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Thomas Forissier

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Empirical papers: Synopsis

1) Background, Framework, and Purpose

In the constructivist approach, teaching can be seen as the establishment of effective learning situations for a specific audience. Therefore, the specificity of public is considered by the teacher. Bourdieu and Passeron in 1964 have highlighted the importance of social-economic contexts and works on indigenous science (Hatcher et Al, 2009) have shown the importance of the cultural dimension in the teaching of experimental sciences and mathematics.

Beyond these effects of contexts, in the sense given by Théroutane (2000), a shift is observable between the context of learners and the context of the teacher or the discipline, this article focuses on the idea of the effects of educational contexts (Leurette and Author, 2009) closely linked to learning objectives (climate and astronomical in this text, but may also be ecological, geographical or geological). This idea, very close to epistemological (Bachelard, 1938) and didactical (Clément 2003) obstacles is related to the conceptions (Giordan and de Vecchi, 1987) of Astronomy Knowledge (Blown & Bryce, 2010).

2) Rationale

The aim of this article is to estimate the scientific conceptions of first-year university students from Guadeloupe about two observations: the shape of the moon, especially its orientation relative to the vertical, and the climatic characteristics of the seasons. This choice is justified by three common characteristics:

- They correspond to direct and frequent observations of nature. They do not require complex equipment or protocol. They are not rare, and everyone in inter-tropical zone, is confronted daily with the weather (precipitations and temperature) and very often with observation of the moon.
- They are treated in science courses in French secondary school, in life and earth sciences for seasons, and physical and chemistry for the observation of the moon. These are national programs and textbooks are the same in the French West Indies and in the rest of the country.
- Many representations of the temperate seasons and the vertical moon are used in Caribbean zone. They are related to the arts (literature, cinema, music...) and to various symbols (drawing, for example, on the agendas of the moon).

For these two examples, a contradiction exists between the first point, linked to direct and local observation, and the two others correspond to observations of temperate zone. This article aims to estimate the relative impact of these factors on conceptions (Giordan and De Vecchi 1987) of students at the end of their secondary school. In other words, our goal is to observe, on a representative sample of students (first year of science university), if their description of the temperate seasons is more accurate than the seasons of the West Indies, and if their conceptions are related with simple observation of nature.

We are particularly concerned in students who will follow a university course for science because we start from the premise that they are no less influenced by the science courses in their designs than other students. In addition, the first goal of science education in secondary schools is defined in the official instructions (Ministère de l'éducation nationale, de la jeunesse et de la vie associative, 2008):

“Following their studies in college, students must have built the first comprehensive and coherent representation of the world in which he lives. It must provide some simple but consistent response to questions: "How is the world I live? "" What is my place? "" What are the individual and collective responsibilities?"”

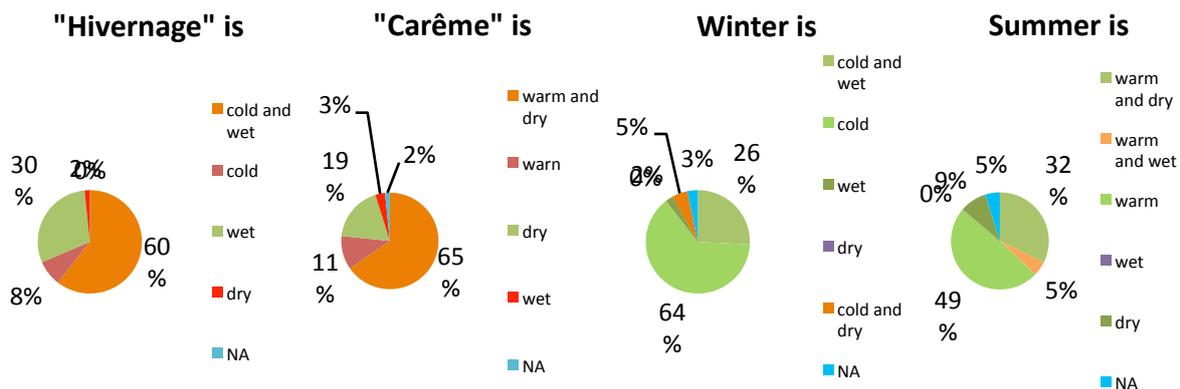
3) Methods

The sample consists of 124 first year (Licence 1) Science students. This first year is common for students intending to pursue studies in mathematics, physics, chemistry, biology or geology. The questionnaire was filled in 15 minutes in university context

(amphitheatre). The first multiple choice questions analyzed here ask to characterize the climatic seasons of 2 towns, one in Guadeloupe, and the other in France. The second question asks to choose a photography (see on the right) that could have been taken in Guadeloupe (it is stated that the top of the photo corresponds to the vertical). Only the second picture corresponds to an observation made in tropical latitude, it is the expected answer. The first picture corresponds to a usual observation in the temperate zone and the third is rotated to appear upright. On pie diagrams, the answers expected or considered valid appear in shades of green, non-responses in blue, the others red or orange. Statistics analysis and significant results (5% Khi2 possibly with Yates correction) have been found.

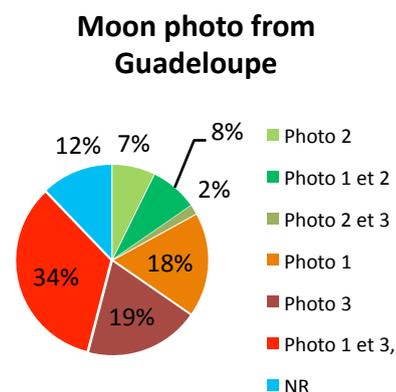


4) Results



The descriptions of seasons completed by the students of science in first year university in Guadeloupe oppose the winter and summer in one part to the “Carême” and “hivernage” on the other. For the observable seasons, no answer expected have been found (hot and humid for hivernage, carême cold and dry), 19% or 30% valid response (wet winter, dry Lent) and between 70% and 80% of unexpected answers. Summer and winter are described correctly in 90% of cases. These response profiles are highly dependent pairs ($p < 1\%$). A correlation ($p < 0.05$) between the responses and expected studies for the next year is noted: valid responses are most often given by students intending to pursue MIPC (Math, Computer Science, Physics, Chemistry) than by those intending to pursue in Natural Sciences.

Of the three photographs, only the second was taken in Guadeloupe. Only 7% of students have only checked this photograph, 10% have checked photograph 2 and another one. The most common answers (71% in total) are those excluded photograph 2. A correspondence exists ($p < 0.05$)



between the validity of those responses about the direction of the moon and the months cited to describe the winter.

5) Conclusions and Implications

The photograph of the moon taken in Guadeloupe is chosen by only 17% of first year science students. Less than 10% have chosen this photography only. Night falling to 18.30 in Guadeloupe, we exclude hypothesis that students never look at the moon. Then, the question is what they see when they watch the moon. An interpretation taking into account the relationship with reality and the observable can design the Umwelt (Uexküll 1965) of students. Their representation of the moon being built from models and observations when the moon is vertical or slightly tilted: international models used in teaching the phases of the moon, models such as daily diaries, meteorology or cultural product in temperate zones (movies, children's books, various illustrations).

First-year science students describe the temperate seasons much better than seasons of the place they live both in terms of periods of the year (month quoted) and climatic characteristics. The seasons and their roles in the occupation of ecosystems are a part of national school programs (for 11-12 years old pupils) without specifying which seasons are in question. But the occupation of the ecosystems is weakly explained by the seasons in Caribbean zone, compared to ecology data between tropical rain forests to dry forests and mangrove areas (salinity).

Here we seem to face a kind of inverted obstacle in the epistemological sense. It is not the naive observation of nature that makes it more difficult to understand scientific concepts but universal selection of content (examples, models, order of ideas) that explains science taught imperfectly observable in an individual educational setting.

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