

CMEF 2009 Working Group 11 Significant Statistics

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Facilitator Kevin Keen

Presenters Bruce Dunham
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Project Title

Statistics 11: A Course for University Transfer Credit

Project Summary

The next few years will see changes in secondary school statistics as jurisdictions in Western and Northern Canada implement the 2008 Common Curriculum Framework (CCF) of the Western and Northern Canadian Protocol (WNCP) for collaboration in education. The exposure to survey sampling and computations with the normal distribution of the 1996 Common Curriculum Framework are gone from the Pre-Calculus stream as the 2008 version places greater emphasis on algebraic skills and proficiency in trigonometry and functions. The Foundational stream still provides good exposure to statistical concepts but few school districts, in British Columbia for example, have the resources to mount three streams of mathematics courses in grades 10 through 12. It is anticipated that 2013 will see students in the Pre-Calculus stream entering university without much exposure to statistics or probability.

The last decade has seen changes in the approach to introducing statistics and probability at universities. Students are entering university without completing pre-calculus stream courses in grades 11 or 12. Traditional algebra-based introductory courses in probability and statistics have proved to be a barrier for these students. At UNBC, MATH 240-3 Basic Statistics has been expressly developed to meet the needs of these students. The emphasis is placed on statistical concepts and not the rote-manipulation of formulae and arcane paper statistical tables. Graphing calculators and statistical software are used to lighten the algebraic load. Like many introductory courses in probability and statistics at universities and colleges, MATH 240 Basic Statistics is cal-

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culus-free. Unlike many of these courses, MATH 240-3 is virtually algebra-free as well. The course is taught with 150 minutes of lecture and 50 minutes of laboratory each week in a 13-week semester.

Project Goal

The working group was to consider how to take MATH 240 Basic Statistics with its 43 hours of lecture and lab and adapt it to the environment of a grade 11 course where there is the luxury of 100 to 120 hours of instruction. While providing instruction in probability and statistics for Pre-Calculus stream in grade 11 was the stated initial goal, Statistics 11 would, in fact, be open to students in the other two CCF streams: Foundations of Mathematics and Apprenticeship & Work-place Mathematics.

Working Group Synopsis

Unlike the other Forum working groups, Working Group 11 got off to a late start in February 2009 before the Forum meeting 1 – 3 May 2009. It was decided to proceed with a presentation-based approach for the first two meetings of the Significant Statistics Working Group on Fri 1 May 2009 and the third meeting on Sat 2 May 2009. The deliverables for Working Group 11 include PDF versions of the presenters' slides.

The [first presentation \(Link to WG11 keen\)](#) was by the Working Group facilitator: Kevin Keen. The purpose of this presentation was to set the goal for the Working Group and outline the linkages among the four planned presentations. It was noted and agreed that failure to create a curriculum plan for the proposed Statistics 11 would not be considered a failure. The goal of the Working Group was to be the journey not the destination. After the structure for the activities of the Working Group was presented, Kevin discussed the instructional elements of UNBC's MATH 240 Basic Statistics with specific attention to the role of the TI-83 series graphing calculator and R statistical analysis software in reducing the burden of algebra and in aiding the visualization of data. Comparisons were made between UNBC's MATH 240 and Statistics 12 that is offered by BC's School District 23 Central Okanagan as a locally developed and board/authority approved course. Statistics 12 requires as a prerequisite Principles of Mathematics 11.

The [second presentation \(Link to WG11 weldon\)](#) was by Larry Weldon of Simon Fraser University. The title of Larry's presentation was *Authentic Content in Statistics Courses: Adapting Content to Modern Practice*. The basic proposal in Larry's talk was that teachers should guide students through a series of experiences in data analysis, introducing tools and concepts as they are suggested by the needs of each application. In this apprenticeship model, the students are introduced to the tools and concepts that they will actually need as practitioners of statistics. The textbook is used as a resource rather than a lecture guide. He admitted the difficulty of implementing this strategy in the public school system, but suggested it as a worthwhile goal.

The [third presentation \(Link to WG11 dunham\)](#) was by Bruce Dunham of The University of British Columbia (Vancouver). The title of Bruce's presentation was *Through a Glass Darkly: What Students Retain from a Course in Statistics*. Bruce interviewed approximately 30 students several months after completion of UBC's STAT 200. Bruce also presented results from feedback from individual students in real time by the use of electronic classroom *clickers*. The good news from both surveys was that students did generally well in understanding broad concepts. The bad news was that the students struggled with the details of mathematical-statistical definitions. These results are important to bear in mind for secondary school curricula as early as grade 10.

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The fourth and [final presentation \(Link to WG11 ekol\)](#) was by George Ekol of Simon Fraser University. George's presentation was entitled *Teaching statistics as a "science of need": Is it too much asking?* George spoke to the need for teacher preparedness in the teaching of statistics in the school system and the design of learning activities. He noted that it has been hard to find room for Statistics in a high school curriculum dominated by preparation for Calculus. George noted that it is important for teachers to have a say in curriculum. He spoke to the need for the development of workshops for teachers of statistics in our schools to share ideas and practice. On the topic of assessment, he noted the need to consider the place of the Advanced Placement (AP) Statistics exam in the context the proposal of Statistics 11. It fell to George the task of pulling together all four presentations in a summary. It was broadly agreed amongst the Working Group participants that statistics instruction within the secondary school setting needs to stress conceptual understanding through active learning with appropriate technology applied to genuine data. This is not at all different from the university setting.

Epilogue

The working group was not successful in developing a curriculum for a Statistics course for grade 11. For one thing, the Working Group lacked participation by secondary school teachers—a consequence of a late start. However, by posting online this discussion and the slides of the presentations for the Significant Statistics there is a starting point for further discussion by and engagement of school teachers.

For those presently teaching statistics within the secondary school mathematics curriculum, the slides of presentations by Kevin Keen and Larry Weldon provide brief descriptions of resources available to assist with the instruction of Statistics. Things that appeal to university students, such as the use of Smarties® and loaded dice to understand variation, the video series *Against All Odds* (available on DVD's and online from www.learner.org), episodes from the television series NUMB3RS, simple surveys and experiments for decision making, and small-group discussions about the nature of confidence intervals, will likely work well with secondary school students. The lasting legacy of the Significant Statistics Working Group might be that through its web record that school teachers can discover that they are not alone and not left without resources.