EPIDEMIC: A COMPUTER BASED TRAINING ENVIRONMENT FOR INFORMAL INFERENTIAL REASONING

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INFORMAL INFERENTIAL REASONING AND CHANGE POINT DETECTION TASKS

Inferential statistics is the scientific method for evidence-based knowledge acquisition. However, the logic behind statistical inference is difficult for students to understand. The recent literature (e.g., Pratt & Ainley 2008) discusses different concepts of introducing inductive reasoning, which precedes a formal treatment. The implied focus is on considerations of variability in data and an assessment of whether different characteristics are due to systematic effects or to random variability. Research in this field begins to offer insight into the learners' inferential reasoning and how that thinking might be shaped more effectively by well-designed tasks.

Change-point detection tasks are a special type of statistical decision problem which occur in process control like monitoring health hazards. Sequential data from a process that is in a certain state are observed. At some point in time the distribution of the data changes. Has something occurred that altered the state of the system (a "breakdown"), or are these new observations within the range of the expected when acknowledging random variation? Should one declare that a change took place ("raise an alarm")? A false alarm costs resources, credibility etc., but NOT raising alarm when, for example, in fact a new health hazard occurs, may be even more harmful.

EPIDEMIC AS A LEARNING ENVIRONMENT FOR INFORMAL REASONING

"Data Games" is an innovative project created by KCP Technologies and the Scientific Reasoning Research Institute at the University of Massachusetts at Amherst. It provides web-based games that engage students in developing mathematics and data analysis skills. Erickson (2012) describes the challenges faced in designing and teaching with these games. The data game "Epidemic" is a computer-based training environment to shape intuition for inference in the context of a change-point detection task (Engel & Erickson 2013). A random mechanism produces data sequentially ("incidence counts of newly diseased people") with a likely built-in shift in location at random time. These counts have some inherent natural variation, some days the numbers are below and other days they are above average. At some unknown day, the mean shifts to a larger value: This is the day of the outbreak - the epidemic. From that day on the actual number of sick people varies around the new mean. The challenge in the game is to identify the day of the outbreak of the epidemic with as little delay as possible and without raising false alarm. Different levels of the game linked to different signal-to-noise ratios correspond to gradually increasing difficulties to detect the outbreak of the epidemic. Detailed analyses of the users' strategies and the effectiveness of the game are still to be explored.

CONCLUSION

Change point detection tasks are a promising context for training and assessing students' informal reasoning. Implemented as a web-based computer game Epidemic provides direct contact with decision making under randomly varying data and adds a playful factor for students to be introduced to statistical inference. The game is freely available on the internet http://www.eeps.com/changepoint/.

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