement); revealing the need for a concept of *measurement*.

From the above described, we can find coding attributes emerging via saturation, they are:

'- *quantitative'*: numerically defined in the concept
'- process': defined as a set of consecutive stages
-'exppracexpe': defined as practical experiences or experiments.
-"units" defined by the use of a standardized quantity of a given magnitude adopted by convention or by laws.
-'uninumber: defined binomial number and unit.

4.1.3. The concept of *matter* in L.E.C.

As with the concept of *measurement*, with *matter* we should start with the Greeks. And let us go back to that time because different positions, especially by Aristotle, arouse around *matter*. Needless to say, for the purposes of this piece of research, we will stick to the traditional academic performance rather than to the philosophical one. We can say that Aristotle was the pioneer in the conceptualization of *Matter*, the fundamental characteristic of which was the receptivity of the shape; *Matter* is anything capable of receiving a shape, on a continuum, *Matter* is the power to be something, that something being what will determine the shape. (Metaphysics XI, ESA, 2003)

To the dictionary of the Royal Spanish Academy (DRAE 2001), *matter* is: *"primary reality of which things are made; spatial reality perceptible through the senses, which, with energy, constitutes the physical world. "* this concept being understood as coming from language.

When we search for the L.E.C. of Chemistry, *matter* is also one of the first concepts presented in the agendas. To Ebbing (1997) and Babor and Ibarz (1973), *matter* is related to the topic of mass and conceptualizes it as "anything that occupies space and we can be perceived through the senses" .Kotz and Treichel (2003); Chang (2010); Brady (1999); Brown, LeMay and Bursten (1998); Whitten et.al. (2008); Whitten, Galey and Davis (1992); Whitten, Davis and Peck (1998); Sorum (1975) and finally Mortimer (1983) present *matter* as anything that occupies a place in space and has mass.

Hein (1999) introduces in the concept of volume *"anything that has mass and occupies a volume."* To Petrucci, Harwood and Herrin (2003) *matter* is: *"anything that occupies a place in space and has a property called mass and has inertia"* thus introducing the idea of inertia so far not seen in other authors. Masterton, Slowinski and Stanitski (1990) make a wider concept "a term for any kind of material."

From the above, we can find coding attributes emerging through saturation, such as:

- '*occupation'*: defined as space covered by *matter* in space
'- holding': defined as the mass of *Matter*
-perception': defined ass the sensory experience caused by matter.

4.1.4. The concept of *energy* in L.E.C.

While it is true that the previous concepts come from ancient times, the concept of *energy* is more recent. By the mid-seventeenth century, Christian Huygens undertook the study of the behavior of bodies during collisions, thus establishing a relationship between mass and the velocity of the body under observation. Later on, Leibniz called the amount resulting from this relationship vis viva (live strength) from where the concept we now know of movement-or-kinetic-energy-related energy arises. (Zemansky 1985)

By 1842, J. Mayer showed heat in a force that could be transformed into mechanical force, "the heat of a body must be in an invariable numeric relationship with the work needed to produce it", thus introducing the idea of work in energy as a formulation of the conservation of energy. Also, through his essays, Mayer defended the indestructibility and conversion of energy. (Zemansky 1985)

To the dictionary of the Royal Spanish Academy (DRAE 2001), *energy* is the *"capacity to do work*." It is conceptualized the same way by Kotz and Treichel (2003); Hein (1999); Petrucci, Harwood and Herring (2003); Brady (1999); Babor and Ibarz (1973); Longo (1975) and Mortimer (1983). In all cases the concept of *energy* comprises the content of thermochemistry.

To Brown, LeMay and Bursten (1998); Whitten et.al. (2008); Whitten, Galey and Davis (1992); Whitten, Davis and Peck (1998) *energy* transfers heat and, to Chang (2010), *energy* carries out a task and makes a change.

From the above, we can find coding attributes that emerge through saturation, such as:

'- *capacity''*: defined as the property of the energy to do
'- *capacity1'*: defined as work
'- *capacity2'*: defined as heat

4.2. Textbooks

As already indicated in previous chapters, we start from the idea that the textbook is a discursive and pedagogical construction of unique features due to the contents it develops, due to the ideological burden, the conception of the educational process and the cognitive processes that it generates. The textbook corresponds with the syllabus of the subject Chemistry of the third year of Secondary Education (high school), hence its topics are prescribed.

4.2.1. The corpus of textbooks

The corpus consists of three textbooks used to teach the subject Chemistry in the third year of Secondary Education (high school)

The objective that led to the constitution of this group of textbooks was to collect a representative sample of the explanations contained in them to teach chemistry and make qualitative analysis of their use, characteristics and the implications they may have in transmitting knowledge.

Based on the above, we took into account for their selection that:

- The texts selected for the corpus of analysis are the most popular in the educational area selected for the study according to the publishers, bookstores and educational area.
- The texts chosen for their cost or being free of charge and their distribution are the most accessible to students.
- A group of authors with colorful profiles were selected, in order to approach the possible variations that they can have in terms of the budgets in which they are grounded.
- We only took into account the versions of theory books; no textbooks of lab work will be dealt with due to the aspects of extension of the piece of research.
- The latest edition published by each publisher of each textbook was chosen.
- We did not take into account the approval and evaluation of the textbook by the Ministry of Popular Power for Education because, for the latest versions of the texts, the evaluation offices that deal with the approval for the dissemination of textbooks are not active.

4.2.2. Textbooks under study

Based on the selection criteria defined above, the following textbooks were selected:

1. Chemistry 3rd year – Related Series

Author (s): José Manuel Rodríguez (Pedagogical Director)
Beatriz Ramirez, BPh In Chemistry, U.C.V.
Briccycle Cova, MSc in Chemistry, U.S.B.
José Luis Rada, BPh in Biology U.S.B.
Daniel E. A. Rios, Professor of Chemistry, UPEL
Yhonnatan J. Vergara A. Prof. of Chemistry, UPEL
Publisher: Santillana.
Location: Caracas, Venezuela.
ISBN: 978-980-15-0653-9
Year: 2013

Overview of the author: Text prepared by a graduate from Venezuelan universities, with bachelor degrees in science (Biology and Chemistry) and Chemistry faculty professorships. The pedagogical director of the book is a professor of biology, graduated from the (UPEL, 1998), graduated in Editing (UCV, 2008), Master of Publishing (Autonomous University of Madrid, 2015). He has worked within the

Salesian Publishing House as an editor of Natural Sciences, editorial coordinator of Natural Sciences and Mathematics, coordinator of digital developments and currently Editorial Editor.

The textbook is also available in its digital version at http://issuu.com/santillanavenezuela/docs/quimica_3

2. Science for living in community. Natural Sciences 3. Volumes 1 and 2 – Bicentennial Collection.

Author (s):	Aurora Lacueva Teruel (I.P.C.) Carlos Buitrago Volcano Carmen Alvarez Gloria Guilarte Hilda Herrera Itzel Perez Chaparro José Azuaje Camperos Juan Linares Chacoa Maria Maite Andrés Mirtha Andrade Said Gomez Geraldyne
Publisher:	Ministry of Popular Power for Education
Location:	Caracas, Venezuela.
ISBN:	978-980-218-332-6
Year:	2012

Overview of the author: Text prepared by a teaching team graduated from Venezuelan universities and educational institutes, with degrees in science (Biology and Chemistry) and Chemistry faculty professorships. In some cases, it was not possible to find the professional profile of the co-author. Prof. Aurora Lacueva, who participates in the development of the textbook, is Professor of Secondary Education in the specialty of Biology and Chemistry, she is a graduate from CPI, Master of Arts in Science Education (Master of Science Education), Master of Arts in International Education Development (Master of Education for Doctor of Philosophy and Educational Sciences graduated from the University of Barcelona.

The textbook is also available in its digital format at the page of the Ministry of Popular Power for Education (MPPE):

Volume 1:
http://www.me.gob.ve/coleccion_bicentenario/pdf/media/ciencias3t1.pdf

Volume 2:
http://www.me.gob.ve/coleccion_bicentenario/pdf/media/ciencias3t2.pdf

3. Chemistry 3rd year

Author: Freddy Suarez
Publisher: Romor
Location: Caracas, Venezuela.
ISBN: 978-980-381-063-4
Year: 2010

Overview of the author: Text prepared by a Venezuelan professor graduated from the Pedagogical Institute of Caracas in the specialty of Chemistry and General Science. He served at the undergraduate level and for supervisory positions in the Ministry of Education.

4.3. Content analysis of the basic concepts of *measurement, matter* and *energy* in the Venezuelan chemistry textbook.

Below is the result of the content analysis of textbooks to recognize their treatment of the concepts of *measurement, matter* and *energy*.

4.3.1. Text: Chemistry 3rd year – related series – Santillana Publishing House

Overview of the text: The text from Santillana Publishing House was prepared in 2013 in Caracas, Venezuela, as a conceived work, designed and developed by the Editorial Department of Santillana Publishing House under a pedagogical direction and a group of specialists in textbooks two graduates in Chemistry, two chemistry professors and biology professor; plus a team for design and graphic arts. The textbook has ISBN and Legal Deposit. The body of the text consists of 203 pages.

The chemistry text belongs to the Related Series, a set of educational goods produced to meet new challenges in secondary education. These goods are the textbook, a teaching guide for the teacher, mediabook in DVD version also for teachers.

Its presentation states that the series is based on four main themes: health and environment, cultural diversity, information and communication technologies and work.

In addition to the main themes, the text states that there is proficiency-based training in response to the training purposes demanded by the current high school and promoting meaningful learning as construction of critical and reflective knowledge.

a) The concept of *measurement*:

This concept appears in Unit 1: Materials, Topic 2: Materials I non-characteristic properties, one of its purposes being *"to relate physical magnitudes with the corresponding measurement units and their conversion into equivalent units"* (Santillana, 2013, p.14).

In the subtitle *The measurement process*, the concept is presented as *"... measurement is a method of comparing the magnitude of a physical property with a previously accepted unit and conventionally accepted as a standard."* (Santillana, 2013, p.15). The text continues presenting aspects of *measurement* such as precision and accuracy in measurement, measuring devices and, finally, the physical quantity.

The concept is accompanied by a picture of a digital scale with a piece of cheese on it. In the picture, there is reference to the physical quantity, the unit of measure and mass as the physical quantity. After this, there is another subtitle: *The International System of Measures*.

Analysis:

From the above presented as evidence, we can get the attributes present in this concept:

- *"process": "... a measurement is a process consisting of ..."*
- *'units': "... comparing the magnitude of a physical property with a unit of measurement previously and conventionally accepted as a standard."*

Leaving out the attributes *'quantitative'. 'uninumber'* and *'exppracexpe'.* By this we mean that the concept in the syntactic construction presented in this textbook does not take into account the quantitative aspect of measurement, the conformation of the binomial of measurement (number + unit); however, the start of the topic in a section called *"activate" says: "the measurement values are expressed with a number and a unit."* ('uninumber). *"For example, a kilo of meat or half a liter of milk ..."* (Santillana, 2013, p.14).

Finally, it excludes the specification of measurement as a fundamental part of practical experience or experiment. However, in the subsequent explanation of the concept, as stated above, that application in experimentation is seen.

Quantitatively, the concept contains only 40% of the attributes defined in the approximations with LEC Significantly, the image gets the student closer to the concept because it shows an electronic scale which is most common in grocery stores, supermarkets and food stores by bringing up an everyday fact of the student to the presentation of the concept.

a) The concept of *matter*:

This concept appears in Unit 1: Materials, Topic 2: Materials I non-characteristic properties, one of its purposes being "*to relate physical magnitudes to the corresponding units of measure and their conversion into equivalent units*" (Santillana, 2013, p.14).

In the subtitle *Materials*, the concept is presented as*: "... matter is anything that has mass, occupies a volume in space and has a certain amount of related energy."* (Santillana, 2013, p.14).

The text continues presenting aspects of *matter* such as the physical states: solid, liquid and gaseous. The concept is immersed in the paragraph and is not accompanied by iconography or another organizer. Afterwards, there is another subtitle: *Properties of Materials*.

Analysis:

From the above presented as evidence, we can get the attributes present in this concept:

- *'holding': "... matter is anything that has mass ..."*
- *"occupation": "... occupies a volume in space ..."*

It leaves out the attribute *'perception'*. By this we mean that the concept presented in this textbook does not include the sensory experience caused by *matter*. Quantitatively, the concept contains 66.6% of the attributes defined in the approximations with LEC; and it adds an attribute such as:

'ConcepConec': defined as the connection of a basic concept with another basic concept.

b) The concept of *energy*:

This concept does not have a specific location within the textbook, its use is distributed at the convenience of other explanations with a notable increase in its frequency of use in Unit III: Structure of Matter, which addresses atomic models.

Evidence of this is:

- *"Understand the changes related to the reactions between chemical elements and compounds, and the related energy in the process."* (Santillana, 2013, p.144)
- *"... kinetic energy (energy of motion), allowing dissemination of solids, liquids and gases ..."* (Santillana, 2013, p.149)
- *"... accelerated particle, it emits and loses energy, following a spiral trajectory to the core."* (Santillana, 2013, p.150)
- *"... emissions of radiation within the visible spectrum, ie, they are a consequence of emission of energy."* (Santillana, 2013, p.153)
- *"Channel or anodic rays: a source of alpha particles with high energy that does not stray ..."* (Santillana, 2013, p.154)
- *"... defined by levels and sublevels of energy, which become more energetic ..."* (Santillana, 2013, p.157)

- *"... so the concept of levels and sublevels of energy remains in this current model of the atom."* (Santillana, 2013, p.158)

Analysis:

From the evidence presented above, it is understood that:

-The conceptualization of *energy* is not specifically stated. Although the textbook makes use of the concept of *energy*, it pragmatically presupposes that the student knows it and this is shown when addressing situations relating to the concept of atom and atomic models and the nature of *matter*, where it refers to types of *energy*, behavior of particles, electronic jumps, among others. This pragmatic assumption is based on*: "... the prior knowledge that is assumed and shared by people participating in the communicative action."* (Calsamiglia and Tusón, 1999)
-The concepts inherent in the concept of *energy* are isolated.
-Management of the concept of energy does not correspond with the requirements of the Official Syllabus.

4.3.2. Text: Science for living in community. Natural Sciences 3. Volumes 1 and 2 – Bicentennial Collection.

Overview of the text: The text of the Bicentennial Collection was prepared in 2012 in Caracas, Venezuela, as supporting work for studies of the third year of Secondary Education and coordinated by the Ministry of Popular Power for Education. A group of authors of Chemistry, Biology and Physics worked there. The textbook has ISBN and Legal Deposit. The body of the text is made up of two volumes: the first volume with 272 pages and the second volume with 256 pages.

The volumes that make up this work contain twenty-five readings organized into three emphasizing sections: emphasis on Biology, emphasis on Chemistry and emphasis on Physics, plus two additional sections: *"integrative introduction"* and *"something more ...".* For this piece of research, we will consider only the section *Emphasis on Chemistry* and the additional sections: *"integrative introduction*" and "something more ...". This clarification is done because you can find the basic concepts we are dealing with in physics or biology, with the particularities each of these sciences can add to the concept. The readings on Emphasis on Chemistry are: 1 through 8, 9 and 10 in Volume I, and 18, 19, 20 and 21 in Volume II.

In its presentation, it is stated that:

> The textbook aims to contribute to your holistic and civic education, in areas related to the environment and overall health, the use of science to understand reality and develop a good life, multiculturalism, language, information and communication technologies, sovereignty and integral defense of the nation, human rights and culture for peace, liberating work ... hoping you can critically judge what is a priority, just and ecologically sustainable to everyone, today and forever

(MPPE, 2012, p.3).

According to the team of authors, during the development of the contents, processes such as conceptualization, theory building, research, creation, innovation and socio-critical contextualization are presented; in addition to activities of research, creation and innovation, activities of community involvement, activities of problem solving and, finally, activities of self-evaluation.

The scheme that runs each reading is *"an introduction and a development of the topic, where scientific ideas are conceptualized, as reference I take aspects of daily life, history of science, natural language, among others."* (MPPE, 2012, p.5)

a) The concept of *measurement*:

Measurement is not expressly conceptualized in the volumes of the textbook and it is mentioned in sections beyond this study. However, in the Integrative Introduction, reading No. 1: *"The Wonderful World of Natural Sciences*" within the subtitle: "*Matter is made of atoms*," what follows appears:

> So far, no one has seen an atom, but we do know the related phenomena in the macroscopic world, which we can directly perceive through our senses and / or through measuring instruments that, in controlled experiments, confirm their existence, in phenomena or objects such as temperature, electric current, atomic energy, electromagnetic waves, plasma, neutrinos, dark matter, among others
>
> (MPPE, 2012, p.11).

Reading in depth, in this passage we find already defined attributes pertaining to the concept of *measurement* together with the mention of its instruments. This textbook does not devote a section of the readings to approach this concept, it only presents inserted attributes in explanations of other concepts or ideas.

Analysis:

From the above presented as evidence, we can obtain an attribute related to this concept:

> *-'exppracexpe':* "... that we can directly perceive through our senses and / or through measuring instruments that, in controlled experiments ..." (MPPE, 2012; p.11)

No other attributes such as *'quantitative', 'process', 'units'* and *'uninumber* were observed. By this we mean that this textbook, in its section *Emphasis on Chemistry*, does not take into account the quantitative aspect of measurement, the conformation of the binomial of measurement (number + unit), measurement as a process and the importance of units of measure. However, it includes the

specification of measurement as a fundamental part of practical experience or experiment.

Quantitatively, these indications show the presence of only 20% of the attributes defined in the approximations with LEC Significantly, the image accompanying the fragment is a particle accelerator, because, as he read, measurement is presented in an exhibition that has the atom as a central idea.

b) The concept of *matter*:

While reading the Volume I of the textbook, we found that matter is mentioned in 61 cases, 58 cases out of which refer to aspects related to matter such as physical states, essential constitution, chemical environment, among others. This is not the case in Volume II, 21 in reading called *"The inseparable Companions: Matter and Energy"*, which is the last section in *"Emphasis on Chemistry"* when *matter* is conceptualized:

> Think for a moment about the material things you have at home, you will find: household appliances, furniture, beds, lamps, tables. These objects are perceptible to the naked eye, they have a certain mass and occupy a place in space, in general, we call them *Matter*
>
> (MPPE, 2012; II, p.148)

First there is a contextualization of the concept, seeking to promote the analogy via the attribute of the concept.

Analysis:

From the above presented as evidence, we can get the attributes present in this concept:

- *'holding': "... have a certain mass ..."*
- *"occupation": "... occupy a place in space ..."*
- *'perception': "... are visible to the naked eye ..."*

Quantitatively, the concept contains 100% of the attributes defined in the approximations with LEC through integrating the contextualization of the concept and the concept itself.

c) The concept of *energy*:

This concept has a specific location within the textbook, and is closely related to the concept of *matter* in Volume II, in reading 21 called *"The Inseparable Companions: Matter and Energy"* noting that: *"Energy is an inherent property of matter "*(MPPE, 2012; II, p.148).

The concept of *energy* is presented as *"the capacity to perform a task "* the contextualization of the concept is contextualized, for example:

> *Energy* is the vital force of everyday life, the operation of many devices used in everyday life, from TV, radio, telephone, computers to cars, aircraft, traffic lights, among others, depend on it. The *energy* used by these devices is supplied by a source: fuel, water, sunlight, biomass, etc.
> (MPPE, 2012; II, p.149).

Next to this fragment is the picture (Fig. 21.1) of a group of organic and inorganic materials, machines and objects that contain, produce or transmit any kind of *energy*. This shows that, attached to the concept, there is an explanation or application of said concept.

Analysis:

From the above presented as evidence, we can get the attributes present in this concept:

- *'capacity' "... capacity to perform ..."*
- *'capacity1' "... a task."*

Quantitatively, the concept contains 66.6% of the attributes defined in the approximations with LEC through the integration of the contextualization of the concept and the concept itself and showing only an attribute of capacity to perform another related concept; in this case only *task*.

4.3.3. Text: Chemistry 3rd year – Romor Publishing House.

Overview of the text: The text of Romor publishing house was developed in 2010 in Caracas, Venezuela, with a ringed presentation in horizontal orientation, it has no index, presentation and preliminary pages; once the cover is presented, topic 1 begins. A single author and an editorial board worked there. Within the editorial board, there is a Pedagogical Department made up of the author and two professors from the area. The textbook has ISBN and Legal Deposit. The body of the text is made up of 29 subjects distributed along 182 pages.

Each topic is organized as follows: title, introduction to the topic, definitions highlighted in a box, brief explanation (some with contextualization), conceptual map, explanations with iconographies coherent with the explanation, examples of exercises requiring numerical calculations. No problems to worked out by the student or other learning activities are shown.

a) The concept of *measurement*:

Measurement is not expressly conceptualized in the textbook and it is mentioned in the first topic called "*Materials*". The fragments of text that somehow refer to *measurement* are:

> - *"Mass is operationally defined as property that can be measured with the scale* " (Suarez, 2010; p.4)
> - *"Mass is measured with pan scale and weight with spring scales or a dynamometer"* (Suarez, 2010; p.4)
> - *"Temperature is defined as a property that is determined by reading the thermometer, when putting it into contact with an object or material."* (Suarez, 2010; p.8)

Reading in depth, we find in this passage aspects related to the concept of *measurement* by mentioning some of its instruments.

Analysis:

From the above, there are no attributes related to this concept such as *'exppracexpe' 'quantitative', 'process', 'units'* and *'uninumber*. By this we mean that this textbook does not take into account the quantitative aspect of measurement, the conformation of the binomial of measure (number + unit), the experimented experience, measurement as a process and the importance of units of measure.

Quantitatively, these indications show only the presence of 0% of the attributes defined in the approximations with LEC Significantly, the pictures accompanying the presented fragments are the measuring instruments to which each statement refers.

b) The concept of *matter*:

Measurement is expressly conceptualized in the textbook and is mentioned in the first topic of study called *"Materials*". The concept is presented according to the definition:

> *"The concepts of mass and volume make it possible to define matter as anything that has mass and occupies a place in space"* (Suarez, 2010, p.6)

The author then uses the previous concepts of mass and volume to present *matter*. There is a previous presentation of the idea of material and reference to *matter* is made.

Analysis:

From the above presented as evidence, we can get the attributes present in this concept:

- *'holding': "... anything that has mass ..."*
- *"occupation": "... occupy a place in space ..."*

Quantitatively, the concept contains 66.6% of the attributes defined in the approximations with LEC by integrating the contextualization of the concept and the concept itself.

b) The concept of *energy*:

This concept has a specific location in the textbook, first in topic 15: *"Laws Governing Chemical Changes"* and in topic 16 *"Energy*".

The concept of *energy* is presented as *"the capacity to perform a task"* and the contextualization of the concept is established, for example:

> *"Energy can change its shape, can take on the appearance of electric current, light, heat, sound and movement, but it cannot be destroyed, this is the Law of Conservation of Energy"* (Suarez, 2010, p.106)

After this fragment, some associations of *Energy* with chemical reactions and transformations of *energy* are explained. Together with the concept is an explanation or application of said concept.

Analysis:

From the above presented as evidence, we can get the attributes present in this concept:

- *'capacity' "... capacity to perform ..."*
- *'capacity1': "... a task."*

Quantitatively, the concept contains 66.6% of the attributes defined in the approximations with LEC by integrating the contextualization of the concept and the concept itself and showing only an attribute of capacity to perform another related concept; in this case only *task*.

4.4. Didactic strategies used in teaching the concepts of *measurement, matter* and *energy* in the corpus of selected textbooks

In order to precisely define what we intend to get from the analysis of textbooks in relation to the didactic strategies used in teaching the concepts of *measurement, matter* and *energy*, we understand didactic strategy as *"structures of activity in which They objectives and contents become real"* (Medina and Salvador, 2009), we can then consider them to be analogous to the techniques. The didactic strategies include both learning strategies and teaching strategies, the former are from the perspective of the student and the latter from the perspective of the teacher.

Consequently, if we are to address the teaching strategies, we will refer only to the perspective of the one (textbook) that teaches and the mediating role it establishes

between the concept and the student. The textbook, as we mentioned, is one of the most widely used teaching materials in schools for teachers because they are a fundamental support for information, and one of them is the strategies it proposes for teaching.

> If we carefully study the texts used in teaching and their methods of use, we can approach the teaching style of the lessons, the teachers' didactic mentality and the methodologies used in teaching. But even with the contrary opinion of others, we maintain that the use of the book does not have to necessarily be passive learning of concepts. When starting with an inquiry, an researching pedagogy is practiced, and it raises questions and opens questions, the response of the book can serve to know the explanation of a phenomenon, to clarify or expand facts, to find causes, to study or review concepts after school ... (Medina and Salvador, 2009, p.205)

Therefore, the textbook as a mediator between knowledge, textual and iconographic information and the student must contain teaching strategies that go beyond learning by heart and mere repetition without the cognitive construction of new meanings that make the learned concept be recognized in daily events of the student.

According to content analysis of the corpus of selected textbooks in relation to teaching the concepts of *Measurement, Matter* and *Energy* and following the structure of Didactic Teaching Strategy proposed by Medina and Salvador (2009), Shapiro (1989), Sullivan, Mastropieri and Scruggs (1995), the strategies found were the following:

a) *Contextualization*: in its objective dimension in which the context presented belongs to a reality, to a functional space.
b) *Information on objectives*: where what is going to be learned is presented and why. Specifically, the objectives are set forth in a clear language, what is intended and how to do it is informed, redundant information and examples are used to clarify the concepts.
c) *Centering*: taking into account the age of the audience of analyzed textbooks, which is on average from 14 to 16 years old, they have a selective nature of the information. For this purpose, the texts present information such as news and try to arouse attention.
d) *Presentation of Information*: It promotes meaningful learning and tries to encourage students to process information and personally organize content. In this respect, conceptual semantic organizers are offered. Inquiry is promoted.
e) *Explicit Teaching*: it gradually structures the concept and what emerges from it, it demonstrates by way of examples.
f) *Reciprocal Teaching*: through the guidance of reasoning, students are posed questions to help them build logical relationships between new information (concept) and previous knowledge.
g) *Repetition*: the concept is repeated from its application or derivations during the presentation of other contents.

h) *Focusing*: In which the idea is highlighted using colored boxes or signs that draw the attention of the student. It is placed deliberately.
i) *Clarification*: through the verbal procedure, which includes examples, anecdotes and facts related to the concept.
j) *Questions*: Of the applicative and focusing types.

a. Appropriate to the expected level of knowledge of the student
b. Basic skills when activating prior knowledge
c. Without suggesting any answers and, in some cases, demonstrating the procedure
d. The dichotomous response (yes / no) is not promoted
e. Specific to the content derived from the concept.
F. Clearly enunciated
g. Inclusive in their linguistic construction

5. CONCLUSIONS

Once the study was completed, the following findings were obtained:

Based on the reviews of the *specialized reference books* (LEC), it was possible to establish, via saturation, the attributes that make up each concept:

- For the concept of *measurement*, the following attributes were gathered:
'*Quantitative*': numerically defined in the concept
'*Process*': defined as a set of consecutive stages
'*Exppracexpe*': defined as practical experiences or experiments.
"*Units*" defined by the use of a standardized amount of a given magnitude adopted by convention or by laws.
'*Uninumber*: defined as the binomial number and unit.
- For the concept of *matter*, the following attributes were gathered:
"*Occupation*": defined as the space spanned by *matter* in space
'*Holding*': defined as the mass of *Matter*
'*Perception*': defined as the sensory experience caused by *matter*.
- For the concept of *Energy*, the following attributes were gathered
'*Capacity*: defined as the property of *energy* to do
'*Capacity1*': defined as work
'*Capacity2*': defined as heat

Therefore, it is expected that the optimal concepts are those that have more attributes.

As for the corpus of the texts chosen for the study and following each of statements, they are mostly anchored in theories of constructivist learning, taking the textbook as a mediator of learning and a manual of school activity; their constructions invite the student to reflection and criticism, they make use of colorful images and conceptual maps. The concepts of *measurement* and *matter* are located at the beginning of the text; the former is not explicitly shown as the latter. Concepts are placed in boxes that attract the in-training reader's attention and are accompanied by an image that

relates at least to one application of the concept in the everyday environment of the Venezuelan students. The treatment of the concept of *energy* is a little more elaborate, ie it is located in the last third of the textbook and the first chapters of the text make reference to it, so when students are faced with conceptualization, they already manage the idea of it, then the explanations are accompanied by types of energy and their applications.

The attributes found in concepts from the content analysis of textbooks were:

- For the concept of *Measurement* understood in textbooks as a practical procedure in which the magnitude of a physical property is compared with a unit of measure, the following attributes stand out:
'*Exppracexpe*', '*process*' and '*units*'
- For the concept of *Matter* presented as anything that occupies a place in space, the attributes are as follows:
'*Occupation*' y '*holding* '
- Finally, for the concept of *Energy* expressed as the capacity to perform a task, the following attributes arise:
'*Capacity*' and '*Capacity1*'

From the above, it is possible to understand that concepts lack attributes that make up each of the concepts; however, approaches are made to optimum conceptualization based on the theoretical referents.

Finally, unifying the descriptions with the approach to the concepts, it was possible to recognize the didactic strategies in most textbooks: contextualization, centering, presentation of information, explicit teaching, reciprocal teaching, repetition, focusing, clarification, questions. In short, there were quantitative and qualitative deficiencies in handling the concepts of *measurement, matter* and *energy* but with a varied use of constructivist teaching strategies for teaching.

6. REFERENCES

BOOKS, BOOK CHAPTERS INPUT OR A REFERENCE BOOK, TECHNICAL REPORTS, THESES

Ausubel, D.P (1976) *Psicología Educativa. Una perspectiva cognitiva*. Trillas:México.

Armine, P.D. (1973) *Temas programados de Química general*. México:Diana

Arroyo González, L (1998). *Propuesta de valores para un curriculum Islámico-Occidental en la ciudad de Melilla.* Tesis Doctoral: Universidad de Granada (Inédita)

Ausubel, D. (1976). *Psicología educativa. Un punto de vista cognoscitivo.*Trillas:México.

Bardín, L. (1986) *Análisis de Contenido*. Madrid:Akal

Brady, James E. ; Humiston, Gerard E. (1999) *Química básica: principios y estructura*. México:Limusa

Barrow, G. (1974) *Química General.* Barcelona:Reverté

Brown, T. L., & Lemay Jr, H. E. y Burstein, Bruce E. (1998). *Química. La Ciencia Central*. Prentice May:México
Calsamiglia, H. y Tusón, A. (1999). *Las cosas del decir*. Barcelona: Ariel.
Catalá, M.; Cubero, R.; Díaz, J.; Feu, M.; García de la Torre, E.; García Díaz, J.; Jiménez, M.; Pedrinaci, E.; Pujol, R.; Sanmartí, N.; Sequeiros, L.; Solsona, N.; Vilá, N.; Vilches, A. y Zabala, A. (2002) *Las ciencias en la escuela: teoría y práctica.* Caracas:Graò
Ebbing, Darrell D. (1997) *Química General*, 5ª ed. McGraw-Hill:México
ESA (2003) *Convention for the establishment of a European Space Agency.*Darmstadt, Alemania
Garzón G., G. (1990) *Fundamentos de Química General*. Bogotá:McGrawHill
Hein, Morris (1999) *Química*México:Grupo editorial Iberoamérica
Hernández Sardiñas, F.C. (1995) *Metrología dimensional.* La Habana
Kotz, John C. y Paul M. Treichel. 2003. *Química y reactividad química*. 5.a ed. México:Thomson Learning
Krippendorf, K. (1990): *Metodología del análisis de contenido. Teoría y Práctica*. Barcelona. Paidós Ibérica, S.A
Kuhn, T. (1987) *La estructura de las revoluciones científicas.* 11º reimpresión. Madrid.
Longo, F. R. (1975) *Química General*. Mexico:McGrawHill
Mahan, B. C., & Myers, R. J. (1990) *Curso de Química Universitario*. México: Editorial Addison–Wesley Iberoamericana.
Masterton, W. L., Slowinski, E. J., & Stanitski, C. L. (1990) *Principios de química*. Guanabara Koogan.
Medina Rivilla, A., y Salvador Mata, F. (2009) *Didáctica general*. Pearson Educación:Madrid
Ministerio del poder popular para la Educación (2012) *Ciencia para vivir en comunidad-Ciencias Naturales.* Tomos I y II. Caracas, Venezuela.
Nekrasov, B. (1969) *Química General*. MIR:Moscú
Petrucci, R. H., Harwood, W. S., Herring, F. G., & Pumarino, C. P. G. (1977).*Química general*. Fondo Educativo Interamericano.
Pinto, G. (2003) *Didáctica de la Química y vida cotidiana.* Anales de la Real Sociedad Española de la Química. Segunda época Enero-Marzo.
Real Academia Española (2001) *Diccionario de la lengua española* (22 ed.) Madrid. España.
Rosemberg, J.L. y Epstein, L.M. (1991) *Química General*. Madrid:McGrawHill
Santillana (2013) *Química. Serie Conexos*. Rodriguez, J.M. (comp.) Caracas, Venezuela.
Shapiro, E.S. (1989) *Academic Skills Problems (Direct assessment an intevention)* Guilford Press:New York
Slabrugh, W.H. y Parsons, T.H. (1977) *Química General.* México:Limusa
Sorum, C.H. (1975) *Química General*. Bilbao:Urmo
Suárez, F. (2010) *Química*. Caracas:Romor
Sullivan, G.S., Mastropieri, M.A., Scruggs, T. (1995) *Reasoning and remembering coaching student with learning disabilities to think.* The Journal Special Education, 29, 3, 310-323.

Taylor, S. Y Bogdan R. (1992). *Introducción a los métodos cualitativos de investigación*, Paidos, Barcelona.Williams, M., Unrau, Y. A., Grinnell, R. M., & Epstein, I. (2005). The qualitative research approach.*Social work research and evaluation: Quantitative and qualitative approaches*, *7*, 75-87.

Whitten, K.D., Galley, R.E. y Davis, D. (1992). *Química General.*(3 Ed). Mc Graw Hill:México

Whitten, K., Davies, R. E., & Peck, M. L. (1998).Química General. 5ta. *Madrid. Editorial Mc Graw Hill*.

Whitten, K. W., Davis, R. E., Larry Peck, M., & Stanley, G. G. (2008) *Química*. CENGAGE Learning:México.

Zemansky, Mark W. (1985). *Calor y termodinámica*. Madrid: McGraw-Hill.

PERIODIC PUBLICATIONS, MAGAZINES, AND SIMILAR WEBES:

Holsti, O.R (1968): Content analysis. *En LINDZEY, G. Y ARONSON, E. The handbook of social Psychology*. Vol.2. ResearchMethods, Addison-Wesley, Reading,

Mass.Izquierdo, M. (2004) *Un nuevo enfoque en la enseñanza de la Química: Contextualizar y Modernizar.* The Journal of the Argentine Chemical Society. Vol 92, Nº 4/6. Pp. 115-136.

Mercè Izquierdo, M. (2004) *Un nuevo enfoque de la enseñanza de la Química: contextualizar y modelizar.* The Journal Argentine Chemical Society. 92, (4-6) pp 115-13

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