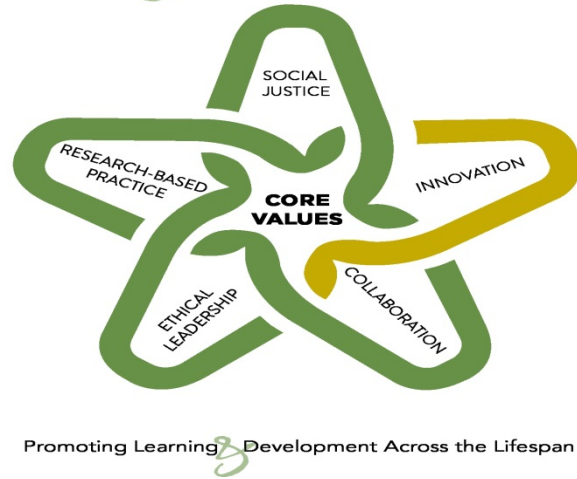**MATH 612: Probability & Statistics
for K-8 Teachers
Department of Mathematics
George Mason University
Spring 2013**

SOCIAL JUSTICE

RESEARCH-BASED PRACTICE

CORE VALUES

INNOVATION

ETHICAL LEADERSHIP

COLLABORATION

Promoting Learning & Development Across the Lifespan

~~~~~~

Instructor: Pamela R. H. Bailey
E-mail: pbailey2@gmu.edu
Phone: 703-993-5081
Office: Thompson Hall Rm. 2202
Office Hours: by appointment
Class Meets: Monday 4:30-7:00 Leis Center

~~~~~~

The amount of data available to help make decisions in business, politics, research, and everyday life is staggering: Consumer surveys guide the development and marketing of products. Polls help determine political-campaign strategies, and experiments are used to evaluate the safety and efficacy of new medical treatments. Statistics are often misused to sway public opinion on issues or to misrepresent the quality and effectiveness of commercial products. Students need to know about data analysis and related aspects of probability in order to reason statistically—skills necessary to becoming informed citizens and intelligent consumers.
(NCTM, 2000)

Purpose of the Course
In today's data driven world an understanding of statistics and probability is critical. Statistics and probability are useful for making sense of the world around us and for making decisions under conditions of uncertainty. We see statistics and probability as we read the newspaper, check the news on-line, and watch the news on TV. More and more jobs are requiring an understanding of statistics and probability in order to complete the work appropriate to that career. In order to be informed citizens and to participate in today's statistical society, we (and our students) need to be able to understand (and critique) reports that one product performs better then another, that one candidate is ahead of another in the polls, that consumer activity is changing, that one curriculum is better than another, and that a certain percentage of the population has a particular attribute. The list goes on and on….

In this course, you will develop understandings of statistics and probability that are necessary for informed citizenry and for helping K-8 students to be informed citizens. You will learn what the numbers reported in a research study mean and you will know how to look for and, potentially, find flaws in reports that we read in the news and on-line. You will develop understandings of statistics and

probability that are useful for making decisions. And, you will develop knowledge, skills and understandings that will be useful to you as you work with K-8 students to help *them* develop understandings of data analysis, statistics, and probability.

Course Description as provided in the Course Catalog
An introduction to probability, descriptive statistics, and data analysis. Topics studied will include the exploration of randomness, data representation, modeling. Descriptive statistics will include measures of central tendency, dispersion, distributions, and regression. The analysis of experiments requiring hypothesizing, experimental design and data gathering will also be discussed.

Guiding Questions
Throughout the semester, as you learn more statistics and probability, you should be asking the following questions:
   • What does it mean to *do* statistics and probability?
   • How is statistics and probability different from mathematics? How are they the same?
   • Why does a particular probability or statistics formula "work"?
   • What research questions require statistics to answer them? Which don't?
   • What kind of data will answer a particular research question?
   • What kind of analysis is appropriate to answer a given research question?
   • How can I explain these data?
And, as you think about *student* learning of these ideas, you should be asking these questions:
   • How do individuals learn statistics and probability?
   • What are common misconceptions students have about statistics and probability?
   • What does it mean for an adolescent to deeply understand statistics and probability?
   • What tasks would facilitate the development of deep understanding of statistics and probability?

Objectives
Success in this course is measured by the degree to which you are able to do meet the following objectives:

NCATE/NCTM Standard 12: Knowledge of Data Analysis, Statistics, and Probability
   Candidates demonstrate an understanding of concepts and practices related to data analysis, statistics, and probability.
   Indicators
   • 12.1 Design investigations that can be addressed by creating data sets and collecting, organizing, and displaying relevant data.
   • 12.2 Use appropriate statistical methods and technological tools to analyze data and describe shape, spread, and center.
   • 12.3 Apply the basic concepts of probability.
   • 12.4 Demonstrate knowledge of the historical development of probability and statistics including contributions from diverse cultures.
   • critically examine the teaching and learning of statistics and probability in grades K-8

AMTE EMS Standards: Data Analysis and Probability
   1   The nature and uses of data: What kinds of questions require data for their answers, and what kinds of data are required? How are relevant data sets created and organized? Designing an investigation, including specification of how the data collected support analysis responsive to the question(s) under investigation.
   2   Distinguish categorical (discrete) data (e.g., gender, favorite ice cream flavor) from measurement (continuous) data.

3   Appropriate types of representation of data, and what they afford: For categorical data, relative frequencies. For measurement data, displays of shape, center, and spread.
4   Basic concepts of probability and ways to represent them; making judgments under conditions of uncertainty; measuring likelihood; becoming familiar with the concept of randomness.

Plan for the Course
We will address the guiding questions and objectives as we progress through the course, which is organized into two sections:

I. Probability
In this part of the course you will explore probability concepts. You will become familiar with the development of probability theory and the definition of probability. You will examine the "rules" of probability calculations and will consider uses of probability in real world settings. You will also become familiar with the challenges K-8 students face in developing strong understandings of probability and you will examine various teaching and learning factors that play a role in the development of student understanding of probability concepts.

II. Statistics
In this part of the course, you will explore and engage in the various steps of statistical inquiry. You will become familiar with data variability and generate questions that require statistical analyses. You will consider strategies for data collection, explore ways to analyze that data, and determine conclusions that can be made based upon that analysis. As you learn about these steps in the overall process of statistical inquiry, you will become familiar with research on K-8 student learning of statistical inquiry.

Textbooks and Materials
Access to the following materials is required:

Peck, R. & Starnes, D. (2009). *Making sense of statistical studies (student module).* Alexandria, VA: American Statistical Association.

Sowder, J., Sowder, L, & Nickerson, S. (2010). *Reconceptualizing Mathematics (Part IV:Reasoning about Chance and Data).* New York: WH Freeman Press.

Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report. Download from: http://www.amstat.org/education/gaise/

Blackboard: Readings and assignments will be posted on Blackboard

Calculators: You will need, at the minimum, a four-function calculator. However, a graphing or scientific calculator is suggested.

Excel: Some assignments will require the use of Excel. You may bring a laptop to class for some of the in-class assignments.

Course Expectations/Assignments
This class will require a significant level of work in-class and out-of-class on projects and assignments. The participation of each class member is vitally important. If you do not come prepared to discuss the readings, to share you work on a given assignment, and to participate in the activities of the day the entire class will suffer. The input of **everyone** is valuable and necessary! You **must** commit to be coming to every class on time, being prepared for the evening's activities, and being ready to participate. All assignments must be submitted on time.

If you are unable to attend class for any reason you must give advance notice. You are responsible for submitting any assignments that are due that class (before class), for checking Blackboard to see what was covered during the missed class, and for preparing the work due the following class.

Also, as prospective mathematics specialists, you are expected to demonstrate appropriate professional behavior toward the instructor and classmates. This includes communication in class and out of class. Cell phone use (including texting) is prohibited in class except in case of emergency.

Every student registered for MATH 612: Probability & Statistics for K-8 Teachers course with a required performance-based assessment (will be designated as such in the syllabus) is required to submit this assessment, Statistical Analysis Project, to TaskStream (regardless of whether a course is an elective, a onetime course or part of an undergraduate minor.) Evaluation of your performance-based assessment will also be provided using TaskStream. Failure to submit the assessment to TaskStream will result in a the course instructor reporting the course grade as Incomplete(IN). Unless this grade is changed upon completion of the required TaskStream submission, the IN will convert to an F nine weeks into the following semester.

The following assignments will help you (and me) to gauge your development throughout the course:

Assessment	Percentage of Grade
Homework	25%
Statistical Analysis Project	25%
Mid-Term Examination	20%
Final Examination	30%

Homework
As any mathematics teacher knows, it is important for students to practice and continue to explore the concepts covered in class at home. Therefore, you will be expected to complete homework assignments each week. These will include problem sets, explorations, small writing assignments, readings, and reflections. All homework assignments should be completed and ready to submit at the start of class. Each week, homework will be graded according to the following rubric:

3	Assignment is complete. Selected problems (1-2) for grading have only minor errors.
2	Assignment is complete. Selected problems (1-2) for grading have major errors.
1	Assignment is incomplete.
0	Assignment not submitted.

If, at the end of the semester, your average homework score is a 2 (or above), you will receive the full 25% toward the final grade in the class. If your average homework score is less than a 2, you will receive a homework grade proportional to your total points.

Statistical Analysis Project – performance based assessment
This project will be ongoing throughout the course of the semester. It will provide you with the opportunity to apply all that you have learned in the course to a real-life study. You will develop a research question, collect data to answer that question, analyze the collected data, and draw a conclusion about your research question based on the analysis you did. Checkpoints are included in the schedule where parts of the assignment will be due as we progress through the statistics portion of the course.

Mid-Term Exam

This exam will be given in class and will assess your ability to apply the knowledge you have gained in the class up to the point of the exam.

Final Exam
This *cumulative* exam will be given in class and will assess your ability to apply the knowledge you have gained from the *entire* course.

Communication
You must have a GMU email address and you must check it often as I will only communicate via this medium. You may have your GMU email forwarded to another address. All university communication will only be sent to the GMU address.

Evaluation
Final course grades will be assigned based upon weighted percentages as indicated by the Course Expectations.

A 93– 100	B+ 87 – 89	C+ 77 – 79	D+ 67 – 69	F 59 and lower
A- 90 – 92	B 83 – 86	C 73 – 76	D 63 – 66
	B- 80 – 82	C- 70 – 72	D- 60 – 62

College Expectations and University honor Code
The Graduate School of Education (GSE) expects that all students abide by the following:

- Students are expected to exhibit professional behavior and dispositions. See http://cehd.gmu.edu for a listing of these dispositions.
- Students must follow the guidelines of the University Honor Code. See http://oai.gmu.edu/honor-code/ for the full honor code.
- Students must agree to abide by the university policy for Responsible Use of Computing. See http://mail.gmu.edu and click on Responsible Use of Computing at the bottom of the screen.
- Students with disabilities who seek accommodations in a course must be registered with the GMU Disability Resource Center (DRC) and inform the instructor, in writing, at the beginning of the