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Paper Title: TEACHERS CONCEPTIONS ABOUT THEIR MEDIATION ROLE AT THE CONSTRUCTION OF THE KNOWLEDGE OF THE ATOM CONCEPT

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We have tried to analyze his pondering about his role as mediator, his concepts on teaching, apprenticeship and the object of knowledge.

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TEACHERS CONCEPTIONS ABOUT THEIR MEDIATION ROLE AT THE CONSTRUCTION OF THE KNOWLEDGE OF THE ATOM CONCEPT

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INTRODUCTION

This work has been brought about from our interest on studying what has been happening to the relations which are established between the subjects in a classroom (teacher and student) and the object of knowledge (the subject of chemistry).

We think of teacher and student as active subjects of their own knowledge, social historically shaped beings. Our aim was basically to transfer the teacher's from his usual "place" so that he could ponder on what has the teacher's action been like in the classroom.

We have tried to analyze his pondering about his role as mediator, his concepts on teaching, apprenticeship and the object of knowledge.

We are concerned with the teaching of concepts which involve abstract notions, highly general notions. On teaching sciences in general and Chemistry in particular, knowledge which demand the concept of model and a great deal of maturity concerning its cognition are introduced to the student.

We believe that school is the typical place where the structure of knowledge occurs, where the teacher's action is more clearly shown as human modifying activity.

We have chosen the subject atom because is holds these characteristics and also serves as a basis for other subjects on teaching chemistry. Therefore, we have tried to follow the work of three teachers from public schools, watching their lessons on the theme of atom.

We have assembled our data from the transcriptions of classes which we recorded; from the students' answers to a questionnaire which we applied

to all of them after the instructions to obtain data on the knowledge of concept; also from the transcriptions of interviews which we applied to about 30 % of the students on each class. These data have been worked out according to a proposal analysis. The classroom data consisted of teaching data. the data obtained through answers form students (both from the questionnaire and from the interview) established the data of apprenticeship.

Finally, introducing the data of teaching and apprenticeship to the teachers after the classes on atom we have organized meetings with these teachers to obtain data on their previous interpretation of the teachers' action, on how they previously noted the students' apprenticeship and on how they understood their own object of knowledge.

Our aim, therefore, considering the data of teaching and apprenticeship analyzed in a classroom situation, was to put them at the disposal of the teacher for his own pondering and then analyze the concepts the teachers presented about their role on mediating the structuring of knowledge on atoms.

Having in mind the aspects we are studying about referred to in a different manner,
the role of instruction, the structuring of knowledge, the teacher's mediation, the student's processes of conceptualization, we admit that the ideas of Vygostsky which relate these aspects in a concepts which relate these aspects in a constructivist sociohistorical point-of-view are quite promising. As concerning our analysis, we have noticed the great wideness of this approach as compared to others we have seen before.

If we are taking these aspects and the relations we may establish with them into account, we believe that widest approach to this study would only be achieved with Vygostsky and his followers' ideas.

Having in mind the studies and works which have been put into practice by other constructivists, we may notice that their discussions tend to focus on the apprentice subject and their intuitive ideas. In these studies we don't see the relations which may be established between the apprenticeship and the object of knowledge in its social nature.

According to Vygotsky's ideas, in a larger field of consideration, we may relate the process of apprenticeship to the object of knowledge and the teacher's mediation. This way, apprenticeship develops an essential social role on the student's development and on his superior mental functions.

THE OBJECT OF KNOWLEDGE

The object of knowledge, while in its process of construction (which is not eternal) is not at random. One must provide the teacher with good conditions, so that he may establish the relations between the themes of knowledge and between these and their social construction nature. Besides, it is through the approximation to the history of this knowledge's structure that the teacher can interpret the object of knowledge's and his own social political role.

To this effect, we were detained to describe, even though briefly, the object of knowledge - the atom. We thought necessary to determine some aspects in our description:

It is interesting to observe that this is what we saw along the structure of knowledge about the atom:

- at the beginning, there were almost individual ideas and the slow progressing of the course;
- since the man's total control over the measuring and controlling methods of his activities, a larger number of people began to respond for the production of knowledge and, since then, it's development was faster;
- at great conflicts' periods of time (beginning of the 19th century - after Dalton and until Canizzaro) it was interesting to see scientists 'touching nature", each of them anchored in different intentions. For a while, these people's divergencies delayed the structuring of a common knowledge. Scientists tried to broach some nature phenomena with the image of blind people who tried to describe an elephant by touching different parts of its body; but they couldn't do so coherently since they parted from different premises.
- The creation of a representative model of this creature who takes part nowadays on the structuring of an atomic theory is never over: the

history of creation of the particles of materials is the most temporary Of all the history of humanity.

Therefore, we would like to emphasize that:

- scientific knowledge is socially structured through comings and goings in the result of experiments of man with nature and its inquiries, conclusions and perceptions, while trying to give sense to reality and while trying to carry out his wish to transform it.
- Historicity and the social issue are inserted in the heart of the form of structuring knowledge;
- scientific knowledge, in this dynamic nature-thought-society process, is basically temporary;
- the atom concept involves primarily the concept of model. It demands a more advanced cognitive level from the apprentice and a great dependence from the word. One can't think of an atom without going through the notion of model. The concept of atom, as it is a scientific concept, is structured from other concepts.

Therefore, teaching about the atom (like teaching any topic) is not just to supply oneself with techniques, resources and methodologies on introducing some matter. To start with, it is necessary to determine the nature of the matter to then start the structuring of activities. The role of the teacher is related to the nature of the matter, once it is him (the teacher) who will encourage the proximal development of the student. On the process of elaborating the concept which the apprentice will go through, he may not reach the scientific conception must be as clear as possible for the teacher or he must be all the time approaching this conception.

PRESENTATION OF RESULTS

Teaching aspects

While trying to analyze the obtained data which relate to teaching and apprenticeship, we tried to characterize the matter atom through some conceptual dimensions. In this sense, the data were grouped in these dimensions:

- the unity character (in this dimension we include the propositions which expressed the idea of atom as constitutive material unit);
- the constitution of an atom (here we included propositions on the contents of an atom);
- the graphic representation of an atom (in this dimension we inserted the propositions which were suggested through drawings or descriptions related to images);
- the concept of model (the propositions which were concerned with the meaning of model were included under this section);
- preservation (under this section we include the propositions which related or explained the composition of some substance through the observation of its physical properties);
- other properties of the atom (any other proposition which brought attributes to the atom, but which could not be included in the previous dimensions were related in this section).

As for the analyses of the three teachers' classes made by us, we could notice in them that there were different ways of emphasizing the different dimensions, there were different frequencies of approach along the classes and, naturally different ways of interacting with the students.

The remarkable dominance of the dimension "constitution of an atom" in all classes may be accepted if we interpret it as evidence of the great inclination to organizing of the chemical content in a classifying way. Talking about the constitution of an atom, its particles and its characteristics is much more comfortable in our point of view, as it puts "substance", in a way ,to the concept of atom, it gives an identity, even with the risk of making it, in this approach, extremely factual. The conceptual categories (propositions) related to this dimension are coherently organized in books, and are easily classified (even if in a formal way) by the student and by the teacher and are an excellent purpose for evaluating questions.

In a opposite way, the low emphasis given to "the unity character of an atom" may be understood if we admit the tendency of teaching, which is very well established, to study the atom in a sectary way, in a isolated way. By calling it "constitutive unity of materials, as a unitary part of a whole, teachers tend to outline immediately a dive into the atom, "forgetting" to come the

surface and describe it or recognize it through the whole for the different parts.

The difference in emphasis on approaching the other dimensions seems to vary as related to the form of appropriation of the contents by the teachers, and this is probably raised from the different styles and sources which were referred to on preparing the lessons and on the proper methodological decisions.

Learning aspects

We have found a great number of categories on students' answers, both in the questionnaire and in the interview. We were able to organize them according to the referred dimensions and we observed that, in a general way, they reflected what had been taught. In view of the wide range of data we obtained through apprenticeship, we decided to present at this moment the most remarkable groups of ideas, through some descriptions and through the presentation of some drawings:

*atom and the materials

In a last moment , the students imagine that the materials consist of a superposition of atoms, a gathering of atoms which add up to each other sequentially in an arbitrary way. The opinion about what there is between them is not always the same. Atoms are colored, shaped and suffer deformities like all materials. The external properties, as observed in a macroscopic level are transferred to the atomic level. Atoms are the smallest part of materials but not the only element, just the smallest part. What is considered in materials to be "geographic center" or the central part, was considered by some students to be the nucleus of the material, which was considered to be the atom. Therefore, the seed was the nucleus to the avocado; the foot of a table, to the table.

*the constitution of an atom

Atoms generally consist of two parts, but the parts are not always the same for all. The layers are a preceding place: there they remain,

independently from the presence of electrons. Particles, or atoms, are static. Only the increase in temperature can make them move. For some of there is a thin layer which isolates and keeps the nucleus particles away from the rest of the atom.

*the concept of atom

The illustration in a book is a picture of an atom.

The atom is what is in the illustration.

The illustration represents what the scientist has determined to be an atom.

The illustration represents the idea of an atom.

Class 1 : variety in drawings and in conceptions.

Class 2 : drawings which are similar to the ones the teacher made.

Class 3 : drawings with similar characteristics among each other.

The meetings : teachers' thoughts

The main observations we could mention about teachers behavior are:
* rejecting his own speech
* being surprised with the apprenticeship data
* blaming external factors for his own action
* difficulty on a approaching the object of knowledge
* the reading of his action is in itself an interpretation.

In a general way, what has happened and keeps happening is :
* low interaction with the object of knowledge : teachers don't interpret, don't criticize, accept the corresponding contents as ready and established.
* displacement of the locus of the problem when they can put its action and external sources to it in doubt.
* lack of consideration concerning the apprenticeship processes of students.
* non-observance of the fact that apprenticeship of an atom/model demands a high of generalization or abstraction. They are inclined to admit that the idea of atom is abstract because we do not see it. The idea of model is not connected here.
* the teacher's difficulty in re-considering his teaching is related to his difficulty in understanding the apprenticeship process of the student and to the fact that he did not assume essential characteristics for the methodological decisions of the atom content.

CONCLUSION

The object of knowledge - the atom - is not at random. Its structuring has taken and still takes place connected to social and historical factors.

Teaching the atom's concept, one must certainly take into account the type of structuring of this knowledge, which implies in considerations of the cognitive level which are necessary to its establishment.

The teacher must show the importance of the object of knowledge and must admit that, on its structuring, social roots are implied. Considering the levels of mental development for its conceptualization, the teacher should

admit that he must follow the processes of apprenticeship which occur in the student.

The processes of conceptualization of the student are of individual and social nature.

Mediation - once the acquisition of concepts of a high level of generalization demands, for a start, social interaction, it is the teacher's duty to play an essential role in establishing his approaching relations to the student, showing him the object of knowledge and helping him, making him work by himself when he is capable of dominating certain levels of conceptualization or providing help at those moments when potentially capable students find apprenticeship.

Because of these considerations, the meetings favored an attempt of mediation. We, the researchers, tried to establish relations among teachers and their own action as object of know -ledge. Their thoughts and ours were covered with a new knowledge character - which was co-constructed in the established proximal development.

In such meetings we can say that the object of knowledge's raw material may consist in:
- teaching and apprenticeship data (from the teachers' classes) are systematized;
- data which are generated by established situations for the teacher's thoughts;
- teaching theories;
- apprenticeship theories;
- chemical contents.

Therefore, as historical and social subjects, we intend to establish conditions for the better quality of the formation of a teacher through :
- establishing situations where the thoughts of its praxis may occur ;
- introducting elaborations of philosophical - epistemological nature ;
- encouraging the accomplishment of analysis operations ;
- Unveiling the theory which is underlying to actions and interpretations ;
- etc .

The present results suggest that the possibilities of pedagogic innovation are related to both the teacher's explicitation of his conceptions on his mediating role in the co-constructing process of knowledge and the understanding by the teacher of the interacting dynamics of the student-subject with high generality concepts.