

THEMATIC WORKING GROUP 5**STOCHASTIC THINKING**

Theme:

STATISTICAL THINKINGRolf Biehler

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1 Statistical Thinking

The papers of this subsession are concerned with statistical thinking. Wild & Pfannkuch (1999) have developed a comprehensive framework for describing and modeling statistical thinking. The paper of Wild & Pfannkuch is at the same time a research & developmental program encouraging more detailed studies and design activities that will support aspects of statistical thinking. The papers of this subsession focus on important aspects such as averages (Batanero, Merino & Diaz), critical sense in graphing (Monteiro & Ainley), solving strategies that students have developed in open statistical tasks (Carvalho) and a paper putting into question assumption of what we might consider as statistical and stochastic thinking. This latter paper of Herman Callaert is a bridge to the subsession on stochastic thinking.

The paper of Batanero, Merino & Diaz discusses students' understanding of averages. The design and analysis of the test was based on an epistemological analysis of the meaning of average on the basis of a theoretical approach towards meaning of mathematical concepts. Compared to previous research a more comprehensive meaning analysis was performed and the multivariate statistical analyses of student responses suggest interesting multifactorial structure of understanding. In the discussion, it was suggested to include even more complex and authentic tasks in which students have to use and interpret means in the context of data analysis. The student responses were classified to make them analysable by statistical methods. It would be interesting to analyze the open responses that partly ask for reasons for their choices from the students. The authors plan this in the next step.

The paper of Carvalho reports about a complex teaching experiment where collaborative peer learning in statistics was a major focus. The educational goals did not only consist in cognitive goals but also included affective ones. The paper reports on the results of a test that was given to the students in this larger project as part of ongoing research. The tasks were partly open and "unusual" for the students in the sense that they had not learned clear guidelines and rules to attack these tasks. The tasks are also related to averages and to problem related choices of averages such as between mean and median. The context was partly related to social contexts with salaries so that students brought in extra-statistical knowledge to the task. Algebraic

and arithmetical strategies were identified and Skemp's framework of relational and instrumental knowledge was helpful for analyzing the written responses and the video data. In the discussion, the interesting open student responses were debated. A further analysis that also uses and develops more specific categories from statistical education and thinking was seen as promising.

The paper of Monteiro & Ainley discusses how to develop critical sense in graphing. School knowledge and media knowledge related to graphs are important to relate to each other. The paper refers to relevant literature with regard to statistical literacy and sense making of graphing. Within this framework results of a study with students are presented who were asked and interviewed with regard to relatively complex media graphs in relevant subject matter contexts: fertility rates & contraception) on the one hand and deaths in road accidents on the other. The analysis of interviews resulted in interesting aspects that were relevant in stimulating students' critical sense of graphing such as the nature of the graph, the questions asked, and the relevance of the data content. It seems that tasks that move the students to an enquiry context related to the data are more promising.

The paper of Callaert is more related to stochastic thinking and develops alternative explanations to some of the findings that Dave Pratt (2000) has presented and that are related to the well-known "equiprobability bias" and the "representativeness heuristics". An interesting thought experiment consists in relabeling the sides of dice and other random generators and posing the tasks in this different shape. The theoretical analysis is plausible and it would be interesting to test these new devices and the hypothesis that some of students' biases and problems will disappear or transform themselves in these new contexts.

All the papers stimulated vivid discussions that showed statistical education as a living discipline.

REFERENCES:

- Pratt, Dave (2000) Making sense of the total of two dice. *Journal for Research in Mathematics Education*, 31, 602-625.
- Wild, C. J., and Pfannkuch, M. (1999), "Statistical Thinking in Empirical Enquiry (with discussion)," *International Statistical Review*, 67, 223-265.

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