ABSTRACT OF THE DISSERTATION

Investigating Elementary School Students' Reasoning about

Distributions in Various Chance Events

by

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Data and chance are two related topics that deal with uncertainty, and statistics and probability are the mathematical ways of dealing with these two ideas, respectively (Moore, 1990). Unfortunately, existing literature reveals an artificial separation between probability and data analysis in both research and instruction, which some researchers (Shaughnessy, 2003; Steinbring, 1991) have already called attention to. In a response to the calls from other researchers (e.g., Shaughnessy, 2003) and recommendations from the National Council of Teachers of Mathematics (NCTM, 2000), this dissertation focused on the notion of distribution as a conceptual link between data and chance.

The goal of this study was to characterize a conceptual corridor that contains possible conceptual trajectories taken by students based on their conceptions of probability and reasoning about distributions. A small-group teaching experiment was conducted with six fourth graders to investigate students' development of probability concepts and reasoning about distributions in various chance events over the course of seven weeks. Each student also participated in pre- and post-interviews to assess their

understandings of probability concepts and probabilistic reasoning. The retrospective analysis of eleven teaching episodes focused on children's engagement and spontaneous understandings in the context of the tasks designed to support them.

This study details the landmark conceptions and obstacles students have and the opportunities to support the development of probabilistic reasoning and understanding of probability concepts, such as equiprobability, sample space, combinations and permutations, the law of large numbers, empirical probability, and theoretical probability. Consequently, the results of this study yielded two major findings. First, students' qualitative reasoning about distributions involved the conceptions of groups and chunks, middle clump, spread-out-ness, density, symmetry and skewness in shapes, and "easy to get/hard to get" outcomes. Second, students' quantitative reasoning arose from these qualitative descriptions of distributions when they focused on different group patterns and compared them to each other. In addition, this study showed that students tended to rely on causal reasoning about distributions relevant to real life contexts. They also often provided deterministic and mechanical explanations when investigating random events generated by a physical apparatus.