STATISTICAL THINKING AS A FUNDAMENTAL TOPIC IN TRAINING THE TEACHERS

Ernesto Sánchez and Ana L. Blancarte
Departamento de Matemática Educativa, Cinvestav, México
esanchez@cinvestav.mx

FUNDAMENTAL IDEAS

The mathematics curriculum published by the Mexican Ministry of Education for middle school (SEP, 2006) suggests that statistics be taught through "data handling". The fundamental objective is that students should, through problem solving, acquire knowledge and skills to: 1) interpret and transmit information by reading, describing and drawing absolute and relative frequency tables, 2) draw and interpret graphs, 3) compare the characteristics of two or more data sets about a phenomenon through central tendency measures and 4) design experiments.

To teach these topics however, teachers usually propose for their students tasks without a meaningful context; this means that the tasks are not directed at solving or answering any statistical research problem. To overcome this teaching method, we suggest that teachers must be well informed about the importance of developing statistical thinking in their students (Wild & Pfannkuch, 1999). Therefore, we think that the features of statistical thinking should be an integral part of the formation and training of teachers.

At the middle school level in particular, the five stages of statistical thinking from the second dimension of Wild and Pfannkuch's model (recognition of the need for data, trans-numeration, consideration of variation, reasoning about statistical models and integrating statistics with context*)* should be part of the basic knowledge that teachers need to develop in their students through the design of their teaching lessons. Also the Problem, Plan, Data, Analysis and Conclusions (PPDAC) cycle (dimension 1) helps in a significant way in lesson planning since it provides a scheme for organizing teaching tasks. In this short presentation we will comment on a research project within a teachers' development program in order to reflect on how to train teachers in fundamental statistical ideas.

THE STUDY

The project on one hand aims at training teachers to improve their statistics teaching by learning from their classroom practices and on the other hand to document and analyze this process. To reach these goals we adapted the Lesson Study Group (LSG) approach, which consists of a cycle of activities in which teachers jointly plan, observe, analyze, and refine actual classroom lessons (Lewis, 2002). We will only report the analysis of lesson planning (the first phase of the LSG) with attempts to answer the question: How do teachers take into account the features of the Wild and Pfannkuch's framework in lesson planning?

Five in-service secondary school (12-15 years old) teachers and two staff participated in the project supervised by the authors. The participants met for five hours every 15-days. In two of the sessions, discussions were held to plan a lesson to cover part of the topic, "graphs and central tendency measures", and we video recorded the discussions during the lesson planning sessions. In this phase the teachers were asked to design a lesson plan taking into account 1) the objectives stated in the syllabus, 2) the difficulties detected through a diagnostic questionnaire that teachers had earlier given to their students, and 3) the elements of statistical thinking from Wild and Pfannkuch's framework.

RESULTS

The teachers designed a lesson to be given in three 50-minute classroom-sessions. Before the lesson planning, they had been asked to think about planning a lesson on graphs and central tendency measures. In the planning session each of the teachers presented their ideas, which were primarily routine exercises. This enabled a discussion on the "recognition of the need for data". They agreed for didactic reasons to use data produced by the students or real data from any research agency instead of just using invented data. As a consequence, the

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exercises from their original thinking were dropped. We also discussed whether to teach both topics in just one lesson or separately, and they decided to begin with graphs and work central tendency measures into the lesson. The tasks relating to graphs were intended to have students: "collect, organize, analyze and interpret data". These statements were written in their objectives. After 48 minutes of discussion, the teachers had not yet formulated the lesson problem until one researcher asked them, "What do you understand about data gathering?" This question made the teachers aware of the importance of the lesson problem. The other researcher posed a problem "Students that carry a weight between 10 and 15 percent of their own weight run the risk of harming their vertebral column. How many children in the classroom are carrying backpacks heavier than the allowed weight?" The discussion raised an interesting question: "Which group (boys or girls) carries the heaviest backpack?" This question was better than the first question because it involved comparing groups and led to central tendency measures and drawing graphs. The question made the tasks more specific; it focused the students on gathering information and designing work sheets and instructions. The instructions were: Guess your weight and that of your backpack. Now find your weight and that of your backpack, calculate the relative weight of your pack in relation to your weight, fill in the information from other members of the group in a table, draw a graph, obtain the mean of the weights of the girls and of the boys and compare.

CONCLUSIONS

The goal of developing statistical thinking in students in their statistics classes is fundamental for teachers in the planning phase of the LSG cycle, and Wild and Pfannfkuch's framework is an instrument that supports this goal in the following ways:

- It helps in defining long term objectives, for example, "the recognition of the need for data", "trans-numeration" and "integrating the statistical and contextual", are some of the aspects that although they were not considered by the teachers in the beginning, emerged when the lesson problem was defined.
- It ensures that the activities to be carried out in the class conform to the PPDAC cycle; in particular, this study revealed that teachers, unlike statisticians who give more importance to the all the stages of PPDAC, were particularly interested in the second and third stages of the cycle.

Wild and Pfannkuch's framework could also be useful in the execution of the other two phases (teaching and analyzing the lesson) of the LSG approach.

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