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CONCEPTUAL MANAGEMENT IN CHEMISTRY THROUGH SOCIAL NETWORKS

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ABSTRACT

The main objective of the this article is to recognize the incidence of the use of social networks, especially Twitter, in a mediating role in managing basic concepts of chemistry in the Venezuelan high schools. This management was approached by analyzing the content of the interactions that, through recurrence of linguistic units of referents, occurred in the participation of students within the social network with participation in these interactions of the e-moderator. The findings clearly show the affinities of the student in the use of social networks and technological tools, the communication among peers and the saturation of contents, allowing consideration of this strategy when teaching concepts as it is innovating and easy to use by the actors participating there and maintenance of the concept according to what is established in the specialized books for consultation.

KEYWORDS
Social networks - interaction analysis – concepts – chemistry

EL MANEJO CONCEPTUAL EN QUÍMICA A TRAVÉS DE REDES SOCIALES

RESUMEN

El siguiente artículo tiene como objetivo fundamental el reconocimiento de la incidencia que tieneel uso de las redes sociales, específicamente Twitter, en un rol mediador en el manejo de conceptos básicos de Química en el bachillerato venezolano. La aproximación a este manejo se hizo desde el análisis del contenido de

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las interacciones que por recurrencia de unidades lingüísticas de referentes se produjeron en las intervenciones de los estudiantes dentro de la red social con la intervenciónenestasinteraccionesdel e-moderador. Los hallazgos develan claramente la afinidad del estudiante en el uso de redes sociales y herramientas tecnológicas, la comunicación entre pares y la saturación de contenidos permitiendo considerar esta estrategia en la enseñanza de conceptos por lo innovador y afín que se hace con los actores que en ella intervienen y el mantenimiento del concepto de acuerdo a lo establecido en los libros especializados de consulta.

Palabras clave
Redes sociales - análisis de interacciones – conceptos - Química.

1. INTRODUCTION

Entering the classroom brings a myriad of enriching experiences for both the teacher who hopes to teach and the students who expect to learn. Simultaneously, there is also a struggle between the strategies that are planned for thematic content management and the technological devices that are part of the lives of many teachers and students who will accompany their academic spaces (Certad, 2011;. Del Valle , 2010)

In schools, there are subjects in the official syllabus of the Venezuelan high schools that permeate these strategies more easily, maybe by the very essence of matter; therefore, both a traditional strategy and a strategy that uses technological tools can arouse student's attention at first; in other subjects this is not easily achieved. For example, the experiences in subjects like geography where art and plastic arts emerge quite naturally as a resource in the construction of maps and climate charts to talk about concepts such as *climate, temperature* and *relief*; or travelling across open spaces for collecting leaves and plant types in studies of nature in the presentation of concepts such as *photosynthesis* or *chlorophyll* are very different from the experiences found in defining concepts such as *energy* in physics or *matter* in chemistry that we will develop hereinafter.

Therefore, the choice of an appropriate strategy for a specific content is an important factor to take into account, as it can facilitate teaching and bring students close to the context so that they can understand the content taught or endanger the effectiveness of learning and condemn the transmission of knowledge , leading the student automatically undoing what is to be learned (Medina and Salvador, 2009). If we combine the skills developed by the student in the use of mobile technological devices, the context of development, and teaching of contents scheduled in official syllabi, the results can be interesting. (Certad, op.cit)

Based on the above, we have decided to describe the variations produced by the use of social networks as a strategy in the teaching of chemistry, and within that, a very specific plot: teaching of basic chemical concepts.

2. OBJECTIVES

The general objective is to analyze a set of interactions that occur during initial management of the basic concept of *matter* through the social network Twitter® in general secondary school students.

3. APPROACH AND METHOD

3.1. Social Networks in Education

Speaking of Social Networks in Education involves turning one's gaze to the so-called Education 2.0. The union of contemporary education with applications emerging from Web 2.0 merge teaching of knowledge with the development of skills and attitudes in a student who interacts with online tools, disseminates information and works collaboratively; therefore, we refer to knowledge, skills and attitudes, which then leads to talk about proficiencies in the knowledge society. (Certad, 2012)
Let us deconstruct a little what we have just stated. The term attitude evokes the way to act, in this case by the student. The expected action for a student with technological skills in the knowledge society gathers being aware of social knowledge, knowledge of the network, contribution without direct compensation, ie, information sharing without expecting anything in return; in this, the teacher should promote the sharing of creations of the students through the network which leads to collaboration.
Group work is commonplace, but teamwork is a little more difficult and collaboration is part of it, it is part of collaborative work. The second attitude then is aimed at integration with peers to produce knowledge synchronously or asynchronously but in reduced time periods since information expires faster than ten or fifteen years ago; in this respect, the strategy and activity are critical and depend on other skills, teaching. As a last attitude we have ethics, or being more direct, respect for intellectual property, the reference to the production of the other and the relationship that develops between different authors. The social network is an ideal space to demonstrate these attitudes.
The term *capabilities* unequivocally leads us to think in being able to perform a task. These capabilities are linked to the student's thinking and their organizational level. Specifically, capacities are evidenced in the development of transcendent and critical, researching, investigating thinking; in creativity in the production of contents, products, models and sponsorships for their works and, last but not least, self-management both in the search for new knowledge and in solving problems during research or search for information.
Finally, proven proficiencies in management of information in the search for, selection, organization and communication of information produced by the students and to be placed to be available on the web. These processes include a specific decision based on previous experience, and previous skills and attitudes for the dissemination of knowledge.

When these skills are refined and displayed in technological areas, through the web and, more specifically, through social networks, we are in the use of social networks as a strategy used in education.

Social networks are understood to be a set of interconnections that form a social structure in which there is multifactorial exchange. This structure has points of convergence and divergence, typical of those who shape it and they reflect human individuality. The points of convergence are of interest to us in this case and they are called nodes. In a node, there can be relationships with other nodes, for instance: family-related, friendship-related, work-related, in short, typical of the essence of what we share, a filial, inbreeding relationship of interest to research, among others. (Medina and Salvador, 2009)

We will focus on the social networks in which the relations that arise are academic in nature, and the information used in it derives from knowledge already produced and placed in a supra-arranged level and how it will produce subordinations or combinations in an interconnected context.

The social network in which the experience develops is Twitter®, which is located in microblogging networks, a structure built by a short text being less than 140 characters. This network is extremely interesting and hence its intended use. First, although it is a social network, its relationships are not necessarily reciprocal, that is, you can read texts written by others without them necessarily reading yours; thus arises a kind of contract that emerges from the kind of social contact: those who follow me and those I follow. We say a kind of contract or agreement because I normally follow the one who follows me, but there is no obligation. When following is reciprocal, the network enters the standards of the social network.

Second, the microblogging. As we said above, we will limit our experience to management of concepts, the higher cognitive process of synthesis is involved there, since the student must handle a volume of information and, using cognitive processes and schemes, convert everything into a text having 140 characters at most. Then, by using the social network Twitter® as a strategy for managing concepts we will also be promoting, in addition to technological proficiencies, higher cognitive processes in students.

And third and finally, the labeling system called hashtag and distinguished by the initial use of number sign (#). Using hashtag allows us to give a distinctive label to our message and group them when searching. This tool facilitates information management and visualization of the development of the idea, taking as reference the time and date of sending; therefore, it allows handling of discussion forums with e-moderator, sharing information and creating discussion groups.

3.2. Teaching of Chemistry

According to the dictionary of the Royal Spanish Academy, Chemistry is a science that studies the structure, properties and transformations of matter from its atomic composition; therefore, the teaching of chemistry emerges as a specialization in the teaching of Sciences.

According Wobbe de Vos and Pilot (2002) chemistry was introduced in secondary school as a regular subject in the Netherlands in 1863. This Science is present in almost any event that arises in the day to day, making it possible for students to be in

continuous and direct contact with each of these phenomena even in an involuntary way. Therefore, using the guidelines for the teaching of Science, you may pick up this factual, unstructured knowledge related to chemical events to make it available to teachers for teaching.

Although there is no manual to show a critical path that the teacher who ventures to this teaching must follow, you can find models derived from what is conceived as the teaching of the science applied to this Chemistry Science, comparing the apprentice to Science as such, assimilating it and transferring the experience to the content, guided by the teacher in the solution of problem situations.

On this basis, it is possible to raise the teaching of chemistry from the interaction between the explanation in the classroom, the chemical language in this explanation and the overall context of the student.

The interpretation of chemistry and its phenomena is be a process that takes place from its gradual explanation, in which the chemical concepts acquire meanings, relationships among them being established based on common or different categories. It is important to note that there are extremely abstract concepts in this chemistry science, this means that there is no specific referent to it as, for example, would be in the case of the concept of car, bird, dog, etc. These concepts will be understood as long as the learner achieves a relationship with events of daily life, otherwise it is quite possible that, in isolation, the concepts are discarded by the student. (Heave, 1995 Catala, 2002; Pinto, 2003)

Broadly, with the chemical phenomena, the cognizant beings progressively develop various levels of explanation, which constitute an approach to the mental model of chemistry that surrounds it. This model is refined as both the concepts and the relationships are perfected, in the light of what would be a true scientific concept, but from its own conceptual construction.

Consequently, the scientific concept is worth a distinctive language of Science, initially maybe not learned but oriented to a reader in training who is enrolled in a field of development of Chemical Sciences. (Bolivar, 1998) This language and the proper construction of the concept encourages the formation of mental models through a cognitive structuring around key ideas and paradigmatic facts (Izquierdo, 2004; Catala, 2002) the paradigmatic fact being understood as the classroom experience the teacher or textbook proposes for analysis and interpretation by the students, gathering characteristics according to what we have discussed, mainly for the fact to be familiar to the students, and that the language used be ideal for a scientist in training (Pinto, op. cit). The challenge is then first to find those paradigmatic facts that allow the phenomenological explanation by the teacher, which then generate significant arguments to the class. Second, the concept is built on a connection between scientific knowledge and school knowledge, therefore its study is imperative.

In this line of ideas, Galagovsky (2007) considered it important to add to what we have mentioned that the planning of teaching chemistry is crucial to list the contents and procedures related to scientific methodology and to teach in this regard and also the outstanding character of laboratory experiments contextualized to the scope of the audience.

Finally, Izquierdo (. Op.cit) proposes the idea of *contextualization and modeling* in the teaching of chemistry based on the following premise:

> If theory does not correlate with chemical experience, the set of chemical theories and specialized languages to be taught, related to a specific way of intervening in certain phenomena, stops being 'rational' and is not 'reasonable' either, as significant arguments supporting as to what has to learn can be generated. "(p.128)

In consideration to what was previously stated, chemistry as a science should be taught from a prescriptive approach that models paradigmatic facts in the students so that they, in turn, through transfer, succeeds in anchoring this fact to a chemical abstract concept in an articulated, connective way, making use of a language not necessarily erudite but as scientific as basic in a significant way.

3.3. Concepts in Chemistry

As mentioned above, chemistry as science must rely on units of knowledge, ways of understanding or concepts. In chemistry, many of these concepts are really abstract. And when we say abstract we mean that there is not necessarily a visible, concrete, palpable referent to 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 to express the concept in words while keeping the characteristics of the "object" intact; in this regard, Ausubel (1976) considers that these abstractions must be preceded by direct empirical experience; therefore, if the concept is not for completely and correctly conceived and related to the experiences of the learner, what underlies it is an incomplete or knowledge-lacking diagram, as well as its communication.

> Ausubel goes on explaining (op.cit):
> The simplified and generalized representation of reality, achieved by the existence and use of concepts, makes it possible the invention of a language with relatively uniform meaning for all members of a culture, so that communication is facilitated (Vygotsky, 1931). And as important as this is that it makes it possible: a) to establish inclusive and generic constructs in the cognitive structure ... and b) to handle, interrelate and reorganize the ideas involved in the generation and testing of hypotheses and, consequently, in significant problem solving. Establishing equivalences, that is, grouping items of related experiences into categories defined by the attributes of judgment of their members, the concepts uniform and simplify the environment and thus facilitate the learning through reception, problem solving and communication. " (Ausubel, op.cit, p.579)

The concept then is consolidated and understood to the extent that the individual succeeds in establishing relations with situations of daily life, if it does not happen, concepts can be discarded (Pairó, 1995 Catala, 2002; Pinto, 2003).
Then, the concept in chemistry in the classroom, with a language proper to science, requires paradigmatic facts, experiences that generate cognitive processes in students, arguments with meaning, with connection between scientific knowledge and school knowledge, between theory and chemical experience, between theory and language in order to be taught (Izquierdo, 2004) without changing the attributes of

the concept and making it possible that a conceptual reality can be similar to an experiential reality.

3. 4. Composition of the corpus of concepts and selection of specialized Books for Consultation (LEC)

The concept that forms the object of this piece of research is *matter*. It belongs to the Venezuelan level of education of third (3rd) year of Secondary Education (high school). The choice of this level of study is intentional because it is the first time the student meets Chemistry as a subject but not the concept of *matter*; the syllabus of Nature for the first year of Venezuelan Secondary Education (high school) addresses the concept of *matter* from explanations that relate to physics.
We are approaching the concept from language and from Chemistry; therefore, its treatment is combined: linguistic meaning and definition in Chemistry. For the selection of this concept, we took into account what follows:

- It is a macroconcept, ie it involves other groups of concepts deriving and dependent thereof that are called microconcepts. These types of macroconcepts give rise to other concepts in subsequent topics prescribed in the official syllabus of the subject. They relate to each other.
- It is proposed in the syllabus of the subject at the selected level of education; therefore, it is the cornerstone in the content of textbooks.
- Its use reappears on the syllabi of the subject at the higher levels of study.

Regarding the L.E.C. chosen to serve as a reference for the theoretical conception of *Matter*, we took into account what follows:

- The existence of L.E.C. in the digital records of Venezuelan libraries with highest number of students.
- L.E.C. recommended by the syllabi of chemistry as a university subject.
- L.E.C. dealing only with the contents of Inorganic Chemistry.
- The L.E.C. with a 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 had 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, mainly the LEC by the following authors will be taken into account:

- *Darrell Ebbing*: Doctor of Chemistry, currently professor at Wayne State University. Several editions of chemistry published with publishers such as McGraw-Hill and Cengage. Translation of the original text by Maria Consuelo Hidalgo, PhD of Chemistry at 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, BSc from the Berry College, Master of Science from the University of Mississippi and a doctorate at 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 Department of Chemistry 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 as well as books for academic consultation with wide coverage. In Venezuela, his work is of reference for the National School Network (Rena), an educational portal of the Ministry of Popular Power for Science, Technology and Innovation[2].

3.4.1. The concept of *matter* in the L.E.C.

Going back to the historical principles of the concept, we should start with the Greeks, and we go back to that time because, concerning *matter*, different positions arose, especially by Aristotle. Needless to say, for the purposes of this piece of research we will stick to the traditional academic interpretation rather than to the philosophical one. We can say that Aristotle was the pioneer in the conceptualization of *matter*, in which its fundamental characteristic was the receptivity of the form; *Matter* is anything that can receive a form, on a continuum, *Matter* is power to be something, that something being which will determine the shape. (Metaphysics XI, ESA, 2003)
Matter, to the Dictionary of the Royal Spanish Academy (DRAE 2001), is: "primary reality of which things are made; spatial reality perceptible by 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 one of the first concepts presented in the agendas. To Ebbing (1997) and Babor and Ibarz (1973) *Matter* is associated with the issue of mass and they conceptualized it as "anything that occupies space and we can perceive 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 *volume* in the concept "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", introducing the idea of inertia not seen in other authors so far. Masterton, Slowinski and Stanitski (1990) make a wider concept "term for any kind of material."

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

From the above, we can find coding attributes emerging through saturation, these attributes will be understood as those syntactic units to be present in the linguistic construction of concept. These attributes are:

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

4. DISCUSSION

Experience: descriptions, discussion and analysis

With a theoretical basis of a double constructive-connective side. The former focuses on the socio-historical theory proposed by Vygotsky (1931) regarding the definition of mediator, par, scaffolding and ZPD made by the author, , and the construction of concepts presented by Ausubel (1976); and, on the second side, by the Theory of Connectivism (Siemens, 2004) in which knowledge is in the network and is shared through connecting nodes.

Let us begin with a brief description of the method applied in the experience. According to its design, this piece of research is framed within a special project (UPEL, 2006, p.21) with support from field research (UPEL, 2006, p.18; Ramirez, 2007;. P 66) in the form of Action Research (Rodriguez, 1996; Martinez-Miguelez, 1998; Grossi (1988) cp Bartholomew, 1997), and its type corresponds to Joint Research as a result of the integration of quantitative and qualitative methods (Bericat, 1998). Qualitative information will be managed with the use of the content analysis technique proposed by Holsti (1968) and Krippendorff (1980).

Stages of experience:

- **Home**: For this first moment, the label (hashtag) #conceptoquimico was established within the social network
Twitter®. We selected the group of third year of secondary education and, deliberately, those participants within this group who:
  - Have a cell phone or tablet.
  - Have a cell mobile line with WiFi connection from the classroom
  - Are registered with a Twitter® account and make (daily) frequent use of it.
  - Attend the third year of Secondary Education.

- **Interaction**: The activity was designed in three moments that would allow recognition of the way in which information management processes, activation of prior knowledge, higher cognitive processes and events emerging from the same activity occur:

- **Moment 1 Prior Knowledge**: In this stage, a tweet with the mention of predefined label for the activity with the initial questioning is sent:
"@moderator: In 20 second, answer: What is matter? #conceptoquimico "
upon receiving the *tweetanswer* from the student, the e-moderator answers the student:
"@moderator: *@xyz* received feedback ..."
then

"**@moderator**: Wait in a few moments the next part of the activity of #*conceptoquimico*."

- **Moment 2 Connection, new structures and conceptual management**: For this stage, we first developed an in-depth search for existing concepts of *matter* both in textbooks and in internet academic portals as Google Scholar, Scielo, Redalyc, among others. Second, the student must produce a concept that comes from the synthesis of the concepts found in the search:
"**@moderator**: Using texts and academic search engines, find five #conceptoquimico of *Matter* and build a concept from those found"
five minutes later:
"**@moderator**: Post your #conceptoquimico of *matter* constructed from other publications."
"**@moderator**: *@xyz* received, feedback ..."
"**@moderator**: From your published #conceptoquimico of matter, provide three examples from your context."

- **Moment 3 Expansion**: As a final part, the expansion of the activity is proposed; so that the activity does not end but grows and the management of the concepts that arise in the course of the subject can be collected in this label '#conceptoquimico'.
"**@moderator**: All have exemplified solids from #conceptoquimico, and is air matter?"
five minutes later:
"**@moderator**: In the # conceptoquimico published by each of you there is another concept that is repeated, what is it?".
five minutes later:
"**@moderator**: Repeat the procedure with this new #conceptoquimico and publish your concept"
10 minutes later:
"**@moderator**: *@xyz* received, feedback ..."

-**Farewell**: As mentioned at the last moment on the stage of interaction, it is intended to continue with the support of teaching concepts in Chemistry in social networks, so this part ends with:

> "**@moderator**: In the coming days we will continue with management of #conceptoquimico in social networks. I'll be waiting for you!"

4.1. Analysis of Experience

A. Home: This initial stage was personally approached with the students, finding out that the total enrollment in the selected class is 32 students. Once participants had been selected according to predefined criteria, we found out the following features:

-- Nine (9) males and fourteen (14) females resulting in 23 participants or 71.9% of total enrollment, statistically representative. We can infer

that women in this class use more Twitter® for reasons unknown to this study.

- Men are divided into five (5) being 15 years old, one (1) 16 years and three (3) seventeen, while females are divided into seven (7) 15 and (7) 16 years. Consequently, there were twelve (12) students aged 15, eight (8) students 16 years and three (3) students being 17 years. These findings coincide satisfactorily with the age indicated in the official curriculum and programs for the addressed level of study.

b. Interaction:

-- **Moment 1: Prior Knowledge**: the verbatums obtained from publications of the students using the tag #conceptoquimico were:

1. "it is what the universe is made of or the amount of many atoms"
2. "it is any body that has mass, weight and volume"
3. "what is occupying a place in space"
4. "it is everything we see and touch"
5. "it means something material to me "
6. "it is what occupies a volume and weight in space"
7. "it is what we are made of, matter is everything"
8. "it is anything that has energy and can be changed or maintained"
9. "It is mass occupying a space or body"
10. "everything around us"
11. "something physical in a space"
12. "it has to do with element ... I think"
13. "....."
14. "is all what a body occupies, volume and mass and occupies a place in space"
15. "a set of products that take up space"
16. "it is a mass that is at a given space"
17. "a physical part that occupies space"
18. "is what makes up everything we see and touch"
19. "a body"
20. "it is everything around me"

Analysis:

Out ff the 23 students who started, 20 effective participations were collected, meaning students who posted the requirements requested for interaction, including proper use of hashtag. Quantitatively, we have a range of 86.95% out of the total.
This first moment sought to activate prior knowledge, because, as we mentioned earlier, this concept has already been worked on previous levels so that the student has been in contact with it and its situation. Let us recall also that, according to L.E.C., the attributes of this concept are: "occupation": defined by space spanned by matter in space, 'holding': defined as the mass of matter and 'perception': defined as sensory experience caused by matter. The integration of the three attributes leads to

optimal construction of the concept. Based on this and taking the verbatums of participants, we have:

Chart 1
Collection of verbatums for identification of attributes in the concept from previous knowledge of students

Participation	'occupation'	''holding'	'perception'	Other
3	"what it is taking place in space"			
4			is everything we see and touch"	
6	""it is something that takes ... [volume ...]			[[concerned] ... volume and weight in space."
8		"it is anything that has energy ..."		
14	"is all that occupies a body ... [,] ... and occupies a place in space"			... [mass, volume] ...
15	"set of products that take up space"			
17	"physical part that occupies space"			
18			"it is what makes up everything we see and touch"	

Source: Autohrs

Therefore, out of the twenty statements, eight had at least one attribute of the concept. Most of these students agreed in the attribute 'occupation', ie, matter

"occupies". Two of them accompanied the attribute with other categories such as *mass* and *volume*. The interventions are arranged in order of appearance in the timeline of Twitter®. Intervention No. 3 was the first to encourage the emergence of *retweet* (replicas of the intervention) so it surely was presented as a referent for home and activation for other interventions of the group; then intervention No. 14 gave way to three *retweets*.

- **Moment 2: Connecting, new structures and conceptual management**:

  - **Concept of matter**: the verbatums (the number of characters of the statement is specified in parentheses at the end of the verbatum) obtained from publications of the students using the tag #conceptoquimico were:

1. "matter is defined as anything that has mass and occupies a place in space, can be measured and modified" (107)
2. "it is anything that has a spatial location, has energy and changes over time" (94)
3. "it is that which has mass and occupies a place in space, ie, that can be measured." (85)
4. "an extensive, indivisible and impenetrable substance that can take all kinds of forms. That of which something is made"(117)
5. "it is anything that has a spatial location, has energy, weight and volume" (78)
6. "it is something that occupies a place in space and can modify its rest" (71)
7. "it is anything that has a spatial location, has mass and is in nature" (83)
8. "anything that occupies a place in space and is detected by the senses" (72)
9. "it is something that occupies a place in space, has mass" (55)
10. "anything that occupies a place and composes a body" (46)

Analysis:
Out of the twenty-three participants, currently ten students participated, which is 43.47% of students who met the selection criteria, and 50% of all participants at the start.
For this moment, we included the Verbal Capital (Calsamiglia and Tusón, 1999) because, as the maximum characters allowed in the microblogging is 140 characters, the capacity of synthesis is relevant, therefore, a concept raised by the student that contains the attributes predefined by LEC, after having searched in several sources of academic platforms, and is less than or equal to 140 characters, will be considered an excellent concept. Accordingly, it is found that:

Table 2
Collection of verbatums for identification of attributes in the concept from cognitive processes of inquiry by students.

Source: Author.

Participation	'occupation'	'holding'	'perception'	Other
1	... and it occupies a place in space, [can] ...	(Start) "material is defined as something that has mass ... [and it occupies ...]		... can be measured and modified (end)
2		[space] has power ... ... [and has]		(start) "is everything that has spatial location, ... [] ... and shows changes over time (end)
3	[mass] ... and occupies a place in space, ... [is]			(start) "is that he has a body ... [and occupy] ..., that is, you can measure." (End)
5		(Start) "is everything that has spatial location, ... [has]		[... space,] has power, weight and volume" (end)
6	(start) "it is something that occupies a place in space ... [and ...]			[space ...] and can modify his rest. (finish)
7		(Start) "is everything that has spatial location, [is ...]		([space, ...] has mass and is in nature" (end)
8	(start) "all that occupies a place in space ... [and ...]		[space] and is detected by the senses" (end)	
9	Start) "is something that occupies a place in space, [is ...]	[space] has mass" (end)		
10	(start) "everything has its place [and ...]			[location ...] and comprises a body" (end)

Source: Authors

It is important to highlight that utterances in no case exceeded the maximum number of characters, and a correlation between verbal capital and the number of attributes included in the concept was not established. Also; the frequency was balanced on the

attributes of the concept and the attribute 'occupation' predominated. Interestingly, after the inquiries made by the students, there were other attributes, different from those predefined in the LEC, that had also previously appeared in the studies of said LEC, but they failed saturation.

Participating students were curious in getting new information, so their disposition was possibly increased when faced with traditional inquiries. These students added new categories to those that had already been denoted in the previous time or startup. The first intervention originated five *retweets* (tweets No. 3, 6, 8, 9 and 10) from other members of the group. The findings were satisfactory.

- **Examples of the concept of matter**: the verbatums obtained from the publications of the students using the tag #conceptoquimico were:

1. "clothes, books, building"
2. "Roberto's nose, clear, cloth"
3. "games, telephone, table"
4. "desk, door, house"
5. "home school, door "
6. "car, table, air conditioning"
7. "TV, car, door"
8. " volleyball ball, telephone, table"
9. "school, building, trees"

Analysis:

Obviously, from the definition of the concept, there are suitable examples so the ability to show conceptualization is broadly demonstrated. However, it is evident that students included the physical states of solid and liquid in the macroconcept of *Matter*, leaving gases out. Given this observation, we proceeded to activate knowledge with the next question in Moment 3, leading them to realize that gases are *matter* too.

- Moment 3 Expansion: the verbatums obtained from the publications of students using the label #conceptoquimicopara were:

- is the air matter?:

1. "Yes, it is gas"
2. "it occupies a volume, it is matter"
3. "I never came up with it, teacher, it is matter because it has volume"
4. "oooooohhhh yes, it is matter, it occupies a place"
5. "yeah, of course, but we do not see it, and it is matter, it has volume"
6. "it is not matter, it is gas"
7. "Yes, it is matter. I did not notice, ha, ha! "

- The #conceptoquimico that is repeated, what is it?

1. "it has mass"

2. "mass"
3. "mass"
4. "space"
5. "mass"
6. "the mass"
7. "mass"

- Concept of mass:

1. "something you can touch"
2. "everything that is in space"
3. "mass is what occupies a volume and weighs"
4. "it is a solid you can touch"
5. "that which is palpable, ie a body"
6. "anything tangible"
7. "it is what weighs"
8. "everything that is in one place"
9. "all you can touch"
10. "what is in space"
11. "it is what matter is filled with, which occupies a space, whether visible or not"
12. "a material that is looked or felt "
13. "it is what is weighed from matter"
14. "it is what is attracted to the center of attraction by gravity"
15. "That which weighs"
16. "it is the group of particles of something"
17. "it is the amount of matter in a body"
18. "mass is what you can touch and modify in a given space"
19. "it is the matter that occupies a space, whether liquid solid or gas"
20. "it is the main product of which the materials are composed"

Analysis:

As discussed in the previous analysis (Time 2), this moment begins with an activation that encourages cognitive conflict to restructure subordinate concepts. The experience was satisfactory and succeeded in having participants include gases within the concept of matter; This is evidenced by the verbatums.
Subsequently, in the questionnaires on the concept that is repeated, the answer mass predominates. It is from this intervention when the strategy now expands to ask a new concept "What is mass?"; these expansions produce loops of questions that must be conducted by ele-moderator.
Although it is not included in this article, as we only set out to address the concept of *matter*, we can see from the answers of the participants that there should be a bias between *matter* and *mass*, confronting them with common and differential attributes allowing them to establish reference criteria and to consolidate the concept.

C. Farewell: the Verbatims obtained from publications #conceptoquimico students using the label for this stage were:

1. "Thanks"
2. "insurance"
3. "other activity and hope"
4. "Thanks"
5. "Bueniiiiiiiisimoooo"
6. "Graxs !!!!!!!!"
7. "thank you teacher"
8. "thank you"
9. "ok"
10. "ya?"
11. "ok"

5. CONCLUSION

The inclusion of technological tools brings the necessary refinement of teaching strategies and updating by teachers in these subjects; This effort translates into fruits that are satisfactory for the actors in the educational process. Bring the student to knowledge using social networks in which naturally are managed, it represents a window to innovation and a willingness to participate in such strategies up to the same curiosity.

Chemical science being located in the abstract sciences, the adoption of these strategies help understanding concepts and experiences, bringing them through the search and inquiry to this knowledge. Also, in this search skills and attitudes that then formed the scientific expertise in the wake student.

The experience left satisfactorily see how the participants act and interact in technological areas, and across lines conceived as neighboring content to share. Also, they develop cognitive processes such as synthesis, taking the information volumes considered necessary and integrating them with others, in this case, to set maximum one hundred forty characters.

The closure demonstrates the desire of repeating, retrying not only using social networks as a teaching strategy, but also other strategies to present knowledge in an entertaining, different way that allows the student to expand into cyberspace.

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