

Teaching Earth Sciences In Morocco: The Representation Of Learners About Europe As An Obstacle To The Construction Of Learning On The Rif Mountain Chain

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Abstract:

Background: In Morocco, the teaching of Earth sciences, which is part of Life and Earth Sciences (LES) programs, suffers from multiple obstacles. Didactics of Sciences aims to provide elements of response to the problems posed by the transmission and acquisition of scientific knowledge. Among the concepts forming the substrate of didactics of sciences, we cite representation. Much work in didactics seeks to show how to rely on the learners' representations to overcome a number of barriers to apprenticeship. Following a problem detected in class session when teaching Rif mountain chain, this study shows the impact of the representation about Europe on geology learning among Moroccan learners.

Materials and Methods: As a basic research method, the researchers used the qualitative methodology: Focus Group Discussion (FGD). We used this method as is a type of educational research, in which the researcher decides what to study, asks specific questions related to the problem detected in class session. There were 23 learners selected to collect qualitative data concerning their conceptions on the Rif mountain chain (Northern Morocco) within the tectonic context of the Western Mediterranean orogenic belt. Valuable feedback and transcriptions were noted by researcher while discussion. Data gathered from two session of FGD were analyzed by using the content analysis.

Results: This study allowed to detect a source of learning obstacles related to the phenomenon of illegal immigration among Moroccan learners. Our analysis allowed exploring how the example of representing Europe was at the root of a resistance encountered in learning the Rif mountain range located close Europe.

Conclusion: This didactic research allows to identify a new example of representation constituting an obstacle to the construction of geological knowledges. This representation detected for the first time remains specific to Moroccan society or even the Maghreb. The study focuses on the importance of being aware of all types of learner representations in geology teaching.

Key Word: Earth sciences; Representation; Europe; Illegal immigration; FGD; Obstacle.

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I. Introduction

Since the 1970s, didactics of the sciences aims to produce new knowledge on the processes of transmission and acquisition of scientific knowledge. It provides answers to the problems posed by science education and thus constitutes a tool for teacher training. This support for specific teaching content constitutes one of the fundamental characteristics of didactics¹. The didactics of a discipline is interested in the processes of transmission and appropriation of knowledge relating to this discipline. Among the concepts forming the substrate of research in didactics of the sciences we cite representations (or conceptions). In teacher training, taking into account the representations of learners in teaching is now widely generalized. Much work in science education seeks to show how to rely on representations of learners to overcome a number of barriers to apprenticeship. In this article, we provide an example of teaching practice that illustrates the importance of being aware of learners' representations in geology teaching.

Problem Statement: Synopsis of a course on Rif mountain chain and identification of a representation as barrier to apprenticeship

At the beginning of this part we point out that internal geodynamics is part of the Life and Earth Sciences programs in Morocco. The broad outlines of various themes are presented in the second year of college. The study of the different concepts of the internal dynamics of the Earth is deepened at the terminal of the high school. We present in the paragraph below the synopsis of session of course on Rif mountain chain that shows how representations about Europe influences on learning Rif mountain chain located close Europe.

Our case study was experienced during a lesson on the Rif mountain chain in the final year of high school. After having first studied the Himalayan range, learners normally must succeed in relating the different geological phenomena that characterize the collision chains. Then, the targeted knowledge consists in studying the Rif mountain chain as a second example of collision chains formed in convergent plate boundary. Before continuing our synopsis, we recall that the Rif mountain chain (northern Morocco) constitutes, with the Betic Cordillera (southern Spain), western ending of the alpine belt. This belt results from the collision of African plate and Eurasian plate. The construction of knowledge on the Rif mountain chain may be based on what has been studied before for the Himalaya chain formed when two large landmasses, India and Eurasia, driven by plate movement, collided. A course aim is to explain the different stages of formation of the Rif mountain chain and that It have formed as a result of the collision between the African plate and Eurasian plate.

During the class session, learners are required to build knowledge about the Rif range and relate the different geological phenomena that mark this mountain range. The action is guided by the teacher and helps them express their ideas and their representations. The knowledge construction moves forward in the same way in the Himalayan range. But when we treat the ocean closure that separates the two plates converging, one learner asks a question about the time remaining for Africa to collide with Europe. Another learner replies that the two continents have already collided. Some learners answered together "Yeeessss", others answer "nooooo". Another learner replied there are the two plates which collided not the two continents. So at this moment a real cognitive debate between the learners begins to take place. The learner who asked the question was amazed that the majority of learners, including the diligent students in the class, confirm the collision phenomenon. He explains that he wants to know when Africa collides Europe with total closure of the ocean as in the case of India and Asia. Here, we realized that there was a problem for this learner and perhaps for others who shared the same idea but remained silent. In order to facilitate discussion and organize scientific debate between learners, we asked this learner why you ask this question. He replied: "I just want to know when Morocco which is the country closest to Europe collides with Spain so that we can cross (or hrague) to Spain on foot. So it seemed we faced a problematic situation linked to the problem of illegal immigration that the majority of young people in Moroccan society suffer from. We recall that in the migratory context in North Africa, the term "hrague (or hrigue)" is used figuratively with the meaning of "burning the border". This term, has spread since the 1990s in Maghreb and has taken the meaning of moving from one country to another in an illegal manner by skipping all the steps of an official and legal visa^{3,4}. Thus, migrants (harragas) often go underground and burn down borders by "hrague" to achieve their goals⁵.

Objectives of the Study and Research Questions

The principal objective of our research is to study the possible influence of representations of Moroccan learners about Europe and phenomenon of illegal immigration towards Europe on teaching-learning practices. Illegal immigration is the migration of people into a country in violation of that country's immigration laws, or the continuous residence in a country without the legal right⁶. The question representing the final objective of our investigation which is determined following our research problem is : " How does the representation of Europe by Moroccan learners allow barriers that prevent the construction of relevant scientific knowledge on the Rif mountain chain and that lead to erroneous knowledge?«

II. Material And Methods

As a basic research method, the researchers used the qualitative methodology: Focus Group Discussion (FGD). This qualitative research method is a data collection technique in which a selected group of people discuss a given topic or issue in depth. We use FGD as is a type of educational research, in which the researcher decides what to study, asks specific questions related to the problem detected in class. It is a learning technique in which the student is faced a particular problem. Qualitative research is usually an explorative process and therefore flexible, iterative, reflective, non-predictable and contextualized⁷. A researcher cannot ask participants to provide an answer to the overall research question. On the contrary, it is his/her task to formulate appropriate, concrete and articulate discussion questions to ask participants, collect their responses, evaluate and compare them and finally interpret them in a way that makes it possible to answer the overarching research question.

Population and sample

FGD method allows to collect the data directly from the participants and then interpretate them. This study is delimited to one terminal class of high school. All male students registered in other high school final class that the researcher teaches were the population of the study. There were 23 selected to collect qualitative data concerning their conceptions about the Rif mountain chain (Northern Morocco) within the tectonic context of the Western Mediterranean orogenic belt. All the students' respondents are enrolled in regular mode of instruction with Moroccan nationality and living with theirs family. Two FGD schedule was prepared to get the opinions and detailed information from two groups of students about the subject study. The researcher tried to form two homogeneous groups and distributed the diligent students equally into the two groups. In the first phase of data collection, for ethical considerations, a verbal consent was completed before starting the FGD to allow each participant in the discussion to decide whether or not they want to participate. The second phase involved the collection of students' conceptions and their reflections regarding the ongoing convergence between the African plate and European plate. All the sample participants extended their full co-operation by responding to the questions and participating in the discussion. Valuable feedback and transcriptions were noted by researcher while discussion. Data gathered from the two FGD were analyzed by using the content analysis.

III. Result

This section presents the results derived from analysis of students expressions related to our objective. The questions were structured in the FGD guide according to very specific objectives. The first questions were asked just to prepare the participants for concepts related to plate tectonics in order to arrive at the last question which deals the collision between the African plate and Eurasian plate in order to understand how learners perceive time and space in geology by encouraging them to answer a question relating to an example of geological event in their immediate environment.

The analysis of the participants' expressions shows two types of obstacles encountered by the learners:

- Epistemological representation related to the poor perception of two notions: "geological time" and "geological space";
- Representation of Europe by Moroccan learners and its relationship with the phenomenon of illegal immigration to Europe.

IV. Discussion

Time and space in geology: poor perception by the learners

Several works in Earth science didactics have underlined the difficulties that teachers present in teaching geology. These difficulties can be explained by the relationships that this discipline maintains with geological time^{8,9}. The concepts "time" and "space" are always difficult for the learner to use. Understanding these two concepts becomes more complicated when the concept of "movement" adds up. The concept "time" is closely linked to the concept "space"; it is in this spatial-temporal dimension that geological phenomena should be explained. The movements of the tectonic plates are not imagined in space and in time because of the learners' representations that show that the spatial and temporal dimensions are very badly perceived. Orange (2003) tried to understand students' difficulties in using time in geology; the spontaneous use of time for construction and solving geological problems can hinder their learning⁸.

In Morocco, the majority of geological concepts are taught in middle school, high school and university. The concepts of geologic time and geologic space are not taught as such but are occasionally flown over during the course of the study of different geological themes. Our experience in teaching LES in high school and in training LES teachers shows possible difficulties regarding the appropriation of geological knowledge. These difficulties result from poor perception of time and space by learners and also by future teachers. Indeed, teachers no longer recognize themselves only by the academic knowledge they possess, but also by the didactic and pedagogical skills which allow them to support students and implement the conditions for acquiring knowledge and know-how¹⁰. Less qualified teachers may have difficulty teaching Earth sciences because of a lack of conceptual understanding, which leads to diminished confidence in content knowledge¹¹. For us, the "key concepts" for understanding different geological events are therefore the "geological time" and "geological space". The construction of geological knowledge is necessarily based on a coherent and logical perception of these two notions. The learners should spontaneously estimate the durations of events that range from a few seconds (e.g. sedimentation / erosion) to millions years (e.g. subduction / collision). Thus, it is necessary to problematize the function of time and space during any geological teaching operation in order to understand the events which are the subject of teaching. The role of teacher who must guide the teaching-learning operation of the various geological concepts is to help learners to replace geological events in time and in space when possible. So, understanding geological phenomena is necessarily based on a coherent perception of geological time.

Teach the Rif collision chain in Morocco taking into consideration the representation of learners about Europe

The analysis of ideas contested by some learners shows that the representation of Europe constituted an obstacle to the construction of learning concerning the Rif mountain chain in addition to representations of the “notion of time” and the “notion of space” in geology. The geological events must be explained taking into account the representations of the learners relating to these two notions as well as their relationship without of course neglecting other representations of the learners. The knowledge progresses by destroying the initial representations which are often far from scientific reality. During the external didactic transposition, the teacher must not forget that “geological time” and “geological space” are always difficult for the learner to use. He must not also neglect their impact on the perception of geological processes, more particularly in plate tectonics. In geology, the time and space are linked and their relationship is not simple. These two concepts don't obey the same laws. If for example, the first concept is of an important magnitude the other is not necessarily it (e.g. if the distance which separates the two continents which approach is short, the time remaining for the confrontation can be very great (thousands or millions of years). In addition, the slowness of geological processes makes it difficult to understand the geological events on a human time scale. Given the difficulty of managing the immensity of geological time, learners are unable not only to integrate their previous knowledge to explain certain natural phenomena, but also are unable to assess the chronological succession, the duration of the events of the internal dynamics of the Earth. The objects of geological knowledge must be taught at time scales that vary from one second to millions of years, and at spatial scales ranging from crystal to tectonic plate. In our study case, it is on the continent scale that learner envision the collision instead of plate scale. So here, it's problem of bad perception at the spatial scale. For time scale, Human time is planned from the perspective of a person's life. It is measured in days, months and years. The duration of geological phenomena is usually estimated in thousands or millions of years, which makes it difficult for learners to access geological time and to understand several geological phenomena. Concerning the learner's question in our case studied, the learner does not seek to answer the geological question (i.e. the collision between the two African and European tectonic plates), but rather he seeks to answer the question ingrained in his memory how and when he will be in Europe. The dysfunction that has affected the understanding and acquisition of knowledge relating to the Rif mountain chain is closely related to what the learner is experiencing as inadequate behaviors linked to the barrier caused by the phenomenon of illegal immigration towards Europe. The social experience of the child with his family, and the information mediated by these peers in addition to the experiences he has daily, make the learner has his own representation of the world around him. This is why it is often interesting to know the representations of the learners on a new subject before undertaking the teaching. Astolfi & Peterfalvi (1993) strongly suggest that if the conceptions do not evolve as a result of an informational contribution, it is because there is probably obstacle conception¹². The obstacle conception (also called “barrier representations”) can prove to be interesting for the structuring of teaching content during external didactic transposition. Learning-teaching activities become increasingly complex if three representations intervene at the same time as we detected in our study case: 1- student conceptions of geological time, 2- student conceptions of geological space and 3- student representation of Europe.

The identification of a representation as barrier among a learner requires the teacher to take this "barrier" into account in the learning process and he must neither ignore it nor assimilate it to a mistake. The role of the teacher is to help the learner to change the way he thinks because any false representation is only the manifestation of a barrier to understanding the situation. The construction of knowledge with a “barrier representation” becomes practically impossible as long as the barrier persists. The possibility of detecting possible resistance to learning through the analysis of the representations then makes it possible to envisage teachings which aim at overcoming these obstacles^{13,14}. The conceptions are guided by conditions of interaction (individual, environment, knowledge) that can be modified in some way, and overcoming an obstacle requires work of the same nature as learning a knowledge¹⁵.

V. Conclusion

This research is proposed as research on representations. It shows in a precise way the influence of representation of Europe on the construction of knowledge in geology. The research therefore allowed to diagnose for the first time a new difficulty encountered in the teaching of geology by Moroccan learners. So, this work is the first study to propose the problem of illegal immigration (hgrigue) as a representation that hinders learning Rif mountain chain. This representation seems determine not only the degrees of motivation and involvement in studies, but also it determines the degrees of apprenticeships assimilation. This difficulty will be added to the other difficulties discussed by some recent studies^{16,17}.

Far from any other factor, the notions of geological time and geological space can be conceived in the same way for all learners in the world. But the perception of these two notions in our case is specific to Moroccan society (also in the whole of the Maghreb) where young people are obsessed with the phenomenon of

illegal immigration to Europe. This phenomenon is no longer limited to adults, it also appeals to a good number of underage learners. So, this work is the first study to propose the problem of illegal immigration (hriage) as a representation that hinders learning. This obstacle emerges as a source of resistance to learning whenever the opportunity arises to cite terms that remind the learner of the phenomenon of immigration (example: Europe, immigration, Africa-Europe convergence, Africa-Europe collision, ...).

Morocco has become one of the major emigration countries to Europe. Even if emigration to foreign countries began at the beginning of the 20th Century and accelerated in time at the end of colonization with the departure of minorities, it was really in the 1980s that mass Moroccan migration developed. Morocco now has a diaspora of between 6 and 7 million people over three generations¹⁸. So, given that we are convinced that concerning the phenomenon of illegal immigration (hriage), it is not an individual representation but rather a subject shared and conveyed by a large number of young Moroccans. They focus their reflection on immigration to Europe and seek to broaden the scope of their reflection on this phenomenon from the family and social context to the school context. Sometimes this emigration is experienced by its actors as an individual adventure, sometimes it is described as a mass movement, an "epic" tinged with heroism and bravery¹⁹.

We hope that this article makes a contribution to the reflection on the teaching of geology. Admittedly, the success of learning is at the center of the relations between the teacher and the learner, but it is also a question of targeting the role of the other actors in the teaching of the discipline of the Earth sciences (the writers of the textbooks, inspectors and teacher trainers). They must be aware of the influence of representations in teaching. So, the pan of our research is to attract the attention of education stakeholders to the problem of illegal immigration. The study allows for an in-depth reflection on the representation of Europe and its influence on the "faculty of thinking" during teaching and learning process.

Limitation of the study

When we set the goal of understanding and interpreting a particular reality, a qualitative approach in research often proves to be the most appropriate for understanding precise details of the phenomenon studied. Qualitative research is also very important to identify and study conceptions. Researchers can speculate further about which answers to explore and how to approach them and they can use innate and subjective experience to identify and extract good data. However, the sample size of our study does not allow us to generalize the finding to a large number of learners. We must ascertain whether the impact of representation of the Europe and illegal immigration on learning (which we identified during a class session) concerns a large number of young Moroccan learners or whether they are isolated cases. Hence, we need for a quantitative study which will be the subject of a future research.

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