



**MAED 4201: Mathematics Education Seminar (3 hours)
Fall 2024**

Students are responsible for abiding by the entire syllabus found here. All UNG's university wide policies and procedures apply to this course.

Instructor: **Dr. John Bragelman**
Office Location: **Newton-Oakes Room #220**
Office Hours: **Monday/Wednesday/Friday. 12:00am to 2:00pm, by appointment –
Zoom or In-Person**
Contact Information: **706-867-3267**
john.bragelman@ung.edu

Catalog Description: This capstone course focuses on assisting pre-service secondary mathematics teachers to make insightful connections between advanced mathematics courses and the high school mathematics they will be teaching, while contributing to their mathematical understanding and pedagogical skills.

Course Objectives: After completion of the course the student will be able to:

- demonstrate understanding of the properties of the natural, integer, rational, real, and complex number systems;
- understand the ways that basic ideas of number theory and algebraic structures underlie rules for operations on expressions, equations, and inequalities;
- demonstrate understanding and skill in using algebraic reasoning to model and solve problems from number theory, geometry, discrete mathematics, and statistics that reflect real-world situations;
- demonstrate explicitly how the number and algebraic operations of secondary school can be explained by more general principles;
- trace the development of key number and algebraic ideas from early secondary school through contemporary applications;
- demonstrate mastery of core concepts and principles of Euclidean geometry in the plane and space and applications such as tiling, fractals, computer graphics, robotics, and visualization;
- understand the nature of axiomatic reasoning and the role that it has played in the development of mathematics and facility with proof;
- demonstrate facility with a variety of methods and associated concepts and representations, including transformations, coordinates, and vectors;
- understand trigonometry from a geometric perspective;
- apply the major concepts of abstract algebra to justify algebraic operations and formally analyze algebraic structures;
- examine trigonometric and closely related geometry ideas including the laws of sines and cosines, identities, the Pythagorean Theorem, similarity, and the interplay of exploration and proof;
- revisit elementary functions of high school mathematics from an advanced standpoint;
- examine conceptual difficulties in learning mathematics concepts;
- identify functions associated with relationships such as $f(xy) = f(x) + f(y)$ or $f'(x) = kf(x)$ or $f(x+k) = f(x)$;
- recognize patterns in modeled data, equations, and formulas associated with each important class of functions and the way that parameters in these representations determine particular cases;
- translate information from one representation (tables, graphs, or formulas) to another;

- use functions to solve problems in calculus, linear algebra, geometry, statistics, trigonometry, and discrete mathematics;
- explore data using a variety of standard techniques for organizing and displaying data in order to detect patterns and departures from patterns;
- identify misuses of statistics and invalid conclusions from probability;
- draw conclusions involving uncertainty by using hands-on and computer-based simulation for estimating probabilities and gathering data to make inferences and conclusions;
- use appropriate methods such as random sampling or random assignment of treatments to estimate population characteristics, test conjectured relationships among variables, and analyze data;
- determine and interpret confidence intervals;
- anticipate patterns using theory and simulations to study probability distributions and apply them as models of real phenomena;
- use probability models to draw conclusions from data and measure the uncertainty of those conclusions;
- understand basic concepts of probability such as conditional probability and independence, and develop skill in calculating probabilities associated with those concepts;
- apply discrete structures (sets, logic, relations, and functions) and their applications in the design of data structures and programming;
- demonstrate knowledge of basic elements of discrete mathematics such as graph theory, recurrence relations, finite difference approaches, linear programming, and combinatorics;
- apply the fundamental ideas of discrete mathematics in the formulation and solution of problems arising from real-world situations;
- design and analyze algorithms, including the use of recursion and combinatorics;
- utilize varied informal and formal assessment techniques for evaluating students' mathematical understanding;
- make and investigate mathematical conjectures;
- use representations to model and interpret physical, social, and mathematical phenomena;
- build new mathematical knowledge through problem solving;
- monitor and reflect on the process of mathematical problem solving;
- use graphing calculators, computer algebra systems, spreadsheets, and programming to explore mathematical ideas and to solve problems related to discrete structures and algorithms, calculus, geometry, probability, statistics, number, and algebra;
- apply appropriate techniques, tools, and formulas to determine measurements and their application in a variety of contexts; and
- complete error analysis through determining the reliability of the numbers obtained from measurement.

Required Text: None

Methods of Instruction: The methods of instruction are determined by the instructor and will vary based on the content and the individual needs of students. You are encouraged to assess and monitor your own problem-solving processes to determine when an error has been made or a new strategy should be used.

Evaluation Methods: Student performance will be evaluated using a variety of formative assessment tools such as in-class assignments and student presentations. Special projects and daily grades may also be used at the discretion of the instructor. Summative assessment will be in the form of a student portfolio, which is a gateway assessment for this course. **Students are required to meet a minimum level of performance on all components of the gateway assessment to earn a passing grade in the course.** The gateway portfolio consists of 3 entries in each of the following content areas: algebra, number systems, geometry, probability & statistics, calculus, measurement, and discrete mathematics.

Portfolio Content Sections:

1. Number & Quantity
2. Algebra

3. Geometry and Trigonometry
4. Data Analysis, Statistics, and Probability
5. Calculus

Letter grades will be computed as follows:

Portfolio	75%
Final	10%
SMP Reflection Paper	15%

Attendance: Attendance is strongly encouraged when possible. Students are not required to turn in documentation for absences. Attendance will be recorded using face-to-face interactions and D2L. The online platform records the date and duration of engagement. Faculty have been asked to be extremely flexible with attendance requirements. Please adhere to the UNG decision making tree when questioning whether or not to attend class. **All assignments and class materials will be posted on D2L; therefore students can keep up even if they are required to be absent.** Posting all materials on D2L will help prepared us in the event that classes move completely online. Please befriend your classmates to help hold yourself accountable for the material in this course. Deadlines may be extended on an individual basis at the discretion of Dr. Bragelman.

Tutoring

Students are encouraged to work with their peers on homework and class assignments and to seek help if they do not understand the material. The mathematical tutorial center is located in Newton Oakes room #211. The open hours are posted outside the door. They are typically posted after the first week of classes. Additional services are provided by UNG.

UNG's Tutorial service are posted here: <https://ung.edu/tutoring-services/>

Web-based Resources:

Website Title	Website Address
Purple Math	(http://www.purplemath.com/modules/index.htm)
Math is Power 4u	(http://www.mathispower4u.com/)
Math is Fun	(https://www.mathsisfun.com/)
Khan Academy	(https://www.khanacademy.org/)
Careers in Mathematics	(http://www.ams.org/early-careers/)
UNG Learning Support Resources	(http://ung.edu/learning-support/academic-resources.php)
Desmos	(https://www.desmos.com/)

Technology Resources:

- TI-83/84 Plus SE and TI-89
- *GeoGebra* (mobile, tablet, desktop)
- *Excel*

Bibliography and Supplementary Reading:

- *Principles and Standards for School Mathematics* (NCTM, 2000)
- NCTM Navigations Series
 - *Navigating through Algebra in Grades 9–12*
 - *Navigating through Algebra in Grades 6–8*
 - *Navigating through Geometry in Grades 9–12*
 - *Navigating through Geometry in Grades 6–8*

- *Navigating through Data Analysis in Grades 6–8*
- *Navigating through Data Analysis in Grades 9–12*
- *Navigating through Mathematical Connections in Grades 9-12*
- *Navigating through Measurement in Grades 9–12*
- *Navigating through Measurement in Grades 6–8*
- *Navigating through Number and Operations in Grades 9-12*
- *Navigating through Number and Operations in Grades 6-8*
- *Navigating through Probability in Grades 9–12*
- *Navigating through Probability in Grades 6–8*
- *Empowering the Beginning Teacher of Mathematics: High School* (NCTM, 2004)
- *Empowering the Beginning Teacher of Mathematics: Middle School* (NCTM, 2004)
- *Mathematics Teaching in the Middle School* (NCTM)
- *Addenda Series Grades 9-12* (NCTM)
- *Addenda Series Grades 5-8* (NCTM)
- *Knowing and Learning Mathematics for Teaching*, National Research Council, National Academy Press, 2001
- *EDThoughts: What We Know about Mathematics Teaching and Learning*, J. Sutton, & A. Krueger, Aurora, CO: McREL, 2002

SPECIFIC DETAILS OF THIS SYLLABUS MAY BE SUBJECT TO CHANGE

Students are expected to refer to the [Supplemental Syllabus](http://ung.edu/academic-affairs/policies-and-guidelines/supplemental-syllabus.php) for the following information:
(<http://ung.edu/academic-affairs/policies-and-guidelines/supplemental-syllabus.php>)

Supplemental Syllabus:

- | | |
|---|-------------------------------------|
| 1. Academic Exchange | 7. Disruptive Behavior Policy |
| 2. Academic Integrity Policy | 8. Campus Carry |
| 3. Academic Success Plan Program | 9. Inclement Weather |
| 4. Class Evaluations | 10. UNG 5 Core Institutional Values |
| 5. Course Grades and Withdrawal Process | 11. UNG Alert |
| 6. Disability Services | |

On a final note this class will follow all procedures related to COVID as outlined at Nighthawks Together. <https://ung.edu/together/>

Calendar of Events

The schedule provided is subject to change. Please beware of notices given on-line in D2L.

Week #	Dates	Textbook Sections, Topics & Major Assessments
Week 1	August 13 & 15	Syllabus, Intro to Rubric, What is Culture?
Week 2	August 20 & 22	Personal Finance; N & Q Intro
Week 3	August 27 & 29	Number & Quantity E1 & E2
Week 4	September 3 & 5	Number & Quantity E3 & E4
Week 5	September 10 & 12	N&Q Entries due 9/10 @ 1:59pm Algebra Intro & E1
Week 6	September 17 & 19	Algebra E2 & E3
Week 7	September 24 & 26	Algebra E4 & Geometry & Trig Domain Intro
Week 8	October 1 & 3	Alg. Entries due 10/1 @ 1:59pm Geometry & Trig E1 & E2
Week 9	October 8 & 10	Geometry & Trig E3 & E4
Week 10	October 15 & 17	Flex Week
Week 11	October 22 & 24	G&T Entries due 10/22 @ 1:59pm Statistics & Probability Intro & E1
Week 12	October 29 & 31	S & P E2 & E3
Week 13	November 5 & 7	S&P E4 & Calculus Intro
Week 14	November 12 & 14	S&P Entries due 11/12 @ 1:59pm Calculus E1 & E2
Week 15	November 19 & 21	Calculus E3 & E4
Week 16	November 26 & 28	Fall Break
	December 3 - 6	Calc entries due 12/2 @ 11:59pm Final Exam Week