# Statistics for Teachers: STAT 4/6070

The UGA Statistics Department has been teaching a second course in statistics for mathematics education students since 1998. The course is designed to prepare pre-service and in-service high school mathematics teachers to teach the statistical concepts that appear in the Common Core Mathematics Standards and the Advance Placement (AP) Statistics Curriculum.

Two recent trends have converged to render knowledge of data analysis, statistics, and probability more essential than ever for teacher at the elementary, middle and secondary levels. First, state standards, such as the Georgia Performance Standards (GPS), and national standard recommendations, such as the Common Core State Standards (CCSS), now include an unprecedented amount of content in data analysis and probability in the curriculum, from grades K-12. Second, the professional practice of teaching has become more data-driven, with standardized tests, both state and national, becoming a much larger part of the professional life of the teacher. STAT4/6070 (both for senior undergraduates and graduate students) is designed to prepare high school teachers to meet the demands associated with these two trends.

It is important to recognize that the nature of teaching and learning in Data, Statistics, and Probability is quite different from that of subjects like Algebra and Geometry. Mathematics is a foundation, but not a proxy, for statistics and probability. Statistical reasoning differs from mathematical reasoning in that it begins not with premises or definitions but from evidence or data. Underlying statistical reasoning is a conceptual understanding of important ideas, such as distribution, center, spread, association, uncertainty, randomness, and sampling. One of the goals of STAT4/6070 is to equip high school mathematics teachers to teach probability and statistics with an understanding of the difference between mathematical and statistical reasoning.
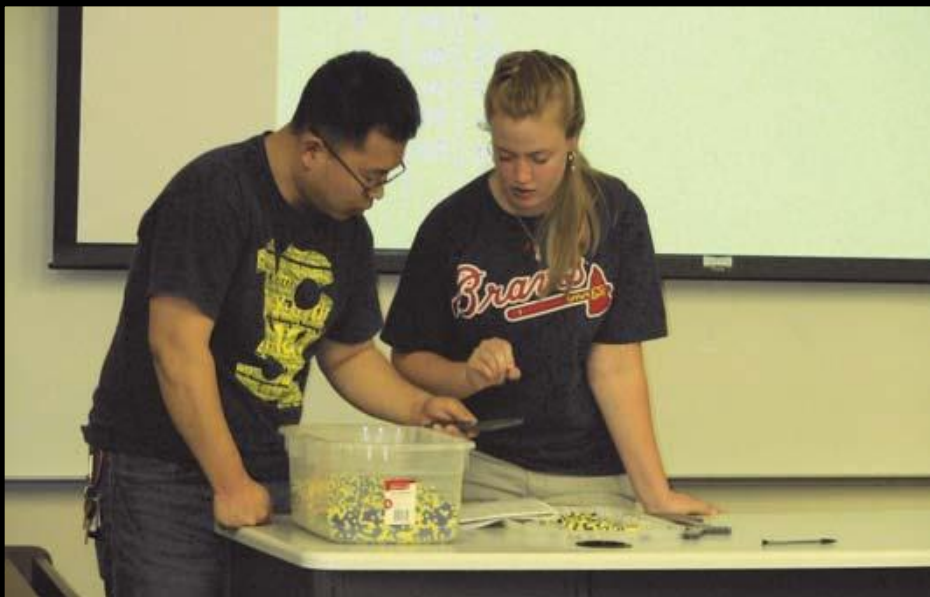
Pedagogically, the course has been taught using an activity based model in which the students complete activities to master certain learning goals. For example, in one activity, the pre-service teachers explore the learning progressions associated with measures of center and variability. The pre-service teachers use stacks of snap cubes to visualize the mean as the fair share value and then to quantify the variability as a measure of fairness. The next level of development for children is to consider the mean as a balance point. The pre-service teachers use this model to create dotplots of datasets that meet certain criteria and then quantify the variability in the distributions they create. This leads to a discussion of the Mean Absolute Deviation (MAD) which is extended back to the measures of fairness and forward to the concept of standard deviation. Not only does participation in the activity deepen the pre-service teachers' understanding of center and variability, it also provides them with activities and a pedagogical model then can incorporate in their own classes.

The assessments used in the course are designed to help pre-service teachers connect their statistical learning to teaching practice and include opportunities for the pre-service teachers to read the research literature on the teaching and learning of statistics. The pre-service teachers complete a portfolio that includes summaries of journal articles chosen to reflect best practices in teaching statistics as specified by the Guidelines for Assessment and Instruction in Statistics Education (GAISE). In addition, the pre-service teachers compare and contrast the student learning goals for statistics and probability specified by the state (GPS) and national standards (CCSS and GAISE). Finally, the pre-service teachers find tools appropriate for use in their classroom, such as datasets, websites, and lesson plans and explain how they might implement their finds in their future teaching.

This course has been nationally recognized as a model statistics course for teacher preparation programs to use in preparing teachers. The course is unique by integrating both statistical content and pedagogy. This course is also the foundational course for the developing masters of Science in Statistics Education degree our department will soon offer. This degree program has also received national recognition (for example, the American Statistical Associate) for the vision our department has shown in becoming a leader in the growing field of statistics education.

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