Nat. Volatiles & Essent. Oils, 2021; 8(6): 577-583

NVEO
Natural Volatiles &
Essential Oils

Teacher's Conceptions Of Scientific Activity And The Nature Of Science

Analysis of some cases about genetic information in the class of the second year baccalaureate

Hakima Seghir[1] , Mustafa El alaoui[1] , and Rachid Janati Idrissi[1]

[1]LIRIP, Interdisciplinary Research Laboratory in Educational Engineering,Superior Normal SchoolENS, Martil

[1]University AbdelmalekEssaedi UAE, Tétouan, Morocco

Abstract: The genetics portion of the second-year baccalaureateclass is a prime time for learning about the nature of science and scientific activity. In this regard, we attempted to identify the conceptions of six biology teachers by interviewing them about their classroom practices - specifically on the sequence of discovering the nature of genetic information. The analysis of the interviews reveals poorly trained conceptions about the nature of science and the scientific method. All teachers interviewed have a linear logic of discovery in science; and the empiricist tradition, remains very prevalent in the epistemic conceptions of these teachers, overvaluing observation and experience in relation to other theorizing processes .This form of staging scientific knowledge leads teachers to present a distorted image of science and scientific activity.

Keywords: nature of science, epistemology, qualitative analysis, scientific method, constructivism.

1. Introduction:

In didactics, a great deal of research conducted to study the idea of science in students, as well as among practicing teachers. Although there is little or no research on the conceptions of science and scientific activity among teachers of life and earth sciences in Morocco. [1, 2, 3, 4, 5, 6, 7, 8]

In this work, we have chosen to collect teacher's conceptions, not from a theoretical discourse (through a questionnaire for example), but through interviews where teachers are asked to express themselves on their classroom practices, in order to identify the relations between teacher'sidea of science and their teaching practice.

Many researchers have used quantitative or semi-quantitative approaches; in our view, as Lederman also points out, a qualitative approach can provide a deeper and more contextual understanding of the idea of science.[2]

According to research by Lederman, the qualitative results suggest a much more sophisticated view of science than that found through a simple questionnaire. We therefore used interviews as a means of data collection, which were also part of a pedagogical approach to raise teachers' awareness of their idea of science and of scientific activity..[2]

2. Theoretical framework :

2.1 The Nature of Science (NOS):

In general, NOS refers to the epistemology and sociology of science, to science as a way of knowing, or to the values and beliefs inherent in scientific knowledge and its development.

Individuals often confuse NOS with scientific processes. While the latter is considered to be activities related to collecting and interpreting data, and developing conclusions. In comparison, the NOS represents the epistemological values and assumptions that underlie these activities. For example, observation and hypothesis building are scientific processes. Related conceptions of NOS include the understanding that observations are limited by our perceptual apparatus, that hypothesis building necessarily involves imagination and creativity, and that observation and hypothesis building are scientific processes that necessarily involve imagination and creativity, and that both activities are inherently theory-laden.[9,10

2.2 The scientific approach:

Since Claude Bernard, the conception of "the" scientific approach among contemporary epistemologists and didacticians has evolved considerably. It is no longer conceptualized as a series of steps of the OHERIC. Do we start with an observation, a hypothesis, a problem, a question, an interest? Is it a linear or iterative process? Does it involve only a few steps or several dozen? Is it a heuristic or argumentative logic? Is it an approach or a method? Is it specific to the sciences only? This approach is still, unfortunately, found too often in volumes of science. It is presented as "the" approach methodically followed by scientists. According to DAGHER Z. & COSMAN, "One cannot reduce the multiple methods of scientists to a mythical scientific method. .[, 12, 13, 14,15]

There is often the impression that there is a step-by-step procedure, similar to a recipe. However, there is no single "scientific method" that would guarantee the scientist, the development of scientific knowledge. [2, 9, 11,14]

Moreover, there is no single sequence of practical, conceptual, or logical activities that will accurately lead to valid claims in the development of scientific .[9,14]

3. Research Methodology:

1. The corpus: teacher interviews

The interviews consisted of having the life and earth science teachers describe the course of certain class sequences and, by questioning them, getting them to express themselves and even justify their practices. Thus, in general, to make the teacher say what he does how he does it and why he does it. Thus, the interview consisted of open-ended questions relating to the characteristics of science, its aims, its mode of knowledge production, its context of implementation in society, etc.

2. Teachers interviewed:

Through various personal relationships as a teacher of life science before being a researcher in didactics, six life and earth science teachers were contacted. This choice is subjective and is not based on any selection criteria. The only criterion is to have taught the theme of genetics during their professional career.

3. Qualitative analysis of interviews:

- **Analysis of teacher's conceptions about the nature of science**

In response to a question designed to get teachers thinking about the differences between science and the arts, the responses are categorized into two main trends:

- Science as an approach;

- Science as a body of knowledge;

However, the scientific approach or method receives the most attention as the main characteristic of science.

During the interviews, teachers spontaneously addressed the aspect of truthfulness of knowledge. The majority of teachers qualified scientific knowledge as true. Only one teacher who mentions that science is temporarily admitted.

For the influence of science on society, overall, it seems that teachers are aware of the beneficial effects of the applications of science in society and their appropriation by society; however, it is mainly the negative effects that attract their attention.

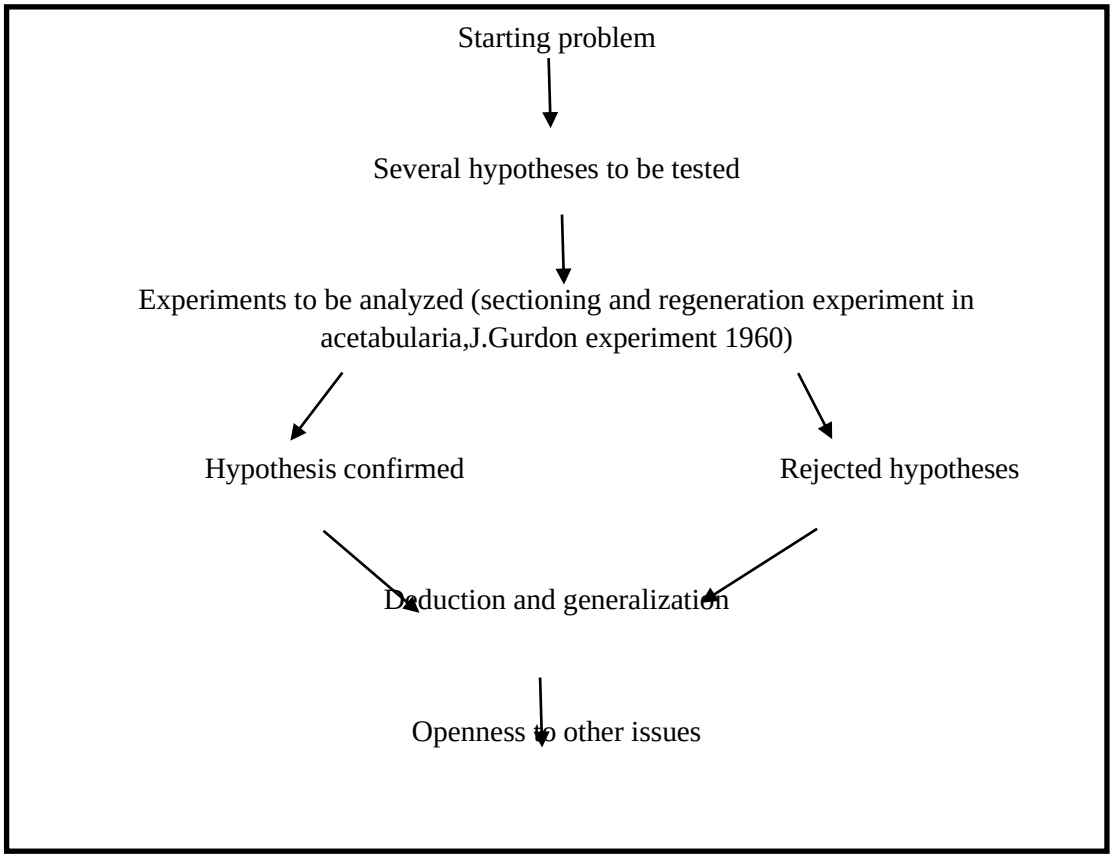
- **Analysis of the sequence "Localization of genetic information".**

- Preliminary analysis:

According to the sequence of the program, this sequence must precede the theoretical notions on genetic information (chemical nature, mode of transmission, laws of transmission...). The program recommends a hypothetical-deductive approach to the study of the location of genetic information. Approach adopted by the 6 teachers.

-Analysis of the interviews in terms of the logic implemented during the teaching of the sequence of the location of genetic information.

Based on the analysis of teachers' accounts of the implementation of the genetic information location sequence. The approach used was summarized in this table



In general, the approach is the same for all six teachers. The difference lies in the starting problem.

For teachers A, D, E, F. The problem is posed by the teacher himself, on the other hand the two teachers B, C, made the students participate in the process of problematization in order to involve them in the construction of their knowledge.

-The myth of the scientific process

Asking teachers: What skill do you want to develop in learners through this sequence?

The answers are all similar, the six teachers want to develop the development of the scientific mind and the acquisition of the scientific process, the latter is considered according to the teachers' account as a series of OHERIC-type steps.

This approach is still, unfortunately, too often found in science books. It is presented as "the" approach methodically followed by scientists.

-The image of science

Another question for teachers: what image of science do students develop through this sequence and through their learning?

This question poses a problem for teachers. They are not able to specify this image well. Teachers A and C mention the empiricist aspect of science, while the others' answers are only in the scientific content.

-The social aspect of scientific activity

The social aspects of science, as organizing principles of scientific activity, are generally very little addressed in curricula and textbooks.

It is necessary to understand that the criteria that preside over the choice of concepts, models or theories, do not reveal a "logic of the necessary or a universal rationality", but decisions linked to a social, historical, and daily context. [14]

Even teachers do not address the social dimension when discussing science.

4. Interpretation & Discussion:

From this observation, we can question the foundations of the pedagogical practice of these teachers. That is to say, the way in which these teachers teach the scientific approach of the experimental type.

It is important to note here that it is not only the content of instruction that influences student learning, but also the way in which the teacher teaches and the implicit models of their discipline that they convey through their teaching.

If we want to look for the origins of this failure in teachers' conceptions of the nature of science, it is advisable to analyze the impact of university studies, as well as initial and in-service teacher training.

At this level, the question of teacher training arises; training that should provide them with the theoretical foundations of reference.

Thus, there is an urgent need to implement the epistemological and historical dimension in teacher training for more effective teaching of science in general and life and earth sciences in particular.

5. Conclusion:

For the past twenty years, the problem of learning and teaching science has been the focus of much attention from researchers in education and didactics. The richness of the literature in this field bears witness to this.

Several journals are devoted entirely to the problem of science education in the broad sense. The research on this subject is so numerous and the questions addressed so diverse that it is certainly not possible to give an exhaustive account.

In this article, we have tried to identify some of the problems that have been widely addressed in Anglo-Saxon countries as well as in Francophone countries. We have tried to articulate these problems of various kinds around some major themes: the nature of scientific knowledge, the gap between the taught scientific approach and the real scientific approach, the difficulties related to learning science.

We wanted to highlight various facets of a complex reality, that of science teaching in secondary schools in Morocco. The various problems raised lead to the development of professional skills in the teacher. Insofar as these skills can constantly evolve through the exercise of the profession.

On the other hand, teacher training, both initial and in-service, has an important role to play in developing a more effective use of the epistemological and historical dimensions of science. Training programs in didactics should be revised, introducing, for example, modules on the epistemology and history of science.

Because of its exploratory nature, this study does not allow for a generalization of the results. To do so, the sample would have to be enlarged: here, six teachers were introduced to the research, which is far from being the general case. However, the initial results reveal promising avenues for further analysis and even more in-depth research on the relationship between teachers' knowledge of epistemology and the history of science and science teaching.

Bibliographic References:

[1]COSSMAN G.W. (1969). The effects of a course in science and culture for secondary school students. Journal of Research in Science Teaching, VoI. 6, n° 3, pp. 274-283.
[2] LEDERMEN, N. G. (1992). Students' and teachers' conceptions of the nature of science: A review of the research. Journal of Research in Science Teaching, 29, 331-359.
[3] AIKENHEAD G. S. (1973). The measurement of high school student's knowledge about science and scientists. Science Education, VoI. 57, pp. 539-549.
[4] DÉSAUTELS J. & LAROCHELLE M. (1989). Qu'est-ce que Ie savoir scientifique ? Québec, Presses de l'Université Laval.
[5] CAREY R. L & STAUSS N. G. (1968). An analysis of the understanding of the nature of science by prospective secondary science teachers. Science Education, VoI. 52, pp. 358-363.
[6] BILLEH V.Y. & HASAN O.E. (1975). Factors affecting teachers' gain in understanding the nature of Science. Journal ofResearch in Science Teaching, VoI. 12, n0 3, pp. 209-219.
[7] ARORA A. & KEAN E. (1992). Perceptions of doing science : science teachers' reflections. In S. Hills (Ed.), 77?e history and philosophy of science in science education. Proceedings of the second international Conference on the history and philosophy of science and science teaching, VoI. 1.
[8] AKINDEHIN F. (1988). "Effect of an Instructional Package on Preservice Science Teachers". Understanding of the Nature of Science and Acquisition of ScienceRelated Attitudes. Science Education ,VoI. 72, n0 1, pp. 73-82.
[9] Abd-El-Khalick, F., Bell, R.L. & Lederman, N.G. (1998). The Nature of Science and Instructional Practice: Making the Unnatural Natural. Science Education, 82(4), 417-436
[10] Chiappetta, E.L. &Koballa, T.R. (2004). Quizzing Students on the Myths of Science, The Science Teacher, 71(9), 58-6
[11] DAGHER Z. & COSMAN G. (1992). Verbal explanations given by science teachers : their nature and implications. Journal ofResearch in Science Teaching, VoI. 29, n°4, pp. 361-374.
[12] GARNEY B., LINDER C. & HAGGERTY S. (1989). Student teachers' conceptions of science and learning : A study in preservice science education. Communication présentée au Colloque de Ia Société canadienne pour l'étude de l'éducation, Québec, juin 1989.
[13] ABELL S.K. & SMITH D.C. (1992). What is science ? Preservice elementary teachers' conceptions of the nature of science. In S. Hills (Ed.), The history and philosophy of science in science education. Proceedings of the second international Conference on the history and philosophy of science and science teaching, VoI. 1. Kingston, Ontario, Queen'sUniversity, pp. 11-22.
[14] CHALMERS A. F. (1988). Qu'est-ce que Ia science ? Traduit de l'anglais par Michel Biezunski. Paris, La Découverte. CONSEIL DES SCIENCES DU CANADA (1984). Rapport 36. A l'école des sciences-

La jeunesse canadienne face à son avenir. Ottawa, Ontario, Centre d'édition du gouvernement du Canada.
[15] Fourez, G. et Lambert, D. (1989). À chacun ses modèles théoriques. In G. Fourez (dir.), Enseigner les sciences en l'an 2 000. Symposium international, enseignement des mathématiques et des sciences, technologies, éthiques et sociétés. Presses universitaires de Namur.