PROBABILITY AND STATISTICS IN ELEMENTARY SCHOOL: A RESEARCH OF TEACHERS' TRAINING[1]

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This project is based the epistemological reflection of the teacher about the stochastic' ideas in elementary education. It considers the European term stochastics meaning "probability and statistics". Throughout the study of mistakes and difficulties in learning and experiencing situations that permit the reflection about stochastics, the teaching and resources' methods and its practical use, the teacher will find different ways in its pedagogical practice to widen its professional development. In this world of information that we live, it's important to have the knowledge of the probability of facts to make decisions, to do forecasts and to acquire more ability to think about the uncertainties, because more and more the population has more access to social and economical issues on which the graphics and tables provide the survey results. So, based on these facts, our project has a main question. Which transformations the process of reflection about teaching of statistics and probability will bring to the training and practice of teachers? To answer this question, we are developing a qualitative research, defining the category in analysis of the empirical material, for the analysis of the interviews, the videos and the reports of the participant teachers. There are five teachers and two group coordinators participating in this research. The group has been working for two years and so far the results are very significant. We believe that the conclusions of this project will present relevant contributions not only for the research in statistics education, but also for the practice and development of the teachers.

INTRODUCTION

When considering the world changing fast, a world of information, like the one we are living, it´s important to have the knowledge of probability of facts to make decisions and to do forecasts. In the same way that it becomes earlier the access of the population to social and economical issues in which tables and graphics synthesize surveys; indexes are compared and analyzed to defend ideas.

We consider relevant that the teaching of Probability and Statistics becomes part of the Mathematics curriculum in the Elementary and Children's Education, because it helps the student to develop the ability of collecting, organizing, interpreting and comparing data to obtain and support conclusions, which are the basis of the performance of a scientific attitude. Students, as well as teachers, should really think critically over the statistical and probabilistical concepts and not simply use them as a mechanical tool. It's the schools' role to provide the student, since Kindergarten, the formation of statistical and probabilistical concepts that will enable them in the exercise of their citizens. Because, for the person it's not enough to understand the percentage exposed in statistical indexes, like the population growth, inflation taxes, unemployment, among others. It's necessary that he knows how to critically analize/relate the presented data, even questioning/pondering its truth.

When developing the Master´s project, we chose for the emphasis in the curriculum and we abandoned the experiences and contacts done with the subject in the Children´s Education and in the graduation of the teacher. The theoretical reference made us use the term stochastics

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when we were referring to the teaching of Statistics and Probability in a inter-related way, since worldwide researches in this area have been recommending an inseparable job of these two subjects. Davis and Hersh (1988) consider that the stochasticsation of the world means to adopt a point of view in which the uncertainty, luck or probability, is admitted as a real aspect, objective and fundamental. At this, thinking in this Doctor´s Degree job, we considered the importance in focusing the teaching of the stochastics in Children's Education, considering the education and the pedagogical practice of the teacher.

Starting with our Master´s research and our experiences with the teaching of Statistics, we came up with issues that directed and motivated us to elaborate this project with the purpose of broaden our vision in the teaching of the stochastics and contribute, so that it can become a reality in the courses of Brazilian Basic Schools (Lopes, 1998).

CHILDREN´S EDUCATION AND THE TEACHING OF STOCHASTICS

Children's Education has become, in the past years, an area of concern and interest of educators and researchers, who want to produce an educational work. Nowadays, in Brazil, children that go to our schools, in this level of scholarship, are from zero to six years old. Moura (1995) considers that the purpose of the education of children younger than six years old consists not of accelerating, but of broadening children's development. For this reason, she says it's necessary to consider the child's possibilities, its interests and tendencies, having in mind that the child has not only to get prepared for life, but it is already living. In this scenario, the Mathematics have been justifying for the necessities of the own children to build and create knowledge, develop the imagination and creativity, as well as, for a social necessity of getting use of them for their lives in this world. Faster and faster it's being required different abilities and mathematical competence to people.

Fischbein (1975) says in his work that the teaching of stochastics should happen since the Children's and Elementary Education, that this work is not only possible but also necessary, having in mind that the lack of this subject makes possible for people to get used to wrong intuitions. We believe that the development of the statistical and probabilistical thought, which should be inserted in the school context, may present important contributions for the growth of this child. Making experiments that involve the guesses and estimates, as well as, the act of collecting, representing and analyzing data that may be important and inserted in his context can broaden his universe of competences and increase his creative potential.

The National Curriculum Reference for Children's Education published by MEC (1998), considers that children have and may have much experience with the Mathematical universe, what enables them to discover things, relate others, start organizing the logical thinking and finding his space. These criteria are highlighted: identify the notions that children have; select the contents and, makes it useful in classroom actions.

Although it shows these topics, we are surprised that such a referential doesn't incline for a work that develops the stochastical thinking. While developing our Master's research, we studied some Mathematics international curriculums, in which we noticed recommendations and orientations of the teaching of Statistics and Probability since Children's Education.

Considering that the solving of problems with experiments can trigger in this level of learning, the development of the stochastical thinking, necessary for the student because it helps him in the capacity of critical analysis ands subsides for making decisions, facing the uncertainty of the everyday life. It is necessary to think in Mathematics for school that provides more and more investigation, reflection and creativity, breaking up with the determinism that predominates in the curriculums of this subject, and more in accordance to the determinist thinking, which inhibits the idea of movement and changes. This emphasis if it's given since Children's Education, can help the growth of a student that thinks more comprehensively about the different issues and establishes accordingly strategies and techniques for the solving of problems that happen in his life.

Shaughnessy (1992) criticizes the delay in the changes of the stochastics teaching and mentions Garfield (1988) that presented four aspects for the block of the effective stochastics teaching as the role of probability and statistics in the curriculum; the link between research and instruction; the preparing of Mathematics teachers; and the way in which the teaching nowadays is being accessed. Unless the stochastics starts in the main courses of our schools in a extended way, the number of people who research in this area will still be small. It's highlighted that the researches in Statistics education have been explaining the importance of the adoption of this system in our schools, because people will use it a lot in different areas of knowledge, independent if we are teaching them or not.

EDUCATION OF TEACHERS, MATHEMATICS EDUCATION AND STATISTICS EDUCATION

If we consider the necessity of educating students who are used to think stochastically, it is needed to re-think the role of the teacher in the teaching/learning process. Many researches like, Godino, Batanero, and Flores (1998), point to difficulties that exist in the education of teachers in stochastics as one of the main difficulties to succeed. According to them, we can't reduce to the development of the conceptual structures and tools for the solving of problems, but also to guide students in a way that they build ways of thinking and a solid system of correct intuitions. Besides these issues related to a specific content, the participation of the teachers as Mathematics educators should also be with the attention in the consciousness of the political action involved in their pedagogical practice. According to Kincheloe (1997), acting like that, teachers legitimize certain beliefs and not others.

For the teaching of Mathematics to contribute in the efficacy of this fact, maybe it's necessary to develop a significative Mathematics, in which we consider its role in the students lives, develop positive attitudes to the discipline, enable pedagogical space that contributes to the process instead of the fact, the ideas instead of the techniques, that proposes a great diversity of problems involving other areas or even internal areas of Mathematics. It's important that students face different problems in their real world and that they have the possibilities to choose their own strategies to solve them.

We believe it's necessary that we, teachers, encourage them to socialize their solutions, learning to listen to criticism, to appreciate their own jobs as well as the other students'. In this context, the work with probability and statistics can be of great contribution, having in mind its natural problems, helping the enrichment of the reflexive process. The work with stochastics in the classroom must promote discussions and reflections to solve a problem-situation which was asked by the students or instigated by the teacher. The teacher should promote, all the time, the debate, keeping opened the "dialogue channel" with students. Such behavior is fundamental to develop the "democratic attitude through Mathematics education" (Skovsmove, 1990). Paulo Freire (1997) also considers that the production of the knowledge with criticism should be a unique work with teacher and student; that to think right, surpassing the naive thinking, needs to be built by the student himself with the teacher and his partners.

To develop an attitude of respect to the knowledge that the student brings to school, acquired in his cultural environment, involves the discussion of subjects like; the pollution of the rivers and seas, the low levels of the well-being of different peoples, the abandon of the public health system, the assistance policies, strikes, unemployment, among others. These are subjects present daily in newspapers, television or magazines. It's obvious that the level of the knowledge of each one of them must always be taken into account and must consider and respect the age in which you are developing the studies.

THE PROBLEM AND THE OFFERED RESEARCH

We believe that to develop the teaching of stochastics, the teacher will need, besides to updating and building his own knowledge about the subject, think about how much he avoids the determinism, in the same moment that he will visualize the fact that we live in a world that is simultaneously stochasticzed and determinist. Besides that, according to Godino, Batanero, and Flores (1998), "an important point in the plan of developing the teacher about a specific

Mathematical subject is the deep reflection about it, yet that can help teachers to understand their role in Mathematics and other subjects, their importance in the development of the students, as well as their difficulties in using the concepts to solve problems".

This deep reflection becomes essential when talking about stochastics. Because this subject can be difficult to teach due to special characteristics, as well as to explore wider questions having analyzed data, like to make judgments of worth over the appropriate models to work the data. But, mainly, through the process of reflexion over controversial ideas, like the bad luck and the casuality. The teacher faces a bigger challenge in the process of acquisition of this knowledge, because he is the one to give opportunities for the students to explore questions and ideas that involve the statistical and probabilistical thinking. We believe that when creating his didactical situations he can also build knowledge, what possibly influences his practice. It puts us in this question: *Which alterations a process of reflection over the teaching of Statistics and Probability can cause in the professional development of teachers that teach Mathematics?* This research has as a proposal, the analysis of the knowledge of teachers about Statistics and Probability of teachers from Children's Education, as well as, possible changes happened from an intervention process. We consider the following questions that come from the central question as part of the development of this research:

1. What is the didactical knowledge around Probability and Statistics that the teacher has elaborated?
2. How does it reflect over the fundamental stochastical ideas?
3. How does a didactical reflection and the reflection over this content happen from an intervention that involves discussion meetings, follow up and analysis of the classes?
4. Which influences this intervention have over your practice in the classroom?

We believe that such questions can help us in the constant moments of review of the project, allowing the presence of the focus in our main question. To answer this question, we developed a qualitative research because we understand that the collecting of the descriptive data - obtained in the direct contact of the researcher with the situation studied - emphasizes more the process than the product and worries in telling the perspective of the participators (Lüdke & André, 1986).

Our choice of getting closer to the perspective of the participators of the research requires that we combine many methods of collecting of data. We are going to use interviews with the participant teachers to obtain their considerations about the teaching of Stochastics, because, given the nature of the analysis of this research, it becomes essential to the verbal impression of the educator according to the subject. We are going to register in video the meetings done with the teachers, and we are going to ask for them the composition of the reports about their practice. About this issue, Lüdke and André (1986) consider that: "While other tools have their destiny sealed in the moment that they leave the hands of the researchers that created them, the interview gets life when we initiate the dialogue between the interviewer and the interviewee" (p.34).

In the beginning of last year, a group of studies and researches about Statistics and Probability in The Children's Education (GEPEPEI) was created, composed by five teachers and two course coordinators of Children's Education of a private school in Campinas. This group meets every fifteen days to study the theoretical reference about the topic, plan and discuss activities of teaching for classes and analyze the development of the students facing these activities. We collect data (observations, interviews, registers) and we are analyzing according to categories built from the reflections about the material, considering the fundamental role that the theory has on this building process.

CLOSING REMARKS

We are analyzing the data collected in two different steps. In a first step, the one referred to interviews and to the initial meeting, at first apart and then crossing the analysis with the intention of defining regularities about the teachers' elaboration. The second step of the analysis considers the data referred to the written and videotaped reports of the meetings and of the

reflections over the usage in the classroom of the activities prepared by the teachers. It also considers the elaboration of the activities and the report of the teacher's practice. We believe that it presents important contributions to the investigation about the pedagogical practice and the development of the teachers who teach Mathematics. It brings considerations about the process of the professional development of a group of teachers when teaching and learning the basic notions of Statistics and Probability in Children's Education. It also has to contribute a lot to the researches on Statistics Education that emerge timidly in our country, in the elementary school.

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