

Teaching Statistics in Non-Statistics Faculties

*L’Insegnamento della Statistica nei Corsi di Laurea di Sociologia,
Scienze della Comunicazione e Relazioni Pubbliche*

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Riassunto: Il dibattito sulla didattica della statistica vanta ormai una tradizione pluridecennale e i contributi presenti in letteratura testimoniano questo interesse (Ottaviani, 2003). In un importante contributo (Batanero, et al., 2000) gli autori evidenziarono come il dibattito dovesse riferirsi ai modelli psico-pedagogici dell’apprendimento, necessità sottolineata successivamente anche da Jolliffe (2003) con riferimento alle teorie di “teaching and/or learning”. Nel presente lavoro le proposte di ri-organizzazione didattica di un corso introduttivo di statistica rivolto a studenti di Corsi di Laurea in cui la Statistica rappresenta quasi un’eccezione per il suo contenuto matematico-formale, sono basate sulle teorie psicologiche di apprendimento degli adulti, ossia sulla cosiddetta andragogia.

Keywords: Statistical Education Research; Andragogy; Activity-based learning.

1. Introduction

It often happens at university that some statistics instructors teach basic statistics or data analysis courses in non-statistics faculties. Especially when they are teaching to students of Sociology, Communications or Public Relations (S&C&PR) faculties they (the instructors) wonder about ways and contents of courses to offer. Several elements underline the need of revising the traditional statistics course in these faculties. Because of cultural interests, beliefs (about themselves and learners) and attitudes, students of S&C&PR faculties show a different way to face quantitative courses in comparison with colleagues studying at Statistics or Economics faculties. The first group often comes to their statistics class with the preconception that statistics is confusing, dull and having nothing to do with their interests. They commonly seem to be less comfortable with mathematics or more generally with subjects full of logical and mathematical formalism. In their curricula studiorum the basic courses also represent the only opportunity to know statistical methods. Despite the involvement of instructors in making the statistics course friendlier, treating formal derivations as secondary in importance, student’s dissatisfaction with the statistics course is still high.

Over the past twenty years much has been written not only about reasons of this dissatisfaction (Murtonen, 2003 and Bulter, 1998), but chiefly about the introductory or service course in statistics (often the one and only statistics course taken by students who are not majoring in this discipline). In recent years many statisticians are involved in a *reform movement* for statistical education. This reform is described in term of

changes in content, pedagogy and technology. The discussion has emphasised the *statistical thinking*, as a main aim of a basic course: "...introductory course cannot make novice students into expert statisticians, it can help students develop statistical thinking, which they should be able to apply to real world situations" (Garfield et al., 2002).

The aim of these notes is to apply the general discussion on statistics education to the specific cases of S&C&PR faculties, considering suggestions from published research. In addition, we hope to encourage interaction and collaborative research among introductory statistics teachers in the above mentioned faculties. As the reform movement took into account also guidelines for teaching introductory statistics, we present (section 2) a short description of psychological learning theories, considering the student as an adult learner. Therefore the categories of andragogy should replace those of pedagogy. Moving from the fundamental issues of the theory of adult learning, in section 3 some proposals for teaching statistics in no-Statistics faculties are given.

2. Theories of adult learning behaviours

Among learning theories we can mention four main models (Antonietti, 1998). According with the first model, known as *association model*, the learning process goes on through associations made by the brain, completely empty at the starting point and then filled in step by step by simple experiences linked each either by similarities, contiguities and concomitances. A second model (*field model*) says that the learning process doesn't proceed matching the successive links in the chain, but it happens whenever the learner grasps the meaning of the entire field structure he is facing and the connections among the different field elements. The third model (*discovery model*) was strongly approved in literature. According to this model the learner is invited to be an active part of the learning process, becoming a knowledge re-constructor. The learner is invited to go again over the stages that brought the scientists to different knowledge. In this case we can speak of *pedagogic activism*, through an individual re-discovery track. Moving from real examples and actual cases, the learner is stimulated through an inductive process to find out principles, regularities, symmetries, and differences. Not always however it occurs that learners show a positive and receptive behaviour towards discovery (in particular for people who are no more very young). The *constructional model*, therefore, suggests a teaching-learning process starting from well-known phenomena to which "anchoring" information and concepts that will be later developed in order to achieve the understanding of more complex cases. In this theoretical overview, the andragogy (the academic discipline that reflects and researches the education and learning of adults) plays an independent role. The above four models can be indeed differently suited for an adult-learner (as the students at the university, even if in their first stage of adulthood) or for a child-learner. Table 1 shows the main differences between pedagogy and andragogy given by Knowels (1980). This is useful for taking into account the strong different way of learning between an adult-learner and a no-adult learner. By Knowels the adult learning is a self-directed: it should be experienced by learner and not by teacher. A relevant implication for practice in teaching experience flows from the above differences: adults are more deeply motivated to learn those things they need to learn. From that the first of the principles of teaching derives: to help learners to experience the feeling of dissatisfaction about the distance between where

they are and where they would like to be, stressing the “new possibilities for self-fulfilment” (Knowels, 1980).

Table 1: *Main differences between Pedagogy and Andragogy*

Regarding	Pedagogy	Andragogy
1 Concept of the learner	Dependent from the teacher	Autonomous and self-directed
2 Role of learners' experience	No or little experience	Experience becomes a rich resource
3 Readiness to learn	High and without boundaries	Focused upon the needs and to satisfy a real-life tasks or problems.
4 Orientation to learning	Subject-centred and useful only at a later time in life.	Problem-centred and of immediate value.

A useful diagram showing adult learning process is the Lewinian Experiential Learning Model, later developed by Kolb (1984). Learning is conceived as a four-stage cycle. Immediate concrete experience (stage 1) is the basis for observation and reflection (stage 2). These observations are assimilated into a “theory” through an abstract conceptualisation (stage 3) from which new implications for action can be deduced (stage 4). These implications then serve as guides to create new experiences. It is therefore very important that teacher helps learner to feel the need of learning through concrete experience, leveraging on emotional, unconscious and rational aspects. It should also be admitted that andragogy has been recently object of a lively debate (see, for example, Rachal, 2002) receiving also some critiques, as the emphasis on real needs and actual learner's experiences. A wide agreement recognises that andragogy is not a theory able to explain how and why people learn, but it is nevertheless a good tool as a guide to teaching adults and its effect is very praiseworthy. Teaching adults is therefore object of our study. The above showed theories act as starting point for developing the next paragraph: the weaknesses of traditional courses (very low interest for the statistical subject, lack of coherence between course's topics and future job activities) pointed out by students through the course evaluation questionnaires are considered by the light of these theoretical frameworks.

3. Experiences, practical suggestions and concluding remarks

Considering the reasons for revising a basic statistics course indicated in the previous paragraphs, we suggest the following for service courses offered in S&C&PR faculties.

- 1) Introduce statistics using one or more real life examples, based on learner's every day life in order to stimulate their motivation to learn (according to andragogy and constructional model) orienting them towards a path of discovery approach (discovery model). Books problem-oriented, with a lot of examples, are highly evaluated by students.
- 2) It is worth to insist on the importance of statistics, illustrating that statistical thinking is in fact, even if unconsciously, present in the mental processes of the learners.
- 3) As emotions can also stimulate the students, seminars given by managers of well known companies, explaining the added value of showing basic statistical skills on the job place, can on one hand inspire students to follow this advice and on the other hand develop a stronger interest for subjects that are not part of the major. The success of such initiatives is underlined by the growing number of students who asked for final dissertation in statistics.
- 4) Keeping in mind that the learning process starts from the experience, move to reflective observation (asking questions to which statistics can give

an answer) stimulating arguments, participation through the solving of exercises or case-studies linked to the real student experiences (following this approach we observed lower drop out rates during the first weeks of calendar course). 5) Manage the answers with an orderly outline using the association model: during the abstract conceptualisation don't neglect the linking to examples and experiences mentioned by students. At this step it could be powerful the use of analogies and of humour in the statistics classroom. 6) According to the last stage of the experiential learning model, propose to the class individual or team project-work. Trying to apply the concept of pedagogic activism, a recent educational experience showed the added value of incorporating an interdisciplinary laboratory (integrating contents of the four main courses of the third academic year) for empirical research (social survey) into statistics course at the Sociology faculty. Third year students of Communication major made another similar experience. They leaded group project-works on topics of their interest, some of those linked to thesis's topic. Each group collected and analysed quantitative data with Excel, writing a report showing step by step the project. The same topic was surveyed using a qualitative approach, following the guidelines given by colleagues of Sociology. The final results were presented to the other groups and to the teachers. 7) Use finally the field model to conclude the experiential learning process, with a final lecture helping the students to put every stage into an overall logical-theoretical frame. In order to do that, it is necessary that students carry out their assignment at least one week before the end of the course. Most of the mentioned experiences showed a positive impact on the course effectiveness: a larger percentage of satisfied students about items on motivations, interest, links to other subjects and global satisfaction. Larger quote of students sitting and passing the exam in the first session after the course, was also observed. In this paper we gave only suggestions for teaching activity. We think that the contents, the choice for "no-false-panic" course titles and the coordination among colleagues should be further discussed.

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