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Didactic strategies to strengthen chemical language in education

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ABSTRACT

The objective of the research article presented below was to propose activities that would strengthen the students of the educational institution "Unidad del Milenio Manuel J." through training activities in the teaching, understanding, and adequate application of the language of chemistry. Street" in the city of Cuenca - Ecuador (MJC), immersed in a feasible project, using the descriptive field design, the population was constituted with 25 students of unified general high school, the observation technique and the questionnaire were used for the collection of information, then with the results found in the diagnosis a proposal was built to give answers to the proposed objectives. In addition to the above, activities were developed to strengthen the chemical sciences, increasing the ability of chemical language, interacting with chemical symbols in a correct way. With all this, innovative and participatory processes were sought to help students assimilate and appropriate the required knowledge, providing answers to their needs for learning chemical language, assuming scientific attitudes, typical of the areas of knowledge, such as being critical and autonomous in their own learning.

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Introduction

Throughout his evolutionary history, man has employed many ways to communicate and understand each other, as well as to interact with each other. All this has triggered an intellectual and professional development of the human being, turning words into language, symbols into important concepts for his development in daily life. That is to say, how to recognize that all scientific symbolism and writing is a dialogue between the author and the readers, and that the meaning is not discovered, but has been constructed or developed allowing students and teachers who live in school environments to communicate in the same language, the chemical-scientific language.

In this sense, Periñán-Pascual & Usón (2010), says that, man first recognizes the content of written text, using perception and then communicates the content with written or spoken language. From this conception, it is possible to express that all symbolism is a decoding of concepts so that the reader can appropriate his knowledge from his previous knowledge, engaging a new information in his knowledge structure. With all of the above, we can recognize the importance in the teaching of learning begins with its chemical language, in such a way that teachers and students must share and develop the same language already pre-established throughout scientific history, in such a way that they do not develop obstacles when students must appropriate this knowledge, in order to be able to issue scientific results that are clearly objective and verifiable without implicit subjective conceptions of people.

Farré, Zugbi & Lorenzo, (2014), express that in the teaching of chemistry, students must know the language of chemistry in order to develop organizational constructions, which will reflect facts, previous and new schemes of reality that they possess, so the teacher must take into account the relationship of the environment that surrounds them so that students can construct knowledge from the perspective of the reality of knowledge. Therefore, this knowledge can be perceived from a previously known reality, promoting communication and reflection within their own practice, assuming values, cognitive skills that will develop skills that will lead them to engage in a comprehensive training, these being the social and cultural requirements of a scientific society.

Shulman (1999) describes several categories that integrate the knowledge necessary for the development of quality teaching, where knowledge of the area of knowledge, the didactic content that the teacher will use for that teaching and knowledge of the context must be taken into account. This makes it clear that the teaching must have an adequate interaction between the content and its didactics, so that the students have an assimilation, understanding of the subject, and then develop the ability to represent the different possible combinations of the chemical elements and reflect on their own actions. Shulman (2005), assumes the criteria that teachers who teach chemistry should possess, from their language, which are the basic knowledge of representing symbolically, that is to say, writing, speaking, and contextualizing exercises and experiments, analyzing the step-by-step process of the phenomena that interrelate, arriving at predicting or confirming theories that awaken the interest and motivation of their students.

In this sense, the need arises to build strategies for the development of activities presented within the institution for the teaching of the language of chemistry in the unified general baccalaureate, for the strengthening of chemistry within the academic context. Therefore, didactic strategies are promoted that are oriented to the formation of the language of chemistry from the process of individual and collective learning in order to strengthen the formative process of the students of the MJC unified high school, developing strategies that are developed in this project as feasible activities that develop the scientific aptitude-attitude of the students, originating in them the assertiveness in the appropriation of decision making in the problems within their learning of the sciences, involving the development of unlearning, learning and understanding the conception of new phenomena. With all the previous argumentation, this research focused on designing activities that emerge from the students' appropriation of the language of chemistry, in order to internalize the different comparisons and/or contrasting the different chemical reactions that can be performed in chemistry, in the MJC.

Overall objective

To develop didactic strategies aimed at strengthening the language of chemistry used in MJC.

Specific Objectives

- To diagnose the didactic strategies used by teachers to strengthen the language of chemistry.
- To analyze the didactic strategies developed by teachers to strengthen the language of chemistry.
- To evaluate the approach of the didactic strategies developed by teachers for the strengthening of the language of chemistry in the institution.
- To design some didactic strategies that develop the strengthening of the language of chemistry in the MJC institution.

Method

The research was executed under the methodological perspectives in which phenomenology is found, thus managing to study the object of study from the experiences lived managing to capture the own nature of the phenomenon that is framed in the level of unified general baccalaureate of the MJC, for what the information was gathered in the daily life that the students live in the teaching of the matter,

Sharing what Van Manen (2016) says, "...phenomenology seeks to explain the meanings in which we are immersed in everyday life" (p. 15). With all the phenomena described above in this research they are proper to reality, to the teaching and learning that is lived in the MJC, thus managing to give meaning to the experiences described. Furthermore, it was also developed under the representations of the symbolic Interactionism, which described by Gadea (2018), seeks the interaction of the human being with the object of study, as well as the use of concepts, interpretative processes with the environment that surrounds him. The sample that took part in this research, in this case the students know and understand the process in which they participated, describing every action and fact that they experienced in the teaching of the language of chemistry.

The design used was a field one, characterized by Guber (2019), as a reality in which it is described as a system, with the purpose of describing its phenomena, to later interpret it, managing to understand its causes. Likewise, it is conceptualized by Hernández, Fernández and Baptista, (2010) "consists of the collection of data directly from the subjects under investigation or from the reality where the events occur, through the concrete work of the researcher". According to what the authors have described above, it can be said that researchers can certify how they have collected their data, so that no doubts arise in the collection of information, thus determining that all the information was collected about the way the teacher teaches and the students' learning of the language of chemistry, in the place where the object of study is located, while at the same time it was possible to analyze the situations and interactions experienced in that context.

This research was developed within the feasible project, since this type of work helps to solve a specific insufficiency in relation to our object of study. Stoner, Freeman and Gilbert (2000) describe the feasible project as a study, in which the researcher elaborates a proposal to originate a solution of a specific problem. In conclusion, a feasible project is aimed at providing a solution to a problem posed by the institution, thus leading to the satisfaction of needs with the resolution of a problem. This feasible project was developed in 3 (three) stages or phases, where a proposal was designed to originate solution or answers to the proposed objectives. The stages and their execution depended on the nature and scope of the research, described by (Hernández, 2014, pp. 11), "phase I: diagnosis, phase II: methodological process, and phase III: proposal design". With this, the researchers framed the research in this way:

Phase I: In this phase the diagnosis of the process is developed, to be able to hierarchize the potentialities and necessities, in this stage it was observed and investigated on the object or problematic of study, that is raised in this investigation, of there it is generated that the technique that was used was the observation and the instrument to collect the information was the questionnaire, in it was possible to be demonstrated the deficiency or weakness that the students had on the language of the chemistry.

Phase II: In the second phase, the methodological process of a feasible project is outlined. In this phase, parameters were evaluated and established to address the study context, and the variables, costs, and resources available to assume its implementation were also selected, as expressed by Gómez (2005) and Mendoza, Cejas, Navarro, Vega y Albán, (2019). To ensure the viability of the proposal, a work schedule was drawn up to ensure greater development of the activities to be carried out, determining human vs. economic resources. These were related to everything concerning the general high school in Ecuador and the research context, so that the proposal would not present limitations.

Phase III: In this phase the design of the Proposal is contemplated, developing a scheme that contemplates the own foundations of the project linking the results coming from the diagnosis. It will lead to a proposal that guides the solution of the problems.

The project was structured within a planning in which the researchers developed field activities, which were previously diagnosed within the context where the object of study was found. Within these activities, in order to respond to the objectives set out, which aimed at strengthening the language of chemistry, they must be executed within the collaborative approach in order to achieve satisfactory results.

Population and Sample

The population is defined by Tamayo (2004), by the subjects or persons who are immersed in the phenomenon under study. Based on this reference, twenty-five (25) students studying at the MJC in the city of Cuenca, Republic of Ecuador, were identified as subjects. The sample assumed is the same as the population, because of the object of study relevant to the institution.

Data collection technique and instruments

This research was developed through field work, so the collection of information or data began with an inquiry about the experiences, interrelations, conceptions and experiences in relation to the object of study, the teaching of the language of chemistry. In correspondence to the previous, the procedures for the collection of

the information the investigators interacted with the subjects to obtain the required or necessary information that leads to the achievement of the proposed objectives, using observation, classification of the relevant events to the study problem.

The instrument used was the questionnaire, consisting of 10 (ten) questions applied to students, which according to Hernandez Fernandez and Baptista (2010) for this research is the way or means for the collection of information.

Validity and Reliability of the Instrument

The results represent reality, which is why validity by degree reflects these results, as expressed by Ortega, M., Lozano, J., & Nieto, J., (2016), that the validity of an instrument calculates the variables it seeks to measure. That is, in this research some items were established with coherence to the objectives. These items were previously evaluated by 5 teachers who are experts in this subject of study.

The reliability will determine the degree of similarity that has been generated in the different previous researches, which studied the same or similar object of study to this research. To evaluate the reliability of the instrument (questionnaire), the coefficient of α Cronbach was used. According to Mendoza (2018), it is a reliable practice because only one administration is used and several parameters can be used in whose items have several answers. The formula used is as follows:

$$\alpha = \frac{K}{K-1}.\left[1 - \frac{\sum Si^2}{S}\right]$$

Identified as such:

- α = Reliability Coefficient

- K = Numbers of Items.

- Si^2 = Variance of Total Scores.

- S = Variance.

The results obtained in this research were taken as reliable, because it yielded a coefficient of 0.825, found in the range of 0.800 - 0.899, being the same determined of high reliability, as expressed by the authors Mendoza, La Madriz, López and Ramón, (2018), in conclusion, the questionnaire used in this research can be executed because it is in a high index of reliability.

Results and Discussions

In the first item entitled "Teachers present the concepts studied in a clear way, applied in the MJC", the answers were found in the following percentage; 40% were found in almost never (CN), and the alternatives almost always (CS) and always (S) were found in the same range of 30%. The 40% who expressed that the teachers do not present the concepts studied in a clear way, stating that there is no strengthening in the teaching of the language of chemistry.

In order to evaluate the explanation of the classes, two items were issued, found in the second and third item, which said "Do I understand what the teachers explain in class?" "Are the teachers' explanations confusing? "; obtaining the highest rank in 65% the alternative almost never (CN), the alternative almost always 18% (CS) and a lower rank with 17% the alternative always (S). In these two items it is possible to evidence that the teachers do not use the best strategies that facilitate the learning of the language of chemistry to their students, according to how the same students express it, who integrated this research.

Continuing with the order of ideas, the fourth item that relates the language of chemistry with the IUPA norms that says "When putting into practice the rules of nomenclature everything becomes confusing"; the answers given by the students were established as a range of 50% the alternative sometimes (AV), 40% the answer almost always (CS) and with a much lower range of 10% the alternative always (S), these results can be evaluated as a positive average, since the range was sometimes found to be 50%.

When grouping the results of the fifth item related to the time factor "Do I need to spend more time to learn the rules of nomenclature"; this category was found with the highest rank the alternative almost always (CS) with 45% and the alternative almost never (CN) with a rank of 30%, and in the lowest value the alternative always (S) with 25%, which is the reason why students do not use the adequate time for the study of nomenclature, producing a negative effect for the learning of it.

In the sixth, seventh and eighth item, which expresses "Do I have difficulties with the use of the prefixes", "Do I need to consult the periodic table to deduce the number of oxidation", "Would it be very useful if more exercises were done", the alternative with a higher value was found at 65% always (S) and at 35% the alternative always (S), this being a result with a quite high % in relation to the difficulty, framing serious problems when students have to be given the prefixes to the names of chemical compounds.

The results obtained in the ninth and tenth item, which asks "Have I learned nomenclature regularly?" and "Is nomenclature a difficult subject?", the results were framed in the alternatives Always (S) 30% and Almost Always 40% and the remaining 30% in Almost Never (CN), which is the reason why students do not use the adequate time for the study of nomenclature, producing a negative effect for the learning of it.

Through the observation of the daily teaching practice, it became evident that it does not use methodologies that strengthen the language of chemistry. In addition, it can be stated that the teachers who teach chemistry in the unified high school in sciences are not accompanied by the didactic components of the contents to obtain a scientific language of the sciences, leading the students to be passive in their learning that is only limited in receiving the information, leaving in a complex process of limitations the understanding, comprehension, and reflection of the needs of the language of chemistry.

Analyzing the answers given by the students and the observation of the pedagogical practice given by several teachers, it can be expressed that the methodology of the teaching of chemical nomenclature is another aspect that can make the learning of the nomenclature difficult. The pedagogical practice developed is incompatible with the planning, since the didactic components in the language of chemistry, which are elementary for a meaningful teaching-learning, are not developed, so that the students' scientific knowledge is intertwined, where questions emerging from experiential situations are developed. With all this, it can be summarized that the practice of teaching the language of chemistry needs spaces where experiences and motivations can be shown in order to raise students' interest in learning, as described by Vázquez, (2006) and Cordero, (2006).

Conclusions and recommendations

The findings of this research can be highlighted as relevant to the strengthening of chemistry language teaching in student formation, so we conclude with the following conclusions:

The modalities of the pedagogical practice in the MJC of the unified general baccalaureate of sciences emerge from the facts that the teaching subjects carry out, in that diversity of facts, the curriculum, values, beliefs, ideologies, school organization and the innate particularities of the teacher prevail, in a historical-cultural context product of personal and institutional interactions.

These elements place pedagogical practice in a modality that, when detailed and contrasted with the theoretical foundation, is called traditional or conservative pedagogical practice. This modality is characterized according to Galagovsky (2005),

A transmissive practice is identified, of a regulatory and discursive order, and only the external product of the student, the text it creates, the problem it solves, and the extent to which these meet the established criteria, is imported. With certain frequency, exams are applied to students with the purpose of homogenizing the acquisition of content or, in a certain case, creating strategies for its acquisition, for example, seeking some kind of support. The use of a single textbook, identical for all, which corresponds to the sequence established in the planning document, almost without support from other materials, prevails. (p. 32).

With the assessment that the author makes, he diversifies the way of teaching in his educational task, revealing in this research an empiricism in the teaching of the language of chemistry, reflecting the excess of content in classes, as well as the little reflection, leading the student to memorize, decontextualizing him from the culture and from the real situations of his environment. Continuing, we can say that the students express that the teaching in the classroom is always repetitive, developing as a master class, being this a pedagogical practice of scarce resources, so it is necessary to make a diagnosis that interrelates the learning of the language of chemistry with the educational purposes according to the school level.

From this educational reality, immersed in the routine of the master class, it is not using the innovative tools necessary to develop in students the ingenuity of scientific knowledge, since their work is always planned with the same recipe, not interacting with the context that should be used as reflected in the educational curriculum.

The didactic components used in the teaching of the language of chemistry is another aspect that can cause barriers in the learning of nomenclature. Chemistry teachers are usually part of a teaching model without pedagogical components, and professionals base their teaching methodology on traditional teaching practices.

There is an inadequate way for teachers to develop this subject. Among the mistakes made according to Fernández (2013) are

> ... the number of different concepts taught simultaneously. The student is surrounded by a conjunction of all of them that makes it impossible for him to assimilate them", "The disciplinary profile is reinforced by the search for classification, which ends up introducing compounds such as metal hydrides, on an equal footing with oxides or salts...

López (2009) expresses that teaching and learning should not be limited only to a directional class transmitted in the classroom, but that other contexts should be sought that favour the quality of student learning by helping them to interact with their environment so that they rediscover and construct their own knowledge, which in this subject is a scientific language.

Recommendations

In the perspective of, as pedagogical practice is developed for the teaching of the language of chemistry at the unified general baccalaureate level, we can say that this action or fact of scientific knowledge needs to be diversified, since the subjects who learn do not recognize, nor appropriate, the knowledge in the same way, even if they study in the same year and the same institution. Compulsory education must be inclusive of all or else it will betray the universal right to education as expressed by Gimeno Sacristán (2005). Therefore, addressing diversity is a great challenge that implies major reconstructions of pedagogical practices, so that quality education that respects differences and avoids segregation is achieved.

A pedagogical practice of openness, the interconnection of the curricular framework, being that it must nuance the context and the humanistic part in which each student finds himself, so that he develops his own scientific potential. Learning goes beyond the mere retention of information; it implies that the individual is able to process it, place it in a specific context and give it a practical meaning; as Rivera (2004) states, "the process by which significant personal representations that have a sense of an object, situation or representation of reality are known as learning" (p. 47).

The study of didactic strategies for the strengthening of the language of chemistry has represented in some student's difficulties at the time of executing the knowledge acquired in this subject. Some authors put forward some reasons that they consider to be a deficiency in the development of the educational practice of the language of chemistry, which they consider to be the following: the conception of a difficult understanding of the subject, the application of an inadequate teaching methodology and memorization as the basis of their learning, developing the contents from systematic reproductions of content, preventing the student from being an active processor of learning, according to Ausubel's theory of Significant Learning, (1963).

For the excellent development and execution of this proposal, the collaborative, participative and motivating approach must be engaged, so that students integrate innovative didactic strategies to strengthen the language of chemistry, discarding the traditional processes of teaching experimental sciences and promoting the integral development of students.

Proposal

General Objective

To present didactic strategies aimed at strengthening the language of chemistry.

Specific Objectives

1. To encourage students to learn chemical language through MJC's scientific educational strategies.

2. To redesign the didactic components for teaching the language of chemistry in MJC

3. To focus on context-oriented educational activities in JCM for the strengthening of the language of chemistry

Proposal Design

With the development of this research, it is assumed that the teacher must change the way in which he or she teaches the language of chemistry, nuancing the construction of knowledge based on the complexity in which this actor of scientific knowledge develops, channeling this process with the necessary framework so that the connections of the teacher and student in the classroom or in other appropriate spaces for the learning of science evolve, in order to consolidate an education of quality content, making science.

With all the above, a need to transform the teaching practice is reflected, that is, the educational fact of the educational unit of the millennium Manuel J. Calle, in which the didactic strategies used for the teaching of

the language of chemistry were studied, which engages different spaces linking with society, where the student is an active being in the construction of his knowledge.

Table 1. Design of the proposal of didactic strategies for the strengthening of the learning of the language of chemistry

Action	Purpose	Expected accomplishments	Activities	Time
Motivate students to strengthen chemical language learning through MJC's scientific educational strategies.	To motivate students to the changes required to facilitate pedagogical practice in the teaching of the language of chemistry.	Understanding, accepting, mastering and developing the processes of learning the language of chemistry. Valuing the language of chemistry.	Preparation of plans -Share criteria. -Edit descriptions. -Gathering judgments. -Discuss findings.	1 months
Redesigning the didactic components for teaching the language of chemistry in MJC	To develop didactic strategies that provide the strengthening of the language of chemistry.	Concept of symbols and chemical elements. The periodic table. Structure of the periodic table. Periodic properties Metals, not metals, metalloids and noble gases.	Planning, implementation and evaluation of the pedagogical processes. -Development of activities that respond to the solution of the problems detected -Implementation of the use of different learning environments	2 months
To focus on context-oriented educational activities in the MJC for the strengthening of the language of chemistry	To propose accompaniment to chemistry teachers for the development of a dynamic, didactic practice of the language of chemistry in an outdoor environment. To integrate representatives, community and academic coordinators	Use of environment. Innovative didactic strategies Evaluation and conformation of open spaces (community days, park, sports field). Development of competencies that integrate sport with the knowledge of the subject.	-Implementation of the use of natural environment methodology - workshop. -Elaboration of matrices to determine achievements. -Information analysis to measure the coherence between planning, activities and implementation of the proposal. -Use of strategy that allows to work a thematic	2 months

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