CHILDREN'S PROBABILISTIC REASONING WITH A COMPUTER MICROWORLD

A Dissertation

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ABSTRACT

This dissertation investigated children's probabilistic reasoning during a two-month teaching experiment. As part of the research process, the researcher developed a computer microworld environment, *Probability Explorer*, for children's explorations with probability experiments. The design of the microworld is based on a constructivist theory of learning, design of mathematical computer microworlds, and research on students' understanding of probability and rational number concepts. Two major features in the microworld include a dynamic link between numerical, graphical and iconic representations of data that are updated simultaneously during a simulation, and the ability to design experiments and assign probabilities to the possible outcomes.

The teaching experiment was conducted with three nine-year-old children. The children participated in 10 hours of teaching sessions using the microworld. Each child also participated in pre- and post- task-based interviews to assess their reasoning in probabilistic situations. Each teaching session was videotaped, and computer interactions were recorded through internal mechanisms to create a video, including children's audio, of all actions in the microworld. These tapes provided the basis for analysis and interpretation of the children's development of probabilistic reasoning while using the microworld tools.

The individual case studies detail the children's probabilistic reasoning during the pre-interview, teaching experiment, and post-interview. After extensive coding, several themes were identified and discussed in each case study. Some of the major themes included: understanding and interpretation of theoretical probability in equiprobable and

unequiproable situations; theories-in-action about the law of large numbers; and development of part-whole reasoning as it relates to probability comparisons, *a priori* predictions, and analysis of relative frequencies.

The children's development of probabilistic reasoning and their interactions with the computer tools varied during the study. The children employed different strategies and utilized different combinations of representations (e.g., numerical, graphical, iconic) to make sense of the random data to enact their own theories-in-action. The results from this study imply that open-ended microworld tools have the potential to act as agents for children's development of intuitive–based probability conceptions. Dynamically linked multiple representations and flexibility in designing experiments can facilitate an exploratory approach to probability instruction and enhance children's meaning-making activity and probabilistic reasoning.