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DEVELOPMENT OF SCIENTIFIC SKILLS THROUGH INFORMATION AND COMMUNICATION TECHNOLOGIES IN CHEMISTRY CLASS

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Abstract: The following article is a construct that is immersed in activities of the doctoral research work which is titled: "QUANTUM CHEMISTRY AND BIOLOGY: ANALYSIS AND OVERCOMING OF EPISTEMOLOGICAL OBSTACLES IN THE DEVELOPMENT OF SCIENTIFIC COMPETENCES, IN HIGH SCHOOL". On the other hand, it is important to point out that this article proposes to publicize the development of scientific skills in chemistry classes with the mediation of information and communication technologies "ICT". For the rest, it is relevant to state that the research in this section emphasized the subject of chemical bonding and intermolecular forces; permeated by quantum mechanics. In the same sense, the research process was resolved as a qualitative study, with an ethnographic approach. Likewise, it is important to highlight that the research was presented at the Álvaro Echeverry Perea educational institution in the city of Cali, with a population of 260 students, Y; As a study sample we have 13 young people. The techniques used in the study are related to information technologies such as: WhatsApp, You Tube, email, Class room, Google meet, Zoom, cell phone, computer or pc, internet. As scientific skills developed by the sample are: explanation, inquiry, laboratory work and communication.

INTRODUCTION

This space corresponds to one of the activities of the research process in general and allowed us to advance in what was budgeted, although considering the following course: in the first part, a theoretical support was made relating the structuring categories of the work, such as the conception of competence science, the teaching of chemistry, information and communication technologies "ICT", of course, the development of the conception of qualitative research with an ethnographic approach is also presented.

Therefore, it is important to locate that this research work is an extension of the idea that was raised as a possibility of carrying out an intervention in the structure of the chemistry program in particular as well as natural sciences and environmental education in general, since, in the auscultation that was carried out in several regions of the country (Colombia), the results that are part of the deepening of these issues do not allow it to be permeated by aspects of quantum mechanics.

This not least fact makes it possible for research to respond in a particular way to the formation of the chemical bond between atoms and that many times we tell students that there are two kinds of forces that hold them together (ionic and covalent bond), and autobiographically it can also be stated that this distinction of the links between metals and non-metals is not regularly justified with sufficient study, likewise, the forces by hydrogen bonds; regularly, one proceeds leaving up the use of the electronegativity table. But, aspects such as molecular geometry can be an important contribution when the student and future citizen of the world can be scientifically literate in order to justify why water and salt form a homogeneous solution or mixture and also why they do not. make water and oil.

Of course, this bet leads us to the fact that we are asking the next question in this activity.

What are the scientific skills that are developed in teaching by research or problem solving mediated by ICT and permeated by quantum mechanics in the explanation of the chemical bond?

METHOD

Teaching by research or problem solving mediated by ICT and permeated by quantum mechanics in the explanation of the chemical

bond, enables the development of scientific skills.

After having raised the problem of this work and the respective conjecture, we allow ourselves to develop the objective of the activity:

GENERAL GOAL

Describe the scientific skills developed by students with the concept of chemical bonding in environmental situations mediated by ICT and permeated by quantum mechanics.

SPECIFIC OBJECTIVES

Identify if a substance is polar or nonpolar.

Interpret the characteristics that determine the behavior of some substances.

Develop scientific literacy and mastery of aspects of the natural sciences in general and of chemistry in particular.

THEORETICAL FRAMEWORK

The background support that we point out in this section is found involving the aspects of scientific competence, the teaching of chemistry, teaching by research or problem solving, information and communication technologies "ICT".

SCIENTIFIC COMPETENCE

In this sense, it is important to highlight the proposal of Hernández (2005; quoted by Viveros, 2011), who proposes that teachers must structure the teaching-learning process according to the interests and abilities of the students. In the words of Quintanilla (2005; quoted by Viveros, 2011); Barrera (2005 cited by Viveros, 2011;), they support the importance of re-signifying the way of teaching science by future graduates, that is, strategies must be sought so that teachers teach science not by converting books in another problem, but that students perceive that they are building the sciences.

TEACHING BY RESEARCH OR PROBLEM SOLVING

According to (Acevedo, 1996. As quoted, Viveros, 2011) it is important to rethink the structure of the curriculum, also touch the teachers; this proposal raised by (Gellon, et al, 2005 as cited, Viveros, 2011), who proposes that students proceed in the same way as scientists proceed in their laboratories, that is, an application of the logic that scientists use to make their discoveries, through the model of teaching - learning by research.

Sosa (2019) conducted a qualitative research where he proposed the development of student skills through teaching by research. He used as research instruments, the field journal, observation, and was able to verify how students with more grounded proposals to the way in which scientific paradigms are developed, can approach the genesis of generalities from the sciences. Rivadeneira and Silva (2017) argue that students through an inquiry teaching design can enable autonomous learning, problem solving, as well as interpersonal and intrapersonal skills.

THE TECHNOLOGIES OF THE INFORMATION AND COMMUNICATION: "TIC"

Martínez and others (2018) in a mixed investigation, in the area of chemistry, on the implementation of information and communication technologies. They justify the approach to the research problem among some elements, pointing out the importance of these inputs in reducing the digital divide in Colombia. However, when carrying out the field work, it can be seen that some of the samples show resistance in that for them the board and the chalk are more significant. But, Martín et al. (2016) are consistent in stating through research that involves the use of communication technologies in chemistry how these can be a challenge to generate the

development of critical thinking in students, in addition to enabling self-assessment in time to teach and learn.

Consequently, these proposals clearly show that the work that must be done in some cases to stimulate the development of teaching, learning and evaluation must be managed with the intervention of a paradigm shift by teachers in terms of the use of inputs that they are part of the advances of the 21st century for individuals of this time.

METHODOLOGY

The methodological design that we use in the study allows us to clarify that the type of research that is under the qualitative paradigm with an ethnographic approach.

The population: 260 students - sample: 13 students

Data collection techniques: we use various inputs that involve information and communication technologies such as:

WhatsApp, You Tube, email, Classroom, Google meet, Zoom, cell phone, computer or pc, internet. Also, apps like the padlet and Quizizz.

The work is structured in the following phases:

PHASE 1

Explanation of the chemical bond concept through the development of a "own authorship" video tutorial.

Likewise, guidance is given on aspects related to:

CONTENTS	TIC (used)
The Schödinger equation: a solution (quantum numbers: energy level "n", energy sublevel "l", magnetic "ml"	You Tube – WhatsApp, Classroom, Zoom, el celular, computadora o pc, internet.
Quantum mechanics and the formation of ions (cation and anion)	You Tube – WhatsApp, Classroom, Zoom, el celular, computadora o pc, internet.
Quantum mechanics and Lewis structures	You Tube – WhatsApp, Classroom, Zoom, el celular, computadora o pc, internet.
Quantum mechanics and the chemical bond (ionic bond, polar covalent bond and nonpolar covalent bond)	You Tube – WhatsApp, Classroom, Zoom, el celular, computadora o pc, internet.
Quantum mechanics and molecular geometry	You Tube – WhatsApp, Classroom, Zoom, el celular, computadora o pc, internet.
Quantum mechanics and intermolecular forces	You Tube – WhatsApp, Classroom, Zoom, el celular, computadora o pc, internet.

Table 1. Chemistry content permeated by quantum mechanics oriented through ICT. Font. Own elaboration. 2020.

PHASE 2

In this phase we refer to the orientation of a laboratory: Formation of solutions.

The purpose of this activity was to recognize that polar substances are only dissolved by polar substances and that nonpolar substances dissolve only in nonpolar substances, in addition, to make visible the development of scientific skills related to explanation.

PHASE 3

In this phase we refer to the application of a chemistry laboratory regarding the production of biodegradable plastics.

Purpose: To develop the aspects of science (conceptual aspect, procedural aspect, attitudinal aspect), in addition to developing scientific skills.

PHASE 4

Laboratory on the polarity of substances.

Purpose: in this laboratory it is proposed that students stimulate the processes of building theoretical and observational vocabulary. Considering the experiment as support for the hypothetical framework presented. In that order of ideas, use is made

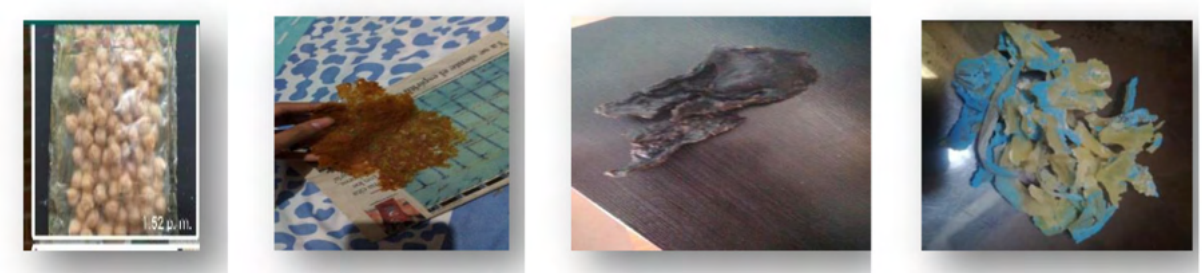

Figure 1. Sample of biodegradable plastics.

Font. Own elaboration.

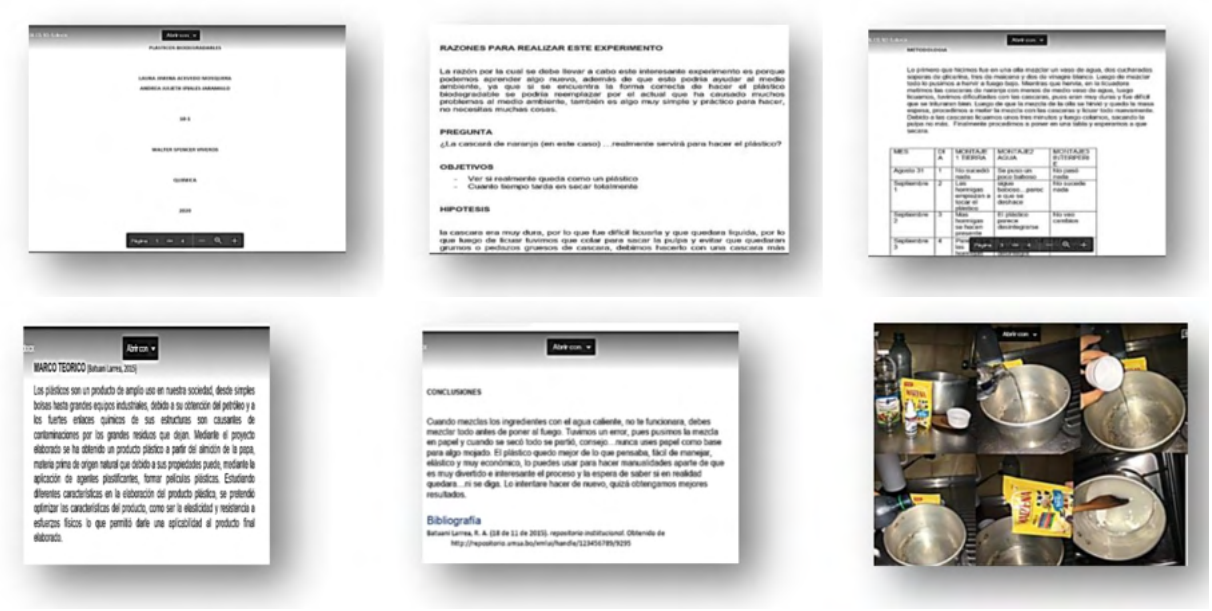

Figure 2. Presentation of the project for the development and monitoring of biodegradable plastic.

Font. Own elaboration.

Figure 3. Laboratory on the polarity of substances.

Font. Own elaboration.

of analysis and reflection of the phenomena of the context or reality of the student. See figure 3.

PHASE 5

Student reflection is presented through applications such as the padlet, Quizizz.

Purpose: to develop the contrast of the domains that involve the aspects of science and the scientific competences developed by the students in different mediation proposals with ICT. and permeated by quantum mechanics in chemistry class. See figure 4. It is shown how students can access the use of applications in a flexible and guided way that foster much friendlier relationships in the teaching, learning and evaluation process when it comes to educating themselves.

RESULTS

According to the different programmatic developments oriented in the chemistry class permeated by aspects of quantum mechanics. In addition to the use of environmental situations, for students, we can establish that there were performances that showed positive responses in aspects of science (conceptual, procedural, attitudinal), see table 2.

Aspect of science	Descriptors
Conceptual	Atom, polarity, chemical bond, covalent bond, ionic bond, dipole moment, electronegativity, intermolecular force, quantum numbers, ion, solution, homogeneous mixture, heterogeneous mixture.
Procedural	It prepares assemblies, determines which are the phases of the procedure in an experience, locates the necessary materials for the verification of hypotheses.
attitudinal	It develops an attitude of respect and appreciation of the products generated by science. It presents the developments and results of its auscultation. Recognize the sources of consultation.

Table 2. Developments of the aspects of science (conceptual, procedural and attitudinal).

Font. Own elaboration. 2020.

In that same sense, we present some of the scientific skills that become visible in the process of this research where ICTs mediate in guiding the problems proposed in the chemistry class. See table 3.

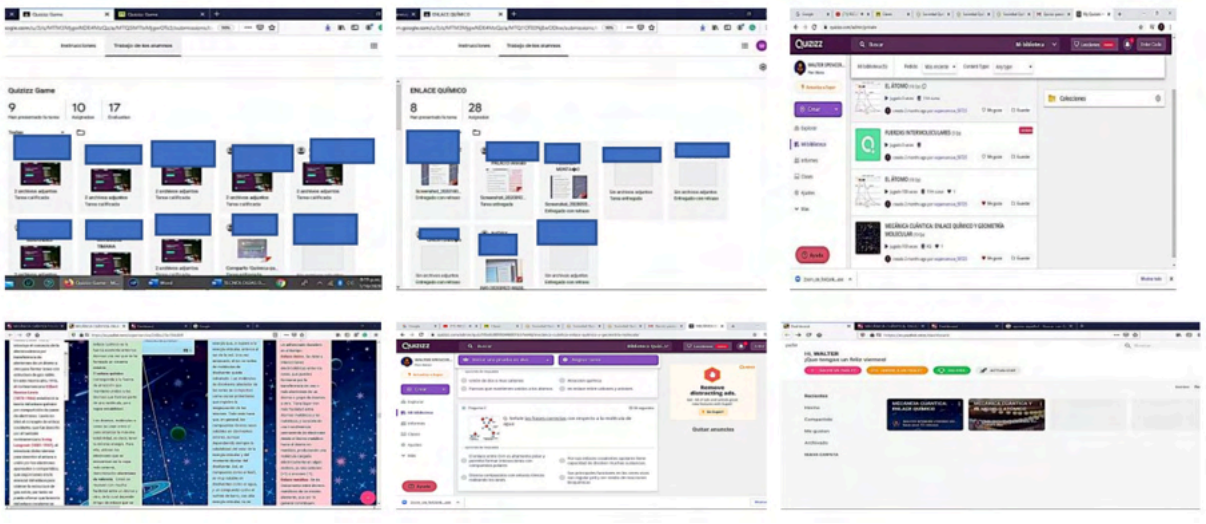

Figure 4. Presentation of processes of reflection on learning by students.

Font. Own elaboration.

For the development of scientific competencies and descriptors we take the proposal of Coronado and Arteta (2015). Where they are defined through an exhaustive reflection on how and what performances could be made visible in the proposed activities with the students in teaching, learning and evaluation. See table 3.

Scientific skills	Descriptor
Explanation	Search for reasons for phenomena
Hypothesis approach	Formulate a conjecture and propose all the elements to corroborate it.
Problem Formulation	I ask questions about the phenomena
Asking questions and searching for answers	I raise and develop procedures to address scientific problems.
Note	It carries out detailed analysis processes of the study phenomenon.
To communicate	Recognize scientific language, use scientific language, use concepts to analyze observations and experiments, understand and write scientific texts, communicate ideas orally and in writing.
To identify	Elaborate, describe, interpret and graph

Table 3. Scientific competences developed by the students.

Font. Own elaboration. 2020.

The use of taxonomy ONLY in this research allowed us to recognize the teaching, learning and evaluation processes in the chemistry class mediated by quantum mechanics, where it was possible to recognize by the students a guideline or guide that would allow them to point in the domain competencies and aspects of the sciences that were proposed, but also; The way in which metacognition becomes evident when learning, as well as autonomy, is significant. See table 4.

On the other hand, it is very important to document how, through this strategy, the results of the teaching planned with the use of video tutorials and the feedback process are significant for the one who teaches and the one who learns. In addition, factors of respect and acceptance can be observed to be developed in a process of learning by doing with the use or mediation with ICT.

The use of WhatsApp, email, platforms and applications is quite satisfactory because it allows to have an incalculable didactic pedagogical link, since, through this, a group was created where exclusive use was given to strengthen and the developments that would contribute to the strengthening of competencies. raised.

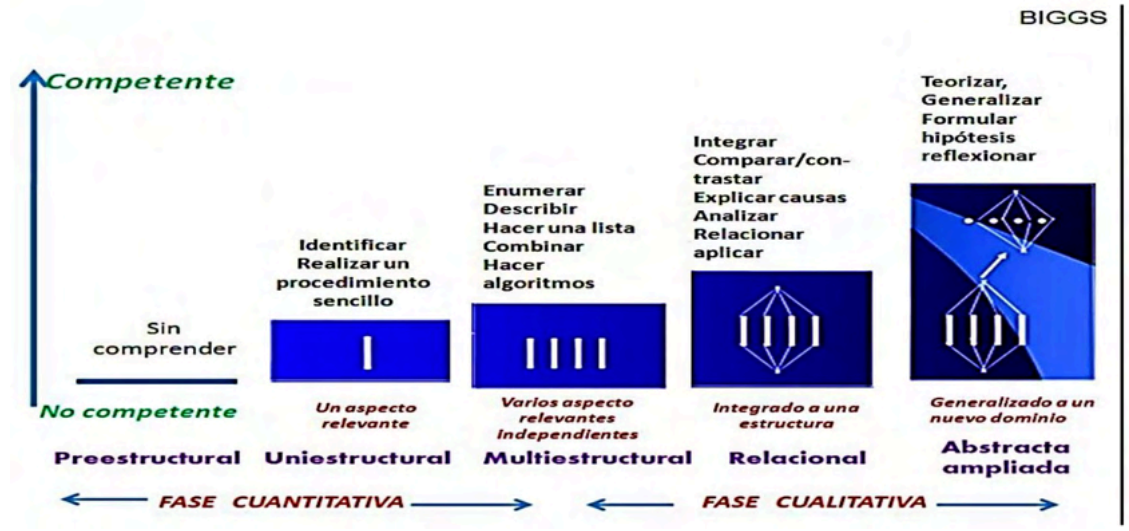

Table 4. Analysis of learning through the SOLO Taxonomy. Font. Abel Suing. 2016.

CONCLUSIONS

In the teaching, learning and evaluation process carried out at the Álvaro Echeverry Perea educational institution in the city of Cali, where we related the follow-up to the scientific competencies that could be developed in a dynamic mediated by ICT with 13 students.

For what follows, we will indicate as an outcome that the students, despite the adversities, in what refers to the sample, were receptive and, therefore; This attitude towards the imparted orientations could clearly show a contribution to the attitudinal aspect of the sciences, where we also attach the assessment that the citizen must give to the results of the scientific and technological research work, but the reflection to which it is applied is also clear. could come from the point of view of the relationship with society and the different political actions that this implies. It is not a minor fact to refer to the conceptual and procedural developments of the natural sciences.

Finally, it is relevant to indicate that students advance with respect to scientific skills, among others, such as the explanation of phenomena, observation, inquiry, experimentation, approach and corroboration of hypotheses. Consequently, it is pertinent to emphasize the design of strategies to guide the teaching, learning and evaluation process through problem solving through research, promoting autonomy, metacognition and; scientific literacy without a sophisticated laboratory for the guidance of chemistry permeated by quantum mechanics.

Making use of situations in the environment and also giving contributions to the environment with the recycling of organic waste for the production of biodegradable plastics and provoke in the individual a strong thought towards entrepreneurship. Likewise, seeking to have a minimum impact at the institutional level. In such a way that, dynamics of public policies at the school level are possible.

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