SOCIAL REPRESENTATIONS OF FRENCH-SPEAKING UNDERGRADUATE STUDENTS IN HUMANITIES AND SOCIAL STUDIES IN THE USE AND DIFFICULTIES IN LEARNING STATISTICS

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In this paper, we shall present the results of two successive surveys carried out among French-speaking students at the undergraduate level regarding their representations of the training they received in statistics, of this subject matter's academic and professional uses, and of the stumbling blocks encountered while learning it. The first set of data was gathered in 2007-2008 from 666 students. The following year, a more in-depth survey, which included semi-structured interviews, was conducted with 146 other students. Data show that representations of statistics vary according to whether the students are in pre-service or continuing education, and according to their academic or professional experience. In addition, and in accordance with Shaughnessy (2006), results show that statistical education is only as effective as the level that students integrate it into their education project.

INTRODUCTION

If we refer to Zieffler, Garfield, Alt, Dupuis, Holleque and Chang (2008), the literature inherent to the teaching of statistics is crossed by three axes: the cognitive dimension, and particularly mistakes made by students; the affective dimension, and the impact of anxiety on learning; accounts of practices that are often innovating. However, a common issue in these works is that they are conducted within the teacher's perspective. If the type of studies led (Becker, 1996) is assuredly to establish a link with the identity of their authors (Shaughnessy, 1992), they could well give rise to bias, of an *epistemological projection* (Bihan-Poudec, 2008b): whether it be mistakes made by learners, their feelings concerning statistics, it is the latter and the teacher that are often given as *primary* references. Would it not be appropriate beforehand to question the relationships of the student with statistics? Do these correspond to those of the teacher or, on the contrary, do they differ? In other words, do students and teachers *see noon through the same lens*? Several authors argue in favour of paying more attention to learners: Shaughnessy (2006) believes in using as a fulcrum the realizations of students and their way of thinking, "an invaluable source for teaching":

Without such opportunities our students will only learn the surface details of statistics, and we will not have clues about their thinking processes.… They will not have the chance to do statistics, to engage in their own statistical thinking, and we will not learn where they are in the development of their statistical thinking... All we need to do to start the process is to ask, "What do you notice? What do you wonder about? (p. 9-10)

Although well dispersed (North America, Oceania, Sweden), this focus on students more than on their mistakes or their anxiety is interested in the conceptions they have of statistics: Earley (2001), Gordon (1995, 1999, 2004), Petocz and Reid (2001, 2002, 2005), Petocz, Reid, Wood, Smith, Mather, Harding et al. (2007), Reid and Petocz (2002), and to a certain degree, Murtonen (2005), Murtonen and Lehtinen (2003). The constant in these works is to seek to identify the conceptions that students have of statistics, to outline the consequences on learning and to look for solutions. But we can push this logic of focusing on the learner a bit further: even before the teaching of statistics, what are her/his representations of it?

METHOD

Our researches therefore are founded on the learner's point of view. Firstly, we shall recall the results of a survey conducted in 2007-2008 with 666 1st cycle French undergraduate students concerning their representation of statistics; secondly, we shall present a more in-depth survey realized the following year with 146 of their colleagues.

First survey

At the beginning of the university year, students were asked to complete a test on association: "what does the term "statistics" mean to you (use the words that spontaneously come to mind)?". They were also asked to specify the program they were following as well as their previous practice of statistics. The courses followed, if they all stemmed from Humanities and Social Studies were specified: in Sociology (48 students, namely 7.2% of the subjects), in Information and Communication (193, 29.0%), in Psychology (138, 20.7%): for these students it was their first year in the program being considered. As for the other students, they were enrolled in the third year in Sciences of Education, but for the most part had not received any university teaching in statistics: their total number was 287, representing 43.1% of the subjects. Two Quebec colleagues at the University of Sherbrooke, François Larose and Vincent Grenon proceeded with a correspondence analysis applied to a two-way table integrating:

- Elements of discourse (lines),
- Category (program of origin).

    The analysis was realized on two successive tables:

- Forms: elements constituting discourse (words or graphic components),
- Repeated segments (sequences of two or more forms, presented more than twice in the discourse).

    In a first analysis (Bihan-Poudec, 2008a), the following elements emerged:

- It is the students in third year in Sciences of Education and in first year of Sociology/Psychology who determine the central core of the representation;
- Statistics appears as a specialized field (applied) to mathematics…
- Statistics is characterized notably by research in central trends within a sample representative of a population and sources of variation (notions of average and standard deviation);
- It is noteworthy that criteria for daily use of statistics are determined by students from third programs (for example: *National Institute of Statistics and Educational Studies*, scientific process…).

    To this, we can add that the affective dimension regarding statistics is barely present in responses given by students, although it is abundantly referred to in the literature: only 18 subjects for 666 responses, 17 responses with negative content, only one ambivalent (Bihan-Poudec, 2008c). This set of elements prompted us to move further ahead.

Second survey

At the beginning of the 2008-2009 university year, students were asked to respond to a questionnaire. The choice of subjects focused on students in their third year of the licentiate in Sciences of Education, as they had been taught the same content in the statistics course and had the same teachers: they differed essentially only because of their academic path in pre-service education, for 100 of them, or in adult continuing education (46 of them). The questionnaire, consisted not only of the same association test (a) taken previously, but also questioned the students on:

- Their previous experience with statistics that they had to specify (b),
- Their interest for this discipline (that they had to qualify from passionate to putting off) (c),
- Their participation in the statistics course, whether it was optional and the reasons for their choice (d),
- The conception of statistics they had to choose from among several definitions (e),
- Their own definition of this discipline (f),
- The interest that students found in it within the framework of their university studies (g), on the one hand and, on the other, for their career (present or future) (h),
- Lastly, some questions of identification: program followed (i), prior experience (j).

In other words, we are seeking to find out if possible prior experiences (b), be they academic, be they professional practices, determine the representations that students have of statistics. As a social representation (Moscovici, 1976/1961), statistics, therefore, is studied in its three dimensions: information, the field of representation (items a, e, f) and attitude (c, d, g et h).

At the level of the association test (a), mathematics (numbers, calculations, average, percentages….) appear as vocabulary common to students; however, terms relative to the utilization of statistics appear more frequently in adult subjects than in youth (this seems corroborated by their use by adults in reports, surveys, etc., in their places of professional exercise). This, on the one hand, should be refined by an analysis of similitude in the whole corpus (Vergès, 2001), and on the other, by a correspondence analysis of students' programs.

The analysis of the question of statistics as an option (d) is interesting. If the responses fully justify themselves theoretically as *taking a stand* (Doise, 1985), they inaugurate clear partitions to responses to other questions: a very clear difference between the two populations (i) in favour of a follow-up of courses by students in lifelong education and a refusal by those in pre-service education (khi-two of 32,6, threshold 1‰); difference of interest paid to statistics (c) (meaningful to a threshold of 1%); difference with prior practice (j) (khi-two of 32,6, threshold 5%). This prior practice rather influences the decision not to take this course: a finer analysis would be required to distinguish between school or university experience and professional use, the latter therefore favouring the making of a decision to follow the course.

This difference between the lifelong education public and the pre-service education public is just as manifest with regard to judgement of the relevance of statistics in the framework of studies (g) and in their professional life (h). If all adult students estimate that statistics has its place in the program they are following, there are only 72,4% in the case of young students (khi-two of 6,03, threshold 1‰); the situation is analogous for professional use: almost all adults see the usefulness of statistics, only 52% of the young people who responded to the question envisage it (khi-two of 20,5 threshold1‰). The analysis of reasons given will enable us to understand this difference.

CONCLUSION

Subject to more advanced analyses, statistics seem to be a field relevant to mathematics. However, whether students be in pre-service or continuing education, this social representation is not homogeneous: paradoxically, the introduction to the teaching of statistics in French high school programs does not seem to be endowed with an appeal for this discipline; professional exercise and the practice of statistics pertaining to it appear as motors of motivation for this learning, envisaged positively from this moment on. As suggested by Petocz and Reid (2005), the teaching of statistics is not to be taken as such but in synergy with the student's project. It is at the level that the student finds in statistics a solution to her/his problems, in short, in a *problem situation* (Bihan-Poudec, 2008; Fabre, 2006), that learning in its affective and cognitive dimensions becomes veritable. Lastly, the context is therefore not all the conditions present in reality, but resides in the manner in which the individual apprehends it.

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