Liliana Tauber (2001). *La construcción del significado de la distribución normal a partir de actividades de análisis de datos* [Building the meaning of normal distributions from data analysis activities]. PhD. University of Sevilla. Supervisors: Carmen Batanero and Victoria Sánchez.

In this research we are interested in the teaching and learning of normal distributions in an introductory data analysis course. The research is based on a theoretical framework where two different dimensions (institutional and personal) of meaning and understanding are considered for mathematical objects. We are interested in the following questions:

1. What is the institutional reference meaning of the normal distribution in a traditional introductory course of data analysis? In Chapter 4 we describe an empirical analysis of 11 University textbooks, from which we determine the main elements of meaning (problems, practices to solve these problems, representations, concepts, properties and types of arguments) that are presented in these textbooks in relation to the normal distribution.
2. How should the teaching of normal distribution be organised to take into account the use of computers? A teaching sequence of the normal distribution, which takes into account the result of the previous analysis and which incorporates the use of computers is described in Chapter 5. The main differences introduced by the use of computers as regards the reference meaning and the student's predicted activities in the different tasks are analysed.
3. What difficulties arise when developing this teaching? In fact, how is the teaching carried out? The observation of the teaching sequence in two successive academic years (1998-99) (1999-2000) and the interactions between the lecturer and the students in the different sessions are analysed in Chapter 6. The main points of difficulty and change predicted in the teaching are described.
4. How does the teaching work for students? What are their difficulties? What do they learn? (evolution of personal meaning along instruction). A total of 117 students were sampled. In each session the students, working in pairs, produced written documents with their solution to open-ended tasks. These documents were analysed to identify correct and incorrect elements of meaning that students used in their solutions. The progression in learning was clear as regards the theoretical concepts and use of software, and less general as regards the methods of solution or real data analysis activities.
5. What is the students' personal knowledge after teaching? We used two different instruments to assess students' learning: a) a questionnaire; b) a data analysis activity from a new data file to be solved with the use of computers. The data analysis showed that the majority of students were able to understand isolated concepts associated with the normal distribution (on average each student gave 70% of correct answers in the questionnaire). On the contrary there was a great difficulty in integrating these elements to solve real data analysis problems (only 40% of students succeeded in the open task). We conclude that data analysis is a high level activity which is difficult to teach in the time available for an introductory course, and that the main aim in these courses should be to train "users of statistics". Finally to complement our work, we compare the main differences in learning between students with and without previous statistical knowledge.