ICME 11 Mexico 2008
11th International Congress on Mathematical Education

Probability Teaching in Basic Education Brazil: Assessment and Intervention

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Structure

- Pedagogical workshop
  - Teachers professional profile
  - Prior knowledge
  - Conditional probability
  - Theorem of Bayes
  - Geometric and Frequentist probability
- Final considerations

I could start talking about the

- importance of teaching probability, of probability reasoning, of the difficulties the teachers have on teaching Probability, but due to our time being limitated, I'll start talking about some action taken in order to improve probability teaching in Brazil such as the pedagogical workshop carried out by our group.

In Brazil, great efforts have been made in order to improve and develop professional knowledge of mathematics teachers who teach probability:

- Workshops and articles in conferences, as "Encontro Nacional de Educação Matemática";
- "Revista do Professor de Matemática", "Educação Matemática em Revista";
- Groups of Research in Statistics and Probability-GT12;
- Master and PhD grade theses in the programs of post-graduation in mathematics education;
- Several researchers offer special pedagogical workshops on such topics.

Objectives

In this work our aim is to contribute to these studies, by describing a workshop developed with a group of basic education mathematics teachers of Lavras, Minas Gerais.

We expect to

These actions reflected into the teaching of probability in Basic Education

Pedagogical workshop

Teachers professional profile

- We’ve first sampled 30% of all the schools in Lavras, with an equal ratio between public and private schools;
- Following, we’ve sampled 25% of all mathematics teachers in the city ;
- And then 30 teachers were finally selected: 21 from grade II of elementary schools (students between 11 and 14 years old) and 9 from secondary schools (between 15 and 18 years old) ;

- Before the start of the workshops, we've made a brief evaluation of the teachers' professional profile; we've found:

  - An average period of professional experience of 14 years ;
  - Most of them attended statistics and probability courses during their studies;
  - They did not have any specific training for questions related to the teaching of these concepts .

- The workshop was carried out in three meetings of 4 hours each, divided into theoretical and practical parts;
- In this work we are relating just the last meeting, entitled "Influence of previous knowledge in a Bayesian approach";
- The themes were Prior information, probability (classic, geometric, frequentist and conditional probability), and the Bayes' theorem.

Pedagogical workshop

Prior knowledge

When planting a coffee farm in South Minas Gerais, what is the probability of it to succeed?

And what is the probability of it to succeed if this coffee farming were carried out in Bangladesh?

Pedagogical workshop

Conditional probability

First didactic sequence

Table 1. Gender and kind of school of the teachers of Grade II, Elementary School.

School	Gender	
	Female	Male
Public	3	14
Private	4	13

a) being male, b) coming from public schools, c) being a female working at a public school, d) being a male or someone from a private school, e) coming from public schools if she is a female.

To debate each didactic sequence we've used the following methodological procedure:

- Initially we've discussed the problems and asked the teachers for solutions;
- We've assessed the solving strategies developed by the teachers, initially without the use of formulas;
- We've formalized the concepts;
- At last, we've promoted some others discussions with the teachers.

Second didactic sequence

- Given that the die lands on a number bigger than 3 (event A), what is the probability that it lands on an even number (event B)?
- Given that the die lands on a number lower than 3 (event A), what is the probability to get an even number (event B)?
- In theses situations, are the events A and B dependent or independent?

Pedagogical workshop

Theorem of Bayes

Table 2 . Results of the pregnancy proof for 300 women. Source: Cazorla (2001).

Pregnant	Diagnosis		Total
	Positive	Negative	
Yes	216	24	240
No	18	42	60
Total	234	66	300

Considering these data, and given that you have a positive result, what is the probability of that finding to be wrong?

Third didactic sequence

- Here we've presented a new problem: The breast cancer problem (Pena, 2006), with the difference that the data were not presented in a cross table but in a verbal form;
- Most of the teachers did not reach an acceptable answer, the biggest trouble being to organize the data in a cross table.
- So, our intervention was needed for solving this question.

Pedagogical workshop

Geometric and Frequentist probability

To start a discussion about the concepts of frequentist and geometric probability, we've given the teachers the following questions:

A person tries to hit a circular target of a radius of 40 cm, with another in the center of a radius of 10 cm, with the eyes blinded. If in a certain attempt the person hits the main target, what is the probability that he/she has hit also the central circle?

What is the probability of a car being stolen?

- The concept of geometric probability can be characterized by the fact that some probability problems are equivalent to the random selection of points within sample spaces represented by geometric figures (Tunala, 1995).

- When the mathematical value of the probability emerges from the process of experimentation, characterizes the so called frequentist probability.

Fourth and Fifth didactic sequences

- We've applied the fourth didactic sequence about Classical problem of Buffon's Needle (Tunala, 1995), in which we use geometric and probabilistic concepts to estimate the value of π ;
- And the fifth didactic sequence in wich we've applied the problem of "the spaghetti"
- Results: Geometrical probability = 0.25 and Frequentist probability = 0.67;
- Besides, we've explored related themes, such as estimates, variability of small samples, and simulation processes.

Final Considerations

- The activities can be incorporated to the practice in the classroom.
- Some teachers also recognized their initial difficulties in understanding various concepts (for example: conditional probability and independence of events).

- We’ve detected the need of following-up these teachers at school in order to verify students’ reactions to this kind of activities.

- Although we’ve perceived a positive evaluation of this work, we see the necessity of planning more pedagogical workshops.

- It is necessary to emphasize the importance of projects of continuous formation in probability directed to reinforce mathematics teachers.

- We consider this experience as a central project with real possibilities of expansion to other towns of South Minas Gerais.

Thank you very much