Quantitative Reasoning from an Advanced Viewpoint

MATH 613-801 (CRN 43835)

Instructor Information

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Instructor Bio:

Please feel free to call me "Josh". I started teaching at Ball State in August 2022, and I am excited to be teaching math classes for educators. I have taught middle and high school math all over the west side of Indianapolis. I have bachelor's degrees in math and math teaching from Indiana State, a master's in math from IUPUI, a master's in educational psychology from Ball State, and a PhD in math education from North Carolina State. My research focuses on math anxiety in teachers, but I have my hands in projects on curriculum development, professional development, and other topics that pique my interests. I love working with teachers, and I am excited to get to know each of you this semester.

Course Information

Course Description

This course focuses on unpacking the concept of quantitative reasoning and the mathematical content needed to effectively teach courses in quantitative reasoning. Students will: interpret and use quantitative information in authentic contexts involving number, algebra, measurement, data analysis, and chance; represent quantitative information with mathematical models; and analyze and construct arguments using quantitative information. Students will also explore issues related to teaching mathematics and will design teaching materials for the development of quantitative literacy.

Prerequisites

None.

Course Content

This course will focus on selections from the following topics and questions. It is unlikely that we will cover each of these topics, though we may see tasks that can be adapted to fit different concepts. Additionally, these topics will not often be covered distinctly but will be covered in contexts commonly found in quantitative reasoning courses.

Introduction to Quantitative Reasoning
- What is quantitative reasoning?
- What is mathematical proficiency?
- What is mathematical modeling?

Numerical Reasoning
- Number sense
- Rational numbers
- Additive, multiplicative, and proportional relationships
- Percent and percent change

Reasoning about Measurement
- Measurement sense
- Scaling
- Approximation
- Reasoning about formulas
- Dimensional analysis

Algebraic Reasoning
- Symbol sense
- Linear relationships
- Exponential relationships
- Polynomial relationships
- Logarithmic relationships

Statistical Reasoning
- Data analysis and displays
- Descriptive, quantitative statistics
- Normal distribution
- Inferential statistics
- Correlation and causality

Probabilistic Reasoning
- Empirical and theoretical probability
- Counting techniques
- Simple and compound probability situations
- Normal distribution
- Conditional probability
- Expected value and the law of large numbers

Pedagogical/Andragogical Issues
- Barriers and challenges to quantitative literacy
- Designing instructional materials for use with students

Course Materials

Required for purchase:

- *Mathematical Mindsets: Unleashing Students' Potential through Creative Mathematics, Inspiring Messages, and Innovative Teaching* (2nd edition) by Jo Boaler, ISBN: 978-1119823063

- *Common Sense Mathematics* (2nd edition) by Ethan D. Bolker and Maura B. Mast, ISBN: 978-1470461348

Any other readings for the course will be provided by the instructor.

Course Objectives

Students will be able to:

- Interpret and use quantitative information in real-world, authentic contexts involving number, algebra, measurement, data analysis, and chance;
- Interpret quantitative information presented in mathematical forms (e.g., with functions, equations, graphs, diagrams, tables, words);
- Demonstrate conceptual understanding and procedural fluency in solving problems in number, algebra, measurement, data analysis, and chance;
- Illustrate quantitative information with appropriate mathematical models (e.g., with functions, equations, graphs, diagrams, tables, words), and recognize the limitations of these models;
- Use quantitative information to evaluate arguments, determining whether stated conclusions should be inferred.

In addition, students will:

- Examine pedagogical issues related to quantitative literacy;
- Design instructional materials to develop students' quantitative literacy; and
- Explore and discuss strategies for teaching mathematics to adults.

Course Rationale

According to the Mathematical Association of America's 1994 report, *Quantitative Reasoning for College Graduates: A Complement to the Standards*, "The foremost objective of both liberal and professional types of higher education should be to produce well-educated, enlightened citizens, who can reason cogently, communicate clearly, solve problems, and lead satisfying, productive lives." The MAA report argues that "every college graduate should be able to apply simple mathematical methods to the solution of real-world problems" and that "a quantitatively literate college graduate should be able to:

- Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them;
- Represent mathematical information symbolically, visually, numerically, and verbally;
- Use arithmetical, algebraic, geometric, and statistical methods to solve problems;
- Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results; and
- Recognize that mathematical and statistical methods have limits."

While the MAA report argues that quantitative literacy is not achieved in a single course, many colleges and universities have developed courses to provide a foundation for quantitative literacy. MATH 613 is intended to prepare instructors for teaching those foundational courses. It is designed to help instructors broaden their understanding of quantitative reasoning, develop their skills in quantitative reasoning, and develop knowledge and skills for teaching quantitative reasoning. It includes the features of quantitative reasoning that are notably in contrast to the features of traditional mathematics. Quantitative reasoning is carried out in real-life, authentic situations; the problems are ill-defined, estimation is crucial, and an interdisciplinary approach is often needed. The course also includes features of traditional mathematics: problem solving; the development of conceptual understanding and procedural fluency; and the development of mathematical models within particular content areas. Because written communication is such an important aspect of quantitative reasoning, participants will engage in the reading and writing of quantitative arguments throughout the course. The course guides participants through explorations of pedagogical issues related to the development of quantitative literacy. Participants will design instructional materials to develop their own students' quantitative literacy.

Course Modality/Structure

This course will be taught using a variety of methods, including readings, discussions, tasks/problem sets, and other formats appropriate to the goals of the course. Information will be delivered through an asynchronous, online format. Generally speaking, assignments will be due at 11:59 PM ET on their respective due dates.

Course Assignments and Grading Policies

Course Modules and Schedule

The course is largely organized into four content-guided modules, plus an introduction and a research project, as outlined in the table below. Each module will begin with a module overview page and contain several types of assignments, including discussion boards, mathematical tasks, and other assignments as relevant. While I try to stick to a consistent schedule for due dates, deviations are sometimes necessary; as such, I recommend developing a habit of checking due dates regularly, and while I provide the following table as a general idea of where our semester will take us, official due dates will be those published in the Canvas course.

Item	Tentative Dates of Module
Welcome to MATH 613!	**1/5 – 1/11**
Module 1 – Mathematical Mindsets	**1/12 – 2/8**
Module 2 – Financial Literacy	**2/9 – 3/15**
Module 3 – Data and Modeling	**3/16 – 4/5**
Module 4 – Probability	**4/6 – 4/26**
Research Project	**Throughout Semester**

Course Assignments:

Each module will include the same four types of assignments.

- Readings and Discussions (35% of grade): Throughout the course, there will be many readings that you will be required to complete. You will be required to post thoughts, reactions, and reflections to these readings to a discussion board in Canvas. You will also be required to post comments on the thoughts and reactions of your classmates. Note: There will also be discussion boards where you are asked to post in-depth solutions (not just the answers but your process for arriving at your answers) to certain tasks and engage with your peers thinking on these tasks, but these will be graded as Tasks (described below).
- Tasks (35% of grade): For each unit, you will have a collection of tasks to work on. You are expected to clearly label all problems, show your work, and explain your reasoning (when requested). Simply providing answers will not be acceptable for homework submissions. You will be required to submit an electronic copy of your tasks and submit them via Canvas ***as a PDF file***. You are *not* required to submit typewritten solutions; it is acceptable to scan your handwritten work or paste photos of your work into a document. Please ensure the photos/scans are clear and your work is legible. Tasks will generally be graded for completion rather than accuracy; however, your instructor reserves the right to grade assignments for accuracy if there are concerns about the quality of student submissions. Additionally, you will discuss the tasks with your peers in a discussion board.
- Research Project (30% of grade): This course will culminate in a research experience. You will research a topic related to quantitative reasoning or the effective instruction of quantitative reasoning and write a brief research paper during the last few weeks of class. The research topic you choose will be subject to my approval. You may not choose a topic that has already been chosen by another person, though you may examine a similar topic from a different perspective. I recommend you keep this paper in the back of your mind as you are reading and reflecting on the course material so you can develop an idea of topics that might interest you for the paper. The suggested length of your paper is approximately ***four to six double-spaced pages***, not counting a cover page, references, or other materials. Format for the paper should be Times New Roman, 12-pt font, double-spaced. The references must include at least three scholarly sources. Sources must be appropriately cited using standard APA format.

Course Weights and Grading Scale

Assignments are weighted by category, and corresponding percentages are provided below. The Grading Scale for final course grades also follows.

Assignments	Percent
Readings and Discussion Boards	35%
Tasks	35%
Final Paper	30%

Course Grade	Percentage Lower Bound
A	90%
B	80%
C	70%
D	60%
F	<60%

Course Statements and Policies

Feedback Policy

- I always try to respond to emails from your official Ball State email address within 24 hours during the work/school week (Monday-Friday) and 48 hours on the weekend. Feel free to send a second email if I miss one of these windows.
- I will read every discussion post but I will not always personally comment on posts.
- I plan to grade assignments and discussions within 1 week of submission, though I appreciate your grace if this doesn't always happen. Likewise, I am happy to show grace if you need extensions on assignments now and then. Just let me know before the due date.
- Contact me directly with questions or concerns about your performance in class.

Attendance/Participation Policy

Your regular participation and timeliness are important to your academic success. In MATH 613, this will take the form of completing all assignments and participating in class discussions via Canvas. As this is an online course, it is up to every student to stay on track and not fall behind. You must be self-motivated and disciplined to meet all due dates. Developing a routine is encouraged. You are expected to submit each assignment by a specified time and date. See Canvas for specific due dates and below for the Late Work Policy.

Late Work Policy

All assignments are due by 11:59 PM ET on their respective due dates unless otherwise noted. Late work will be accepted at the instructor's discretion. Unless there are extenuating circumstances or prior arrangements have been made, a **10% per day** grade deduction will be applied for late assignments. With the exception of the final paper, course assignments will not be accepted after 11:59 pm ET on the final day of classes, Monday, April 27.

Course Withdrawal

The course withdrawal period ends **Thursday, March 19**. Before this date, students can elect to receive a "W" for the course by completing and submitting the proper form. The instructor's permission is not required. For details, see https://www.bsu.edu/about/administrativeoffices/registrar/registration-activities/withdraw-from-classes as well as Degree Requirements and Time Limits in the current Undergraduate Catalog OR Withdrawal Procedures in the current graduate catalog.

Assignment Submission Policy

- Written assignments should be submitted as .pdf documents unless otherwise indicated in the assignment description. If you take pictures of handwritten work, please paste these into a Word document and either *print*, *export*, or *download* your file as a pdf. Alternatively, there are several free tools for scanning your work as a pdf with your phone, and I'm happy to provide suggestions and support as needed.
- Generally speaking, assignments should be submitted using the assignment links in Canvas**.** Occasionally, there may be exceptions to this, but those exceptions will be clearly stated.

Grading Policy

Appropriate evaluation of your academic performance is an integral part of your learning experience. In the absence of mistake, fraud, bad faith, or incompetence, I will be the key decision-maker on the assignment of grades. For information concerning grade appeals, consult the Ball State website.

University Policies

University Statement

We are committed to ensuring that all members of the community are welcome, through valuing the various experiences and worldviews represented at Ball State and among those we serve. We promote a culture of respect and civil discourse. If you need course adaptations or accommodations because of a disability, please contact the instructor of record as soon as possible. Ball State's **Disability Services** office coordinates services for students with disabilities; documentation of a disability needs to be on file in that office before any accommodations can be provided. Disability Services can be contacted at 765-285-5293 or **dsd@bsu.edu**.

Freedom of Expression

In this course, we are committed to fostering a learning environment that values intellectual diversity, encourages free expression, and promotes open inquiry. As members of the Ball State Community, we treat each person in the Ball State community with civility, courtesy, compassion, and dignity and respect and learn from differences in people, ideas, and opinions. Please review Ball State University's Statement on Freedom of Expression, the resources on Ball State's Freedom of Expression webpage, and Ball State's Beneficence Pledge.

Attendance

This course is offered in an online, asynchronous format. Because of that, class attendance is not graded, and for clerical purposes (e.g. "last date of attendance") will be determined based on the date of the last assignment submission.

Ball State Academic Ethics

Honesty, trust, and personal responsibility are fundamental attributes of the university community. Academic dishonesty and other forms of academic misconduct threaten the foundation of an institution dedicated to the pursuit of knowledge and will not be tolerated. To maintain its credibility and reputation, and to equitably assign evaluations of scholastic and creative performance, Ball State University is committed to maintaining a climate that upholds and values the highest standards of academic integrity. Visit the complete Student Academic Ethics Policy.

Also see Ball State's Code of Student Rights and Responsibilities.

Plagiarism Policy

Plagiarism is not acceptable, unless otherwise indicated for all assignments, you must work independently by yourself. Sharing of files is not permitted for any reason.

Potential Violations

Examples of academic integrity violations include but are not limited to:

- Working with another person on any assignment other than authorized group projects.
- Sharing or allowing others to access your files, whether done with permission or not.
- Use or possession of a file created by someone else.
- Reusing work from another semester, course, or section.
- Fraudulent submission of work.
- Using unauthorized materials during Exams.
- Impersonating someone else or having them impersonate you.
- Making fraudulent or dishonest statements regarding your work.
- Soliciting others, including AI tools, to complete work for you.

- Posting course files and resources on study or content sharing websites.

Canvas and Student Privacy

Canvas Accessibility

Canvas provides a user experience that is easy, simple, and intuitive. Special attention has been paid to making Canvas screen-readable. The Rich Content Editor encourages users to create accessible content pages (i.e. text formatting is accomplished using styles). Canvas is designed to allow limited customization of colors and schemes to be accessible for all users. The National Federation of the Blind granted Canvas the Gold Level Web Certification in 2010.

Find more information by visiting the Canvas Voluntary Product Accessibility Template (VPAT).

FERPA and Privacy

As a student, your educational records are considered confidential. Under FERPA (Family Educational Rights and Privacy Act), your records are confidential and protected. Under most circumstances, your records will not be released without your written and signed consent. However, some directory information may be released to third parties without your prior consent unless a written request to restrict this is on file. You can learn more about student rights to privacy by reading Ball State's FERPA and Privacy and Protection.

Academic Support Services

The Writing Center

All writers improve with practice and feedback, so as a student in this course, you are encouraged to use the Writing Center (in Robert Bell 295 during weekdays, Bracken Library First Floor West in the evenings, or online during any of our regularly scheduled hours) to get additional feedback on your writing.

The Writing Center offers free planning, feedback, and accountability sessions (in person and online) to all students composing essays, reports, reflections, research projects, web content, lesson plans, slideshows, poster presentations, resumes, and other digital or print texts. To schedule a free appointment to discuss your writing, go to **http://www.bsu.edu/writingcenter**. Online and in-person appointments are available; however, plan ahead because appointments book quickly!

The Basic Needs Hub

If you are having difficulty affording enough food, do not have a safe and reliable place to sleep, and/or experiencing an emergency or crisis, help is available through the **Basic Needs Hub**. The Basic Needs Hub has information, resources, and provides individualized support to students. To talk with a supportive staff member about your experience, receive one on one assistance, or learn more about resources, you can submit a **Basic Needs Assistance Form**.

Subject to Change Statement

This syllabus and schedule are subject to change in the event of extenuating circumstances.

Syllabus updated 1/2/2026