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ICT: Didactic Strategy using Online Simulators for the Teaching Learning of the Law of Conservation of Matter and its Relationship to Chemical Reactions in Higher Middle Education

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Abstract

It is imperative that a profound transformation be carried out in the traditional way in which we teach science subjects, so it is necessary that the role of student change from being a mere recipient of information to being the main player in the construction of his knowledge. One of the strategies to achieve this is to make use of ICT, within which are educational simulators, as a support resource to facilitate the teaching-learning processes taught in the classroom. The didactic strategy developed in this work was carried out with the PhET (https://phet.colorado.edu) simulator was used to improve the learning teaching of the law of conservation of the subject matter and its relationship with chemical reactions. To evaluate the learnings acquired by students, the Hake factor was determined. In terms of the implementation of this didactic strategy, students demonstrated greater recognition, understanding and appropriation of the knowledge gained about the importance of this law in chemical reactions. This teaching strategy is useful for higher middle-level schools that do not have a school science lab.

Keywords:
Didactic strategy
ICT
Educational simulator
Conservation of matter
Chemical reaction.

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1. Introduction

1.1. Law on the Conservation of Matter

Antoine Lavoisier observed that the total mass of all substances present after a chemical reaction is equal to the total mass before the reaction. This observation, known as the *"Law on the Conservation of Matter"*, which is one of the fundamental laws of chemical change and states: "Matter is not created or destroyed only is transformed". In a chemical reaction the sum of the mass of the reagents is equal to the sum of the mass of the products.

$$2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(ac)} + H_{2(g)}$$
$$46\ g\ Na \quad 36\ g\ H_2O \quad 80\ g\ NaOH \quad 2\ g\ H_2$$

46 g + 36 g 80 g + 2 g

$$m_{reactives} = 82\ g \qquad m_{products} = 82\ g$$

1.2. Chemical Reaction, Chemical Equation, and its Relationship to the Law on the Conservation of Matter

A chemical reaction is the process in which substances are joined together to transform into different ones. This is a symbolic representation that uses chemical formulas to describe the relative identities and quantities of reagents and products involved in a chemical reaction.

To represent what happens in a chemical reaction through an equation, it must comply with the "Law on the Conservation of Matter". It should indicate that the number of atoms of reagents and products is the same on both sides of the strap. A balanced chemical equation must be available.

1.3. Types of Chemical Reactions (Brown, LeMay, & Bursten, 1998)

(http://uapas2.bunam.unam.mx/ciencias/reacciones_quimicas/)

1.3.1. Synthesis or Combination Reactions

They are carried out when two or more pure substances (elements and/or compounds) react to produce a new pure substance (always a compound).

Its general equation is:

$$A + B \rightarrow AB$$

Decomposition reactions:

In this type of reaction, a compound is broken down into simpler pure substances that can be elements and/or compounds.

Its general equation is:

$$AB \rightarrow A + B$$

1.3.2. Simple Displacement Reactions

The reaction is performed when one element moves another in a compound producing a new compound and displaced element.

Its general equation is:

$$A + BC \rightarrow B + AC$$

$$A + BC \rightarrow C + AB$$

1.3.3. Double Displacement Reactions

Two compounds participate in this type of reactions, in which the cation of one compound is exchanged with the cation of another compound. It can also be said that the two cations exchange anions.

Its general equation is:

$$AX + BZ \rightarrow AZ + BX$$

1.4. Symbol Recognition in the Representation of a Chemical Equation

To represent a chemical reaction, symbols are used that constitute what we know as a chemical equation

$$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$$

subscri coeffici subscri coeffici

Substances written to the left of the arrow are called reagents and are the first member of the reaction. The substances written to the right of the arrow are the products and form the second member of the reaction. Within the structure of the chemical equation is diverse symbology (Table 1) that is important to know.

1.5. Balancing Chemical Equations

The rolling of equations is only a consequence of the law of conservation of Lavoisier matter, so the mass of the reagents must be equal to the mass of the products.

To balance a chemical equation, we first must identify the type to which it belongs. Chemical reactions can be generally classified as acid-base or oxide-reduction:

1. In *acid-base reactions* no species changes their oxidation state.
2. In oxide-reduction reactions, at least two species change oxidation state:

When a species loses electrons its oxidation number increases. This process is known as oxidation.

$$Fe^{2+} \rightarrow Fe^{3+} + e$$

When a species gains electrons its oxidation number decreases. This process is known as reduction.

$$Mn^{4+} + 2e \rightarrow Mn^{2+}$$

Table-1. Symbology in the representation of a chemical equation.

Symbol	Meaning
$\rightarrow$	"Yields" or "produces" (separates reactants from products); indicates the result of a reaction.
$\leftrightarrow$	Used in place of single arrow to indicate a reversible reaction.
$+$	"Reacts with" or "produced alongside"; (separates two or more reactants or products).
Δ	Reaction mixture is heated (written over arrow).
NR	No reaction takes place when reactants are mixed.
(s)	Pure substance (reactant or product) is a solid.
$\downarrow$	Alternate to (s); used to indicate a precipitate ("ppt").
(l)	Pure substance (reactant or product) is a liquid.
(g)	Pure substance (reactant or product) is a gas.
$\uparrow$	Alternate to (g); used to indicate a gaseous product.
(aq)	Aqueous solution (reactant or product is dissolved in water).
$\xrightarrow{Cat}$	Catalyst – a substance required for the reaction to proceed (written over arrow).

There cannot be an oxidation reaction without any shrink reaction occurring because electrons are transferred from the oxidizing species to which it is reduced.

The species that is reduced (wins electrons), is called the *oxidizing* agent. Similarly, the species that oxidizes (loses electrons) is called the *reducing agent* (Chang, 2010).

Balancing means finding the stoichiometric coefficients in a reaction (Table 2) such that the number of atoms present in the reagents is equal to those present in the products:

$$Fe_2O_3 + C \rightarrow Fe + CO \quad balanced\ like: \quad Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$$

Table-2. Balance chemical equations.

Before balance			After balance		
Reagents	Atoms	Products	Reagents	Atoms	Products
2	Fe	1	2	Fe	2
1	C	1	3	C	3
3	O	1	3	O	3

If the number of atoms present before and after the reaction is the same, then the sum of the mass of the reagents is equal to the sum of the mass of the products.

2. Teaching Science in the 21st Century

Rich countries with enormous economic, infrastructure, and technology resources for teaching fail to arouse their students' interest in sciences; especially chemistry" (Galagovsky, 2007).

ICT have gradually joined education, generating innovative teaching methods (Webb, 2005) that adapt to new pedagogical models, setting aside traditional teaching methods based on mere knowledge transmission. With this the role of the student is also modified (Chiu & Wu, 2009) since it will not be a mere player of content but must be able to obtain the information, analyze it and apply it in contextual situations.

Among these technological tools are educational simulators, as a support resource for teaching-learning processes that are carried out in various educational contexts (Mistler-Jackson & Butler Songer, 2000). The simulators allow the formation of concepts, knowledge building and the application of these to new contexts (Mumtaz, 2000) which, for various reasons, the student cannot access from the methodological context where his learning takes place (Giammatteo & Obaya, 2018).

There are schools that do not have a school laboratory of Chemistry, which allows students to contextualize previously reviewed knowledge in class and in order to improve the teaching process (Webb. & Cox, 2004) of the law of conservation of the subject and its relationship in chemical reactions, a didactic strategy was developed that uses as a learning tool the use of PhET simulators (https://phet.colorado.edu).

This simulator has a collection of more than 150 interactive simulations that allows to generate significant learning about science and mathematics at all academic levels. It was created in 2002 by Carl Weiman, winner of the Nobel Prize in Physics, who thought of interactive simulations as a tool with the potential to really impact and improve the education of the future by providing us with a tool that allows us to change the traditional learning environment to autonomous and self-taught learning, where the student is now the main player in building his knowledge. Learning guides were also developed as a means of guiding the student through this process (Talanquer, 2009) thus significantly improving the understanding of this topic by allowing students to understand the importance of this law in chemical reactions and at the same time a way of motivating students' interest in science.

3. Methodology

A didactic sequence was designed (Hernández Bravo, Obaya Valdivia, Montaño Osornio, & Vargas-Rodríguez, 2020; Perez-Rivero, Obaya Valdivia, Giamatteo, Montaño-Osorio, & Vargas-Rodríguez, 2019) with the use of simulators for the theme Law of Conservation of Matter and its relationship to Chemical Reactions in Higher Middle Education. The didactic strategy was applied at the High School Instituto Víctor Frankl campus Tepalcapa located in the municipality of Cuautitlán Izcalli, State of Mexico, with students of the morning shift of the first semester. The group consists of 30 students between the ages of 15 and 18 years of medium-low socioeconomic stratum and in most cases from dysfunctional families with a history of addiction, has variable assistance because 35% of them work and in some cases, there are learning problems ranging from cognitive to one generated by an addiction.

This campus does not have a school laboratory, which is why PhET simulators will be used, which can be used directly on the Web or downloaded. For the purposes of this work, the second option is opted as the practices will be carried out in the computer room and you want to avoid any kind of distraction that students might have by having the possibility to access other applications that the Web can offer them.

The type of work is quantitative in that a series of data obtained from the application of an evaluation instrument that was used as a pretest and posttest (Annex 1) are collected and analyzed, subsequently transformed into numerical values to calculate percentages and make graphs, and in this way determine whether the use of simulators as a teaching tool is a strategy that improves the teaching-learning of the law of conservation of matter and helps students to understand the relationship and importance of this law in chemical reactions.

The assessment instrument (Annex 1) consists of twenty multiple-choice questions that were selected based on the agenda (Unit 3: Chemical Equations). It is divided into five topics or clusters with four questions

- Law on the Conservation of Matter (6, 8, 9 and 20).
- Chemical reaction and equation (14, 15, 16 and 17).
- Symbol recognition in the representation of a chemical equation (10, 11, 12 and 13).
- Oxidation status (4, 5, 7 and 19).
- Balancing chemical equations (1, 2, 3 and 18).

To evaluate the learnings acquired by students, the results are compared and standardized using the Hake (1998) where g, is the relationship between the results of % of correct answers after the test and before the test.

$$g = \frac{postest\% - pretest\%}{100\% - pretest\%}$$

Based on the results obtained from the initial application of the evaluation instrument, the study guides were designed to help students review the topics in Unit 3.

Study Guides

Annex 2: Law on the Conservation of Matter.
Annex 3: Practice of Learning 1.
Annex 4: Relationship of the Law of Conservation of Matter to Chemical Reactions.
Annex 5: Practice of Learning 2.

As part of the didactic strategy, online simulators were used for teaching-learning the law of conservation of matter and its relationship with chemical reactions. It is important to mention that during the use of simulators students were motivated, with a positive and participatory attitude by the new teaching strategy they were going to experience, since it was the first time that a non-traditional teaching model supported by ICT was implemented in school.

PhET simulators are freely accessible that can be used in schools that do not have a school chemistry laboratory and allow the student to understand abstract and complex topics through visualization and interaction in non-traditional learning environments, facilitating autonomous and self-taught learning. One of them is: https://phet.colorado.edu/sims/html/reactants-products-and-leftovers/latest/reactants-products-and-leftovers_es.html: In this simulator the student reinforces the concept of law of conservation of matter, by performing different types of reactions, where the student will have to create a specific type of reaction based on the chemical equation posed. The student will also be able to reinforce the concepts of reagents, products,

and understand the difference between reaction and chemical equation. They can then practice with real reactions all the knowledge acquired during this process. Another is: https://phet.colorado.edu/sims/html/balancing-chemical-equations/latest/balancing-chemical-equations_es.html: In this simulator the student will be able to reinforce the relationship that exists between the law of conservation of matter and chemical reactions, identifying in the first instance the reagents and products of the given equation and based on this information decide which stoichiometric coefficients must be modified in order to be able to equal the equation thus complying with the law of conservation of the matter.

Throughout this process the student will have the opportunity to see graphically in the simulator that occurs when the stoichiometric coefficient is modified in a certain compound or element. Recognizing meaningful learning in them, which will lay the foundation for understanding more complex topics.

The student must perform the following procedure:

1. *Go to the google search engine.*
2. *Write in the search engine: simulator in PhET chemistry. (Figure 1).*
3. *Click on: Chemistry – PhET Simulations. (Figure 2).*
4. *Search and select: Reagents, products, and surpluses. (Figure 3).*
5. *Download.*
6. *Find and select: Balancing chemical equations. (Figure 4).*
7. *Once the download is done, we will start with level 1. There are 3 levels. It goes from the simple to the most complex.(Figure 5).*

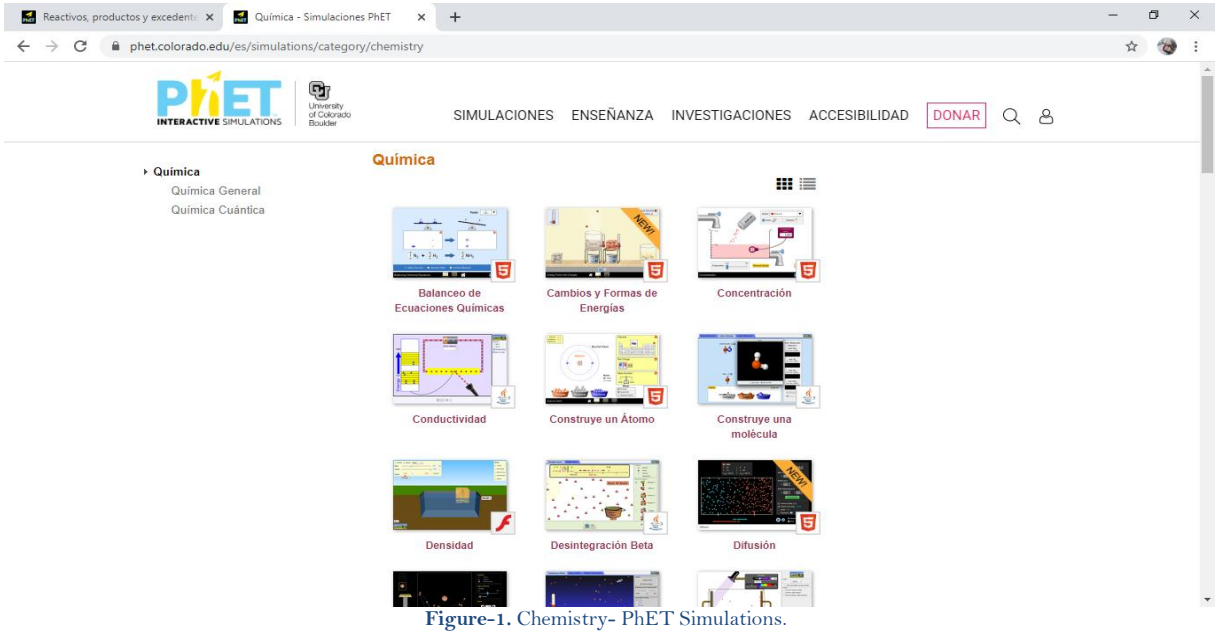

Figure-1. Chemistry- PhET Simulations.

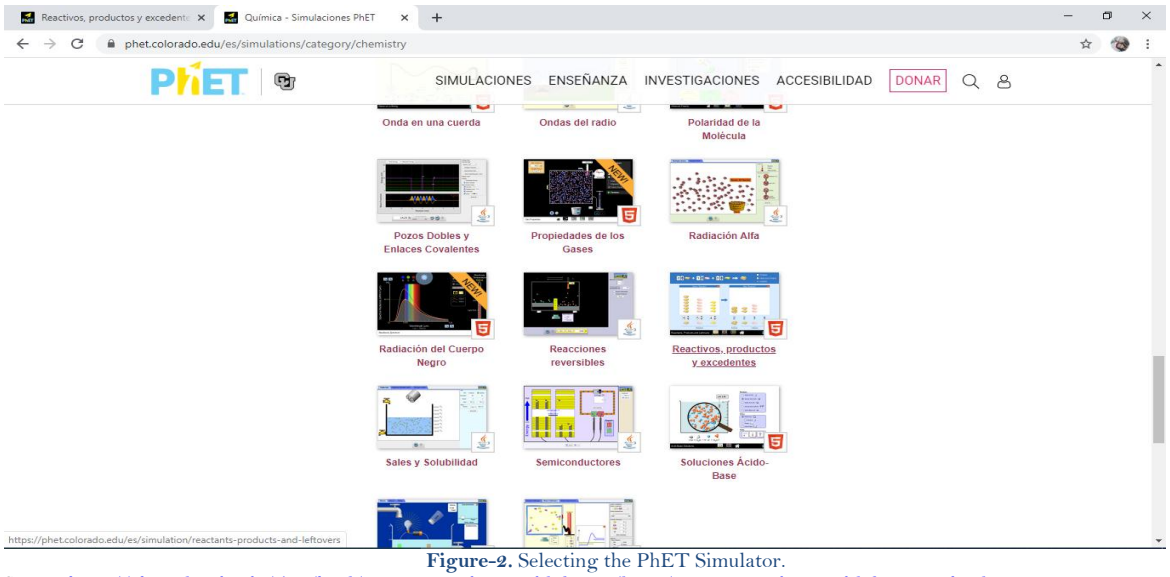

Figure-2. Selecting the PhET Simulator.

Source: https://phet.colorado.edu/sims/html/reactants-products-and-leftovers/latest/reactants-products-and-leftovers_es.html

Figure-3. PhET Simulator: Reagents, products and surpluses.

Source: https://phet.colorado.edu/sims/html/reactants-products-and-leftovers/latest/reactants-products-and-leftovers_es.html

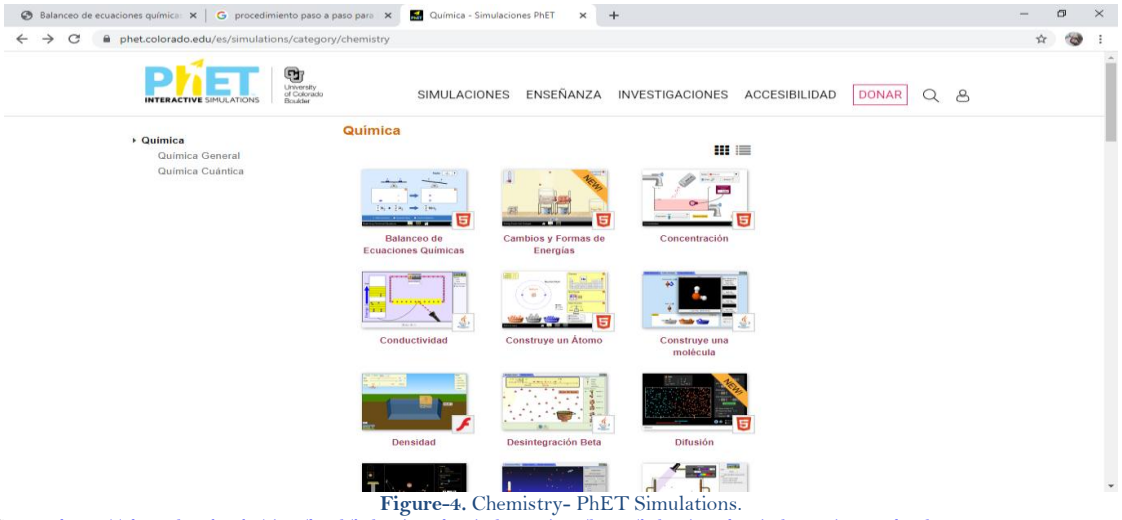

Figure-4. Chemistry- PhET Simulations.

Source: https://phet.colorado.edu/sims/html/balancing-chemical-equations/latest/balancing-chemical-equations_es.html

Figure-5. Selecting the PhET Simulator: balancing chemical equations.

Source: https://phet.colorado.edu/sims/html/balancing-chemical-equations/latest/balancing-chemical-equations_es.html

4. Results and Discussion

The results are presented and analyzed using bar charts, allowing to visualize the progress that students achieved using ICT. To perform the analysis of the results by question obtained from the application of the evaluation instrument such as pretest and posttest (Annex 1) it was counted how many students correctly responded to each of the questions presented in the evaluation instrument. As can be seen in Figure 6, the teaching strategy used for the teaching-learning of the law on the conservation of matter and its relationship to chemical reactions showed a positive impact on all the questions included in the test, being question 6 (Law on the Conservation of Matter) that achieved the greatest % increase in assertiveness after the use of simulators, this shows that the use of ICT in education are a key tool for the teaching-learning process, facilitating the understanding of abstract and complex information, resulting in meaningful learning in students.

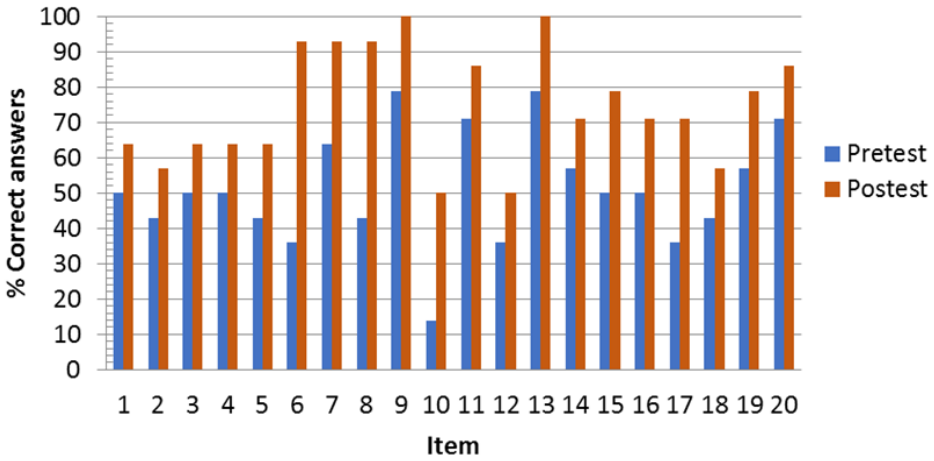

Figure-6. Pretest and posttest results by item.

The results obtained are shown in Table 3, which details the % increase in assertiveness obtained by students in each of the topics included.

Table-3. Increased assertiveness in the topics included in the test.

Topic	% Initial Assertiveness	%Final Assertiveness	% Increase
1	57	93	36
2	48	73	25
3	50	72	22
4	54	75	21
5	47	61	14

The topic 5 (Balance of chemical equations) was the one that obtained the least % increase, this tells us that students still present difficulties in the appropriation of this concept, however, the didactic strategy applied in this work, (Figure 7) establishes the basis to facilitate students the understanding of more complex topics such as the balancing of equations.

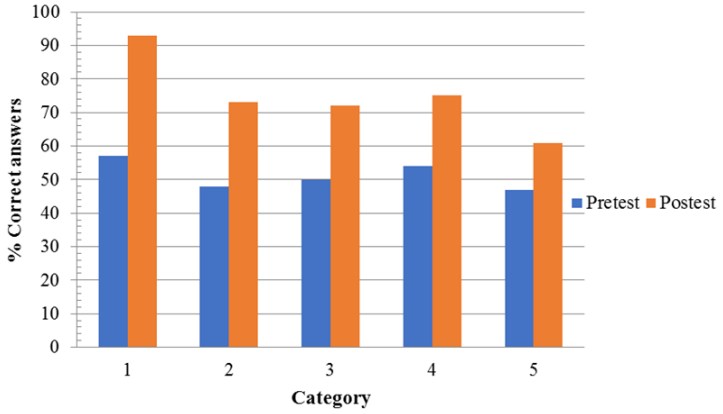

Figure-7. Pretest and posttest results applied to each topic.

To evaluate the learning difference between pretest and posttest, Hake's standardized gain Figure 8 is

determined. This factor is reported as a number between zero and one. It can be observed that g has values for categories 2, 3, 4 and 5 included in the test, with an average of g x 0.44, for category 1 (Law on the conservation of matter) you have an average value of g x 0.82 with a range of values, the results of which are characteristic of active learning achieved from the application of the teaching strategy.$(0.2 \leq g \leq 0.6) g > 0.8 - 1.0$

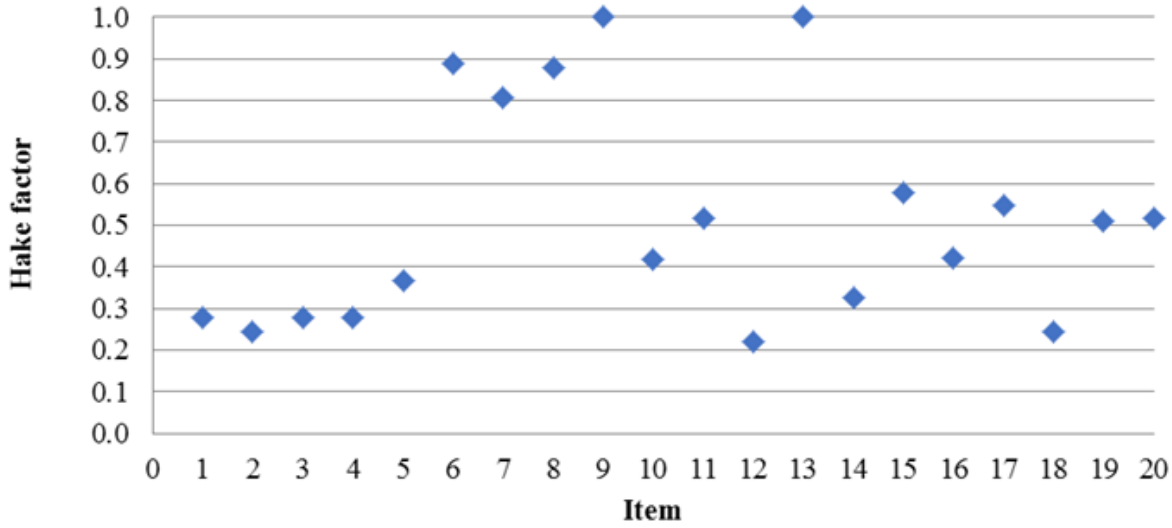

Figure-8. Hake Factor vs Item.

5. Conclusions

This teaching strategy is useful for higher middle-level schools that do not have a school science lab. After applying the teaching strategy using online simulators for the teaching-learning of the law of conservation of matter and its relationship to chemical reactions in higher middle education, it was observed that the use of simulators as part of the teaching strategy yielded satisfactory results, since in each of the categories in which the test was classified a % increase in the assertiveness of the students at the time of answering the evaluation tool. Demonstrating greater appropriation of knowledge and meaningful learning in them.

The topic 1(Law on the conservation of the matter) was the one that had the greatest impact on the % increase in assertiveness (36%) and in Hake's standardized gain (, indicating that there was active participation of students in making use of simulators, that is, because by using them as a teaching tool and complementary to the form of teaching-learning used in class, it allows students to improve the understanding of concepts difficult or impossible to observe with the naked eye even in school laboratories. In addition to the observed in the students a positive and participatory attitude generated by the motivation to experience for the first time a model of non-traditional teaching. $g > 0.8 - 1.0)$

The interaction that the simulator allows, helps them to visually understand what happens during a chemical reaction, because it is important to verify that the law of conservation of matter is complied with, which indicate the symbols in a chemical equation, because it is important to identify the oxidation status of the elements involved in a reaction and finally how to apply all this knowledge for the balancing of chemical equations, resulting in a significant improvement in the school performance of the students.

The use of ICT as a teaching strategy allowed me as a teacher to explain abstract and complex concepts that for students were difficult to understand and visualize, especially since this school does not have the necessary infrastructure to have a school laboratory, which allows students to visualize the knowledge learned in a real context, however, through these tools they were able to achieve meaningful learning that was reflected in their academic performance.

In this new age that is living in education it is important that as teachers we use innovative and different teaching strategies in the classroom, a good option is the use of ICTs, which allow us to capture students' interest in subjects that they consider difficult, boring and in no practical from means that they know and master perfectly, as is the use of computer and technological tools.

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Annex-1. Evaluation instrument (Pretest and Post-test).

Instructions: The following questions present four solution alternatives, underline the one you consider correct. If any of the problems require any development, it can be done next to the question in question.

Answer questions 1 through 3 based on the following information:

The oxidized and reduced terms are defined based on the gain or loss of electrons a substance suffers during a chemical reaction. In the following chemical reaction

$Cr + O_2 \rightarrow Cr_2O_3$

1. The compound that behaves as an oxidizing agent is:
   A. Cr
   B. O_2
   C. Cr_2O_3
   D. *None of the above*
2. The compound that behaves as a reducing agent is:
   A. Cr
   B. O_2
   C. Cr_2O_3
   D. *None of the above*
3. The coefficients that balance the above equation are:
   A. 3,4,2
   B. 2,3,4
   C. 4,3,2
   D. 2,4,3
4. Redox reactions occur when substances that are combined exchange electrons. Simultaneously, with this exchange, a variation in the number of oxidation (oxidation state) of the reacting chemical species takes place. Based on the above, determine the oxidation status of the elements in calcium sulfate:$(CaSO_4)$:
   A. $Ca^{+2}S^{+5}O^{-2}$
   B. $Ca^{+2}S^{+6}O^{-2}$
   C. $Ca^{+1}S^{+6}O^{-1}$
   D. $Ca^{+2}S^{+4}O^{-\frac{1}{2}}$
5. The oxidation number or state is defined as:
   A. The number above that represents the charge of the atom.
   B. Electron gain that is carried out in an oxide-reduction process.
   C. Electron loss that takes place in an oxide-reduction process.
   D. The load we assign to atoms in a molecule or ion, based on the assumption that all the bonds present

in it are 100% ion.

6. According to the equation represented, it is valid to state that:

$$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$$

Element	Molar mass(g/mol)
H	1
O	16
H_2O	18

The amount of matter was preserved.

A. The number of moles was preserved.
B. Increased the number of molecules.
C. Increased the number of atoms in each element.

7. Barium nitrate $Ba(NO_3)_2$ is used in the production of flares and in artificial fires to make a green color. The oxidation states of the elements present in this compound are respectively:

A. -2,+1,+6
B. +5,+2,-1
C. -1,+5,-2
D. +2,+5,-2

8. Determine whether the following equation complies with the law on the conservation of matter:

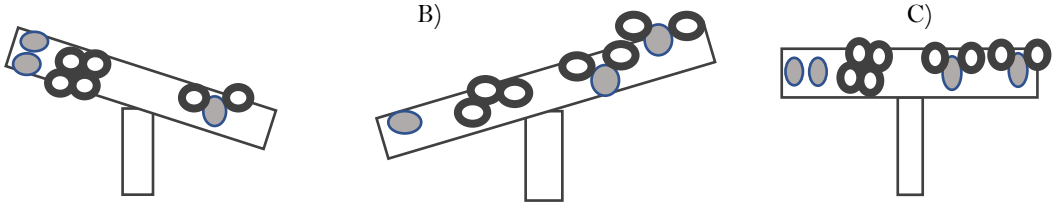
$$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$$

Element	Molar mass (g/mol)
CH_4	16
O_2	32
CO_2	44
H_2O	18

A. No, because of the number of atoms of each type in reactive particles is greater than the number of atoms of each type in the products.
B. Yes, because the mass of the products is greater than the mass of the reagents.
C. Yes, because the number of substances that react is equal to the number of substances obtained.
D. Yes, because the total mass of the reagents is equal to the total mass of the products.

9. In 1774, Lavoiser denounced: "Matter is not created or destroyed, it is only transformed". Based on the information above, select the image that best represents it.

A) B) C)



10. Urea is a crystalline, colourless chemical compound of formula $CO(NH_2)_2$ found abundantly in urine and fecal matter. It is the main terminal product of protein metabolism in humans and other mammals. According to the above chemical formula it is valid to state that this:

A. It has an atom of N.
B. It has 4 H molecules.
C. It consists of four different elements.
D. It has an oxygen atom.

Answer questions 11 through 13 based on the following information:

Plants use a chemical reaction called photosynthesis to convert carbon dioxide and water into food (glucose) and oxygen. This is undoubtedly one of the most common and one of the most important chemical reactions, because in this way plants can produce their own food, besides that it is the process by which they convert carbon dioxide into oxygen. Oxygen is a fundamental substance for life, as it is necessary for breathing not only lung but also cellular, of organisms.

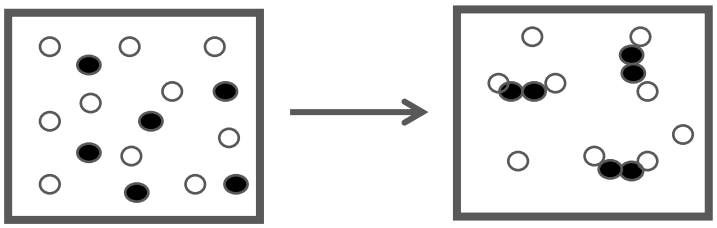
The reaction of photosynthesis is as follows:

$$6CO_{2(g)} + 12H_2O_{(l)} \rightarrow C_6H_{12}O_{6(s)} + 6O_{2(g)} + 6H_2O_{(g)}$$

According to the symbols found in the above equation:

11. The arrow represents $\longrightarrow$:
    A. Moles.
    B. Heat.
    C. Change.
    D. Reversible
12. How many moles of $CO_{2(g)}$ and $H_2O_{(l)}$ are required to produce a mol of $C_6H_{12}O_{6\,(s)}$:
    A. 12 moles de $CO_{2(g)}$ and 6 moles de $H_2O_{(l)}$
    B. 6 moles de $CO_{2(g)}$ and 24 moles de $H_2O_{(l)}$
    C. 6 moles de $CO_{2(g)}$ and 12 moles de $H_2O_{(l)}$
    D. 1 moles de $CO_{2(g)}$ and 1 moles de $H_2O_{(l)}$
13. Symbols in parentheses (s), (g) y (l), represent:
    A. State of matter in which each compound is located.
    B. Moles.
    C. Energy.
    D. Heat.

14. The following boxes represent the reaction between the elemental substance X (○) with the elemental substance Y (●), based on this information answers the following questions:
15.

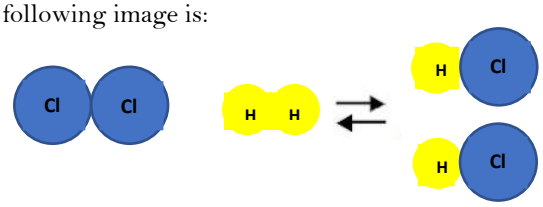


The boxes on the left and right represent respectively:
    A. Elements and products.
    B. Homogeneous and heterogeneous mixture.
    C. Reagents and molecules.
    D. Reagents and products.
16. Which of the following equations best describes the reaction?
    A. $X + Y \rightarrow XY$
    B. $2X + 2Y \rightarrow X_2Y_2$
    C. $X + 2Y \rightarrow XY_2$
    D. $2X + Y \rightarrow X_2Y$
17. The process in which substances come together to transform into different ones is called:
    A. Chemical reaction
    B. Homogeneous mixing
    C. Chemical equation
    D. Heterogeneous mix
18. One of the most well-known acid-base reactions is that which occurs between hydrochloric acid and the physical soda that gives the formation of table salt (NaCl). The equation that describes this process is:
    A. $HCl + KOH \rightarrow KCl + H_2O$
    B. $2HCl + NaOH \rightarrow NaCl + H_2O$
    C. $HCl + 2NaOH \rightarrow NaCl + H_2O$
    D. $HCl + NaOH \rightarrow NaCl + H_2O$
19. The correctly balanced equation is:
    A. $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
    B. $NaOH + 2H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
    C. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
    D. $2NaOH + 2H_2SO_4 \rightarrow 2Na_2SO_4 + 2H_2O$

20. Ammonia (NH_3) it is a gas that dissolved in water can be used in countless cases, especially as a household cleaner. Its properties make it a very suitable product to remove dirt and stains from numerous surfaces. The nitrogen and hydrogen oxidation numbers in this compound are:

A. +3, -1
B. -3, -1
C. -3, +1
D. +3, +1

21. The equation that complies with the law of conservation of matter and correctly represents the reaction presented in the following image is:



A. $Cl_2 + H_2 \rightarrow 2HCl$
B. $Cl_2 + H_2 \rightarrow HCl$
C. $2Cl_2 + 2H_2 \rightarrow 2HCl$
D. $Cl_2 + H_2 \rightarrow 1/2HCl$

Annex-2. Law on the Conservation of Matter
https://drive.google.com/file/d/1gRKkGsAVBcF_gKTs1NFHRURhVatQKg5y/view?usp=sharing

Annex-3. Practice of Learning 1:
https://drive.google.com/file/d/1UdmagapcXtTk8D-tfVVscToHwXvLtraU/view?usp=sharing

Annex-4. Relantionship of the Law of Conservation of Matter to Chemical Reactions
https://drive.google.com/file/d/170VvEz35yY2hDB2Q3duBOurXGG4Bv1SM/view?usp=sharing

Annex-5. Practice of Learning 2.
https://drive.google.com/file/d/1WIvPrvUzTngVahm6c_4eT51ga0gHTVXr/view?usp=sharing