

Program Cover Document --- MAT 212 Data Analysis and Probability for Middle School Teachers

I. Learning Goals

Currently, this course is not a part of any program offered by the Department of Mathematics & Statistics. It is one of a series of courses offered to meet the needs of Elementary Education majors who wish to obtain the New Jersey middle school subject matter endorsement in mathematics. This requires 15 credits in mathematics and passing the Middle School Mathematics Praxis exam. Many students who have taken MAT 105 and/or 106, courses required for elementary education majors, wish to continue their study of mathematics in order to obtain the endorsement and teach mathematics in grades 6-8.

Teaching data analysis and probability effectively at the middle grades requires that teachers have a deep and profound understanding of the data analysis and probability that is part of the K-12 curriculum. The main goal of this course is to enable middle grades preservice teachers to develop an advanced viewpoint of the subject that they will teach.

Each course in the series of courses that are offered to middle school mathematics teachers is focused on a particular content strand from the New Jersey Core Curriculum Content Standards (NJCCCS). The other courses are MAT 211, Number theory and Systems for Middle School Teachers, MAT 214, Patterns, Functions & Algebra for Middle School Teachers, MAT 215, Geometry for Middle School Teachers, MAT 217, Discrete Math for Middle School Teachers, and MAT 218, Concepts of Calculus for Middle School Teachers.

II. Student Assessment

Assessment in this course is similar to the assessment done in the prerequisites, MAT 105 and 106. Preservice teachers can demonstrate their content knowledge through a variety of assessment methods that require them to solve problems, explain their reasoning, and use mathematical representations.

III. Learning Activities

Middle school mathematics curricula are used as a basis for in-depth study of the mathematics content. Many class sessions are devoted to discussions of the mathematics content and the development of the mathematical concepts and skills necessary in the mathematical education of middle-school grades. Other class sessions consist of “hands-on” experiences in order for the preservice teachers to learn how to use concrete manipulative materials, pictorial models, and technology in the development of the mathematical concepts for middle-school grades. Students are expected to complete readings, and prepare projects and/or assignments that are appropriate for the course.

Using middle school mathematics curricula as motivation for in-depth study of the mathematical concepts connects the course content to the middle school classroom. Preservice teachers appreciate that what they are learning will be relevant to their teaching. Teachers must experience standards-based teaching and learning in order to understand how to implement it. A variety of strategies and methods of instruction should be used to model effective teaching of mathematics.

Sample syllabus:

MAT 212/Math 592 Data Analysis and Probability for Middle School Teachers Fall 2025

Instructor: Dr. Cathy Liebars

Office: Science complex P212

Phone: 771-3043

Email: liebars@tcnj.edu

Expectations for response times: *24 hours on weekdays, 48 hours on weekends*

Class meetings: Monday and Thursday, 3:30 – 4:50

Office Hours: Monday 12:30 – 1:50, Thursday 11:00 – 12:20; Other hours by appointment

Course Materials: All required course materials will be posted on Canvas.

Recommended books:

- *Data and Probability Connections: Mathematics for Middle School Teachers* by Debra and Michael Perkowski, Pearson Education, 2007
- *Statistics and Data Science for Teachers* by Anna Bargagliotti & Christine Franklin, American Statistical Association, 2021 (posted on Canvas)

Course description: This course gives the middle school mathematics teacher a deeper understanding of data analysis and probability. Physical materials, models, technology, and middle school curricula will be used to explore data, statistical measures, and elements of probability. Exploration of ways to engage middle school students meaningfully in experiences that lay a strong foundation for more formal work in data analysis and probability will be integrated with the mathematics content.

Course prerequisites: MAT 105 or 106 or by permission of Math Education coordinator

Purpose statement: Teaching data analysis and probability effectively at the middle grades requires that teachers have a deep and profound understanding of the data analysis and probability that is part of the K-12 curriculum. The main goal of this course is to enable middle grades preservice teachers to develop an advanced viewpoint of the data analysis and probability that they will teach. The course is geared toward elementary education majors who wish to get the New Jersey subject matter endorsement in mathematics to teach in grades 6-8. The course is open to undergraduates and graduate students which is the reason for cross-listing the course.

Learning Goals

Performance goals: By the completion of the course, the successful student will be able to demonstrate all of the following:

- I. Deeper understanding of the concepts, processes and algorithms, and the purposes beneath them, found in the middle school mathematics curriculum, with a focus on data analysis and probability.

- II. Improved ability to communicate mathematical and statistical ideas appropriately using the language of mathematics.
- III. Improved ability to reason mathematically and statistically and begin developing mathematical arguments.
- IV. Ability to approach problems involving data analysis and probability from multiple perspectives.
- V. Knowledge of the relationship of mathematics and statistics to other subjects, its applications in society, and relationships within mathematics itself; in particular the relationship between data analysis and probability.
- VI. Increased understanding of national and state standards relating to data analysis and probability.
- VII. Knowledge of the use of concrete manipulative materials, technology, and pictorial representations necessary in the development of data analysis and probability concepts and procedures.
- VIII. To use technology, such as CODAP, as an aid to understanding statistical concepts.

Course Requirements and Grading: The final grade will be based on the following:

10%	Class participation
20%	Check Your Understanding opportunities/videos
20%	Final Exam
30%	3 quests (short tests)
20%	project

Grading scale

A	95 – 100%
A-	90 to < 95%
B+	87 to < 90%
B	83 to < 87%
B-	80 to < 83%
C+	77 to < 80%
C	73 to < 77%
C-	70 to < 73%
D+	67 to < 70%
D	60 to < 67%
F	< 60%

Class policies:

1. Additional assignments for extra credit will not be given.
2. The instructor must be contacted prior to any due date to negotiate alternative arrangements if necessary.
3. Students are responsible for any work that is missed.
4. Make-up quests will be given for excused absences in which case I must be notified within 24 hours of the missed quest. Make-up quests will generally be harder

Format/Learning activities:

The course you are about to begin may be different than any math course you've had before. In this course you will learn the mathematics and statistics you need to become a more effective teacher. This is not a methods course. However, it is often said that teachers teach in the manner in which they learned a subject.

Because you will be thinking about middle school topics in mathematics and statistics in a new way, you will notice very soon that you are not doing the usual kinds of things. You will not be shown how to do some sample problems and then asked to practice more on your own. Instead:

- You will solve new kinds of problems that are designed to provide insight into several mathematical and statistical topics and promote your reasoning skills. Thus, you will understand familiar problems more deeply.
- You will examine patterns and structure; formulate generalizations and conjectures; investigate and test your conjectures using concrete or virtual materials, technology, and other tools; and construct and evaluate mathematical arguments. You will learn to ask yourself: Is there a pattern? What might happen next? Can I make a generalization or conjecture? Do I think my conjecture is true for all cases, true for some cases, true for no cases (that is, false for all cases), and why? Under what circumstances is it not true? Can I give an example? Why does it work? How might I convince my group members that my conjecture is correct?
- And you will frequently be asked to explain your reasoning – how you were thinking while you were solving a problem, why you think students will solve problems in a particular way, and why you think some methods for solving problems work better than others. Developing good explanations that are convincing to others is the best way to know that you understand.
- My role extends beyond direct instruction to support and facilitate your engagement with and exploration of the material.
- In some classes, we will work in visibly random groups on vertical, non-permanent surfaces (VNPS); i.e., the blackboards!
- In some classes, we will use technology for statistical investigations so please let me know if you do not have a device (other than a phone) available that you can bring to class.

Check Your Understanding opportunities and videos:

“Check-your-understanding” opportunities will be assigned frequently. They will not be collected and graded. Instead, solutions may be posted prior to the next class and/or we will discuss your solutions in class and/or we will use Canvas Discussions to record videos of check-your-understanding solutions. You will each choose 5 check-your-understanding problems/questions over the course of the semester to solve/answer and present in a video. (You will not be permitted to sign up for more than one problem in a two-week period.) Keep in mind that your classmates may be watching your videos to try to understand how to solve the check-your-understanding problems that they weren't

able to solve so you should explain the solution clearly. Canvas provides the ability to respond to videos so you will be able to ask each other questions about the solutions. If there is a solution with many questions, it may be discussed in class. In addition to working together in class, you are encouraged to work together outside of class on problems. However, the final expression, the answer to a question, the solution and explanation to a problem, are matters for individual action to show that each person comprehends the matter at hand in their own way. Work that is merely copied will not be tolerated. Expectations and grading for the videos will be distributed separately.

Quests and final exam:

See course outline for dates. The final exam will be given during final exam week at the scheduled time and will be cumulative. It will cover correct use of statistical terminology and concepts studied.

Class participation:

Participation in the course takes many forms, including actively working and contributing in small groups, participating in whole class discussions, asking questions, listening, presenting work, persevering and taking risks when presented with a challenge, preparing for class by completing Check Your Understanding opportunities and assigned readings, etc. To be successful in the course, it is important for you to be an active participant. Below is a rubric for class participation:

	Unsatisfactory 0-4	Basic 5-6	Proficient 7-8	Distinguished 9-10
<p>Class Contributions and Preparation</p> <p><i>*Participation is reduced by absence or tardiness</i></p> <p>**Contributing positively to a class also means listening to, acknowledging, and respecting opinions of others.</p>	<p>Student almost never contributes to class by offering ideas and asking questions, and/or is almost never prepared for class.</p>	<p>Student sometimes contributes to class by offering ideas and asking questions, rarely volunteers to present work, and/or is inconsistently prepared for class.</p>	<p>Acts professionally, often proactively contributes to class by offering ideas and asking questions, volunteers to present work, sometimes perseveres and takes risks, and is usually prepared for class.</p>	<p>Acts professionally at all times, consistently and proactively contributes to class by offering ideas and asking questions sometimes more than once per class, consistently volunteers to present work, collaborates with others, perseveres and takes risks, and is always</p>

				prepared for class.
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- **Note that your participation grade will not be affected if you are ill and cannot attend class. Please do not come to class if you are sick! A zoom option will be available for anyone who is sick and/or must isolate. Please note that zoom is ONLY to be used in cases of illness or isolation. Otherwise, you are expected to attend class as usual.**
- **Important note:** *Incorrect solutions* can add value to a problem. Your participation grade is therefore not based on the correctness of your work.

The project will allow students to explore a topic of their interest using statistical methods learned in class. This will be due after the middle of the term and more information will be provided at a later time.

4th Hour

In this class, the deep learning outcomes associated with TCNJ's 4th hour are accomplished by a series of rigorous educational assignments that extend beyond the typical scheduled class time. These include additional out-of-class reading, writing, and check your understanding problems.

Course Outline (very tentative)

Dates	Content
8/28	What is statistics? The Statistical Investigation Cycle
9/2 – 9/4	Statistical questions Sampling plans/random sampling, biased sampling Types of data and data collection
9/8 – 9/11	Data visualization Multivariate data analysis
9/15 – 9/18	Interpreting graphs
9/22 – 9/25	Measures of center and variability Quest 1
9/29 – 10/2	Wrap up shape, center, and variability Project information
10/ 6 – 10/9	Fall break Scatterplots and line of best fit
10/13 – 10/16	Linear regression and correlation

10/20 – 10/23 Solve problems with bivariate data, interpreting slope

10/27 – 10/30 Categorical association and two-way tables

Quest 2

11/3 – 11/6 Probability simulations and random devices

Experimental and theoretical probability

Project due

11/10 – 11/13 Law of large numbers

Basic probability rules

Independent events

11/17 – 11/20 Compound events

Counting techniques

11/24 – 11/27 Counting techniques

Thanksgiving break

12/1 – 12/4 Random variables and probability distributions

Quest 3

12/8 – 12/9 Review

12/10 – 12/16 Final exam week

NAME AND PRONOUN ACCOMMODATIONS

If you use a name and/or pronouns other than what is in the course roster, please email me with the name and/or pronouns that you would like me to use and I will be glad to accommodate this request.

POLICY ON THE USE OF AI:

The use of generative AI tools (e.g. ChatGPT, Dall-e, etc.) is permitted in this course for the following activities:

- Brainstorming and refining your ideas;
- Drafting an outline to organize your thoughts; and
- Checking grammar and style.

The use of generative AI tools is not permitted in this course for the following activities:

- Impersonating you in classroom contexts, such as by using the tool to solve problems or create videos for discussions on Canvas.
- Writing a draft of a writing assignment, including the project.

- Writing entire sentences, paragraphs or papers to complete class assignments.

You are responsible for the information you submit based on an AI query (for instance, that it does not violate intellectual property laws, or contain misinformation or unethical content). Your use of AI tools must be properly documented and cited in order to stay within college policies on academic honesty. For example, [[See this resource for APA guidance](#)]. Any assignment that is found to have used generative AI tools in unauthorized ways will be reported following the academic integrity guidelines. When in doubt about permitted usage, please ask for clarification.

SELECTED TCNJ POLICIES

Please note that the “[TCNJ Student Support Resources and Classroom Policies](#)” webpage contains all of the relevant policies mentioned below and others that govern the classroom.

Final Assessment

All courses are to have a final assessment and no final assessments will be scheduled before the final exam period. Students are expected to take their final assessments in the time blocks assigned by Records and Registration. Students must notify the instructor two weeks before the final assessment if they have a conflict as defined by the Final Assessment and Reading Day policy.

Attendance

Students are expected to check the college calendar, and plan their course schedules and vacations so as to enroll only in those classes that they can expect to attend on a regular basis. Students are expected to participate in each of their courses through regular attendance at lecture and laboratory sessions, complete assignments as scheduled, and to avoid outside conflicts, including for the final exam. It is further expected that every student will be present, on time, and prepared to participate when scheduled class sessions begin. In all circumstances, it remains the student’s responsibility to initiate discussion about absence and arrangements for making up any missed work with each instructor.

Academic Integrity Policy

The College of New Jersey is a community of scholars and learners who respect and believe in academic integrity. This integrity is violated when someone engages in academic dishonesty. Complaints of student academic misconduct will be addressed and adjudicated according to the *Academic Integrity Procedural Standards*.

COMMITMENT TO DIVERSITY, EQUITY, INCLUSION, ACCESS AND BELONGING

The TCNJ community is composed of people with diverse backgrounds, perspectives, and experiences, and the college is committed to diversity, equity, inclusion, access and belonging. The college’s Campus Diversity Statement can be viewed here: <https://diversity.tcnj.edu/campus-diversity-statement/>.

CLASSROOM ENVIRONMENT AND COMMITMENT TO STUDENT SUCCESS, SAFETY AND WELL-BEING

The TCNJ community is dedicated to the success, safety and well-being of each student. TCNJ strictly follows key policies that govern all TCNJ community members’ rights and responsibilities in and out of the classroom. In addition, TCNJ has established several student support offices that can provide the support and resources to help students achieve their personal

and professional goals and to promote health and well-being. You can find more information about these policies and resources at the “TCNJ Student Support Resources and Classroom Policies” webpage here: <https://academicaffairs.tcnj.edu/tcnj-syllabus-resources/>.

Students who anticipate and/or experience barriers in this course are encouraged to contact the instructor as early in the semester as possible. The Accessibility Resource Center (ARC) is available to facilitate the removal of barriers and to ensure reasonable accommodations. For more information about ARC, please visit: <https://arc.tcnj.edu/>.”