The investigative approach in the framework of the new programs: study of two cases in France and Morocco

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Abstract. In France as in Morocco, the teaching of science in schools has been subject to various evolutions for many years, and not only to those brought by the new official instructions of each country. For example, the implementation of the "investigation approach" is as much a new approach for the teacher as it is an approach that aims to give more space to the student, which consequently influences the teaching practices. In a case study, we tried to understand what construction of scientific knowledge could be achieved within the framework of an inquiry approach. The analysis of these moments of science led us, in addition to the study of the difficulties of the implementation of an investigative approach and the nature of the knowledge obtained, to question the possible links between the resources mobilized by the teachers and the nature of the knowledge that they make the students construct. This observation converges between several didactic and pedagogical issues and are at the same time for the teacher and the pupil the means of different processes of knowledge construction.

Key words: investigative approach, teaching practice, problematization, resources, scientific knowledge.

Introduction

Numerous researches have focused on the place of science teaching. These works have highlighted that the expected roles of these activities are as well the acquisition of a scientific culture, as the development of manipulative skills, the learning of scientific knowledge, methods and attitudes. This research is part of the field of science didactics and more precisely in life and earth sciences didactics. It takes as object the link between what teachers base their preparation and the way they conduct the science moments on the one hand, and the impact of the choices taken on the construction of knowledge

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on the other hand. The work presented here concerns the implementation of the investigative approach in two different countries: France and Morocco. We explain, during this research, the choice of these two fields. Appeared in the French primary and then middle school curricula in 2002 and 2005 respectively, the choice of inquiry-based science teaching has just been adopted in 2018 in Morocco with the new strategic vision of 2015.

1.1 Problem and research object

The central concern of the research conducted is the implementation of the inquiry-based approach during science teaching sessions in elementary and middle schools. The focus is on teachers' practices in order to understand how they translate the directives of the official instructions and conduct these moments of science in their classrooms. Knowing the teacher's activity in his class requires a study of all the tasks related to this activity (the choice of resources and the conduct of the investigation process). In this research, we propose to highlight the knowledge involved in an activity that is usually not very accessible, despite its institutional recognition: the preparation of lessons. Indeed, the official instructions for the preparation of a science lesson propose the existence of the following elements

- The annual progression.
- The choice of the lesson;
- The definition of the objectives, methods and techniques assigned to the lesson;
- Choice of materials;
- Identification of theoretical needs;
- Identification of material needs;
- Preparation or pedagogical sheets.

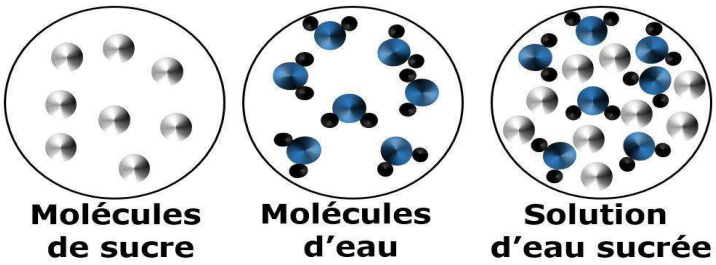
Although the difficulties encountered by the teachers interviewed in implementing the inquiry process were identified in our previous research (Master's degree), the ambiguity that persisted brought to the fore certain questions that still require clarification. These questions mainly concern the reluctance of some teachers to implement the investigative approach and the difficulties that explain teachers' choices. In addition to these points raised, our research has established the link between the references on which teachers base themselves (resources, choices, etc.) and the knowledge produced. Speaking of knowledge to be constructed in science is to emphasize the importance of the problem in the construction of this knowledge which is opposed to simple unquestioned and unreasoned opinions and that nothing can be based on them (opinions) (Bachelard, 1938, p.10). For this reason, we try to understand the link between the resources mobilized and the knowledge constructed in a science teaching declared based on investigation. Thus, through this research, we try to answer the following question:

In what way could the resources mobilized by the teachers contribute or not to the construction of scientific knowledge?

To do so, we refer to the theory of learning by problematization (Orange, 2000).

Theoretical framework.

Bachelard considers that "for a scientific mind, all knowledge is an answer to a question" (1938, p.10); Popper for his part affirms that science begins with problems (1991 p. 287; 1985 pp. 230, 329). As a result, the problem (construction of the problem) in scientific activities and learning occupies an important place in the definition of scientific knowledge (Orange, 2000, 2002; Ravachol-Orange, 2003; Beorchia, 2003). In the following, we present our theoretical framework, in this case learning by problematization, by highlighting some of its characteristic points. In this framework, scientific activity focuses more on explanatory problems (Popper, Toulmin). In other words, problems that aim to explain phenomena or events. Hence the central role played by the construction of explanatory models. For example, to build a model explaining the dissolution of a substance in water is to put in relation what the class observes (a homogeneous mixture of solute and solvent), and the model explaining the outcome of this result (the solute molecules move until they are uniformly distributed in the water.



Model explaining the dissolution of sugar in water

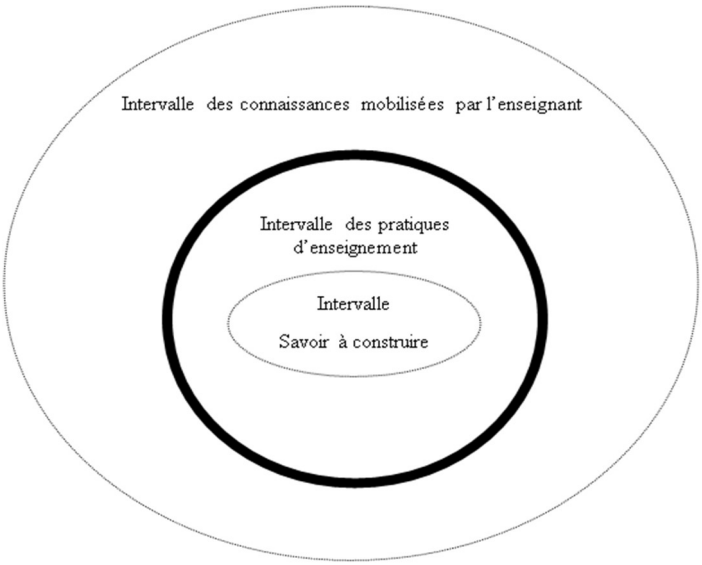
This model finds its explanatory power, adds Orange (2000), in what he called the explanatory register. If the scientific activity focuses on explanatory problems, scientific knowledge is not reduced to the solutions (models) of these problems. They are more interested in the arguments, the reasons and the controversies produced in the course of a scientific debate. In other words, it is not a question of "knowing that" (assertoric knowledge), but knowing "why it cannot be otherwise" (necessity character, apodictic knowledge). These characteristics of scientific activity lead, according to Orange, 2000, to the identification of constraints and conditions of possibility of solutions (necessities).

Research and analysis methodology

Our research took place in two different places but one inspired by the other. In France where we started our research and visited new places: Elementary school and a college in Maubeuge. In Morocco in two elementary school in two different environments, one in a privileged environment and the other in a disadvantaged rural area. The choice of these two places was not made at random, it is governed by certain considerations. First of all, in France, the teaching of science has been the subject of much debate and discussion on the

renovation of this teaching and giving more space to the student. In Morocco, a country whose science teaching is in the middle of a discussion on the new official instructions for 2019, the investigative approach and the language of instruction have been the subject of renewal. As a result, these two seemingly different research areas both aim to make science teaching more attractive and motivating.

In an attempt to answer the question posed in this research, we have used́ some data collection tools observation, note-taking, documentary analysis and interview. The analysis of practice is focused more on language practices in action and explicitations as well as the written traces of the teacher and students. They are therefore three distinct intervals, but they articulate each other in such a way that one leads to the other.



Intervals of didactic actions

The interval in bold refers to the teachers' practices during a science session. While the two other dotted intervals refer to the possibility of reconstructing (from the identified practices) the knowledge mobilized by the teacher to conduct a science session and the knowledge to be built at the end of this teaching.

Conclusion

Based on these prescriptions, the knowledge targeted by the official text is intended to be more reasoned and to have a meaning constructed by the learner. The scientificity of knowledge, according to the text, will be achieved as soon as the student is able to explain and develop his reasoning. Scientific language, during the debates led by the teachers, will play an important role in this process of knowledge construction. Indeed, the learner is supposed to be able, at the end of the first cycle, to solve situations by following the investigation approach is that, specify the new programs, by proceeding to questioning and

expressing himself or herself orally and in writing (sentences, diagrams ...) on issues related to his or her near universe (programs, 2018, p. 38). However, the ambiguity of the official texts of the two fields studied with regard to the implementation of science teaching based on investigation leaves the teachers facing different resources that are not necessarily in line with what the official instructions provide. This leads us to foresee, in future research, other forced situations in order to conceive a science teaching whose resources and approach could be framed in order to understand more the student's space of action.

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