

M574: Probability & Statistics for Teachers

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Office hours: By appointment. Please email me to schedule a meeting with me.

Course webpage (Moodle): <http://www.umonline.umt.edu>

Important Acknowledgement: The content of this course was adapted from M 595 Probability & Statistics from a Problem-solving Perspective, which was a pilot of our course. M 595 was developed by my colleague Prof. Fred Peck and a group of graduate students participated in the course and provided feedback in 2017.

About the course

“Statistics” is often used as a noun, and is associated with a particular kind of mathematical *content* to be learned. In this course, rather than conceptualizing statistics as a noun, we will explore what it means to think about statistics as the *practice of statistical reasoning*, and as a *way of seeing the world*.

Learning outcome

The main outcome of the course is that **participants will develop as mathematicians and teachers**. Development involves the acquisition of knowledgeable skill, but it’s much bigger than acquiring content knowledge. Development involves *becoming* a member of a community, and thus it affects not simply what we know, but also who we are and how we see the world. Therefore, development cannot be reduced to an enumerated list of learning outcomes nor can it be standardized across participants.

We develop as members of a community as we participate in the practices of that community. Thus, rather than thinking about the course in terms of *outcomes* to be attained, it is better to think about the course in terms of *practices* to participate in. During the course, participants will (a) participate in the practice of statistical reasoning, (b) participate in the practice of mathematical argumentation and critique, and (c) ask for and provide help as a member of a mathematical community.

Course activities and deliverables

1. **Lab workbook:** Our primary text for the course is a lab workbook. There is very little content exposition and no worked examples. Instead, the text engages you in a variety of statistical and modeling activities, guiding you to learn content via problem-solving.

Deliverable: You should complete all of the activities in the assigned pages, and you will turn in selected pieces of the lab workbook. Some weeks there will be a Moodle discussion on the lab work. I will post worked solutions by Prof. Fred Peck for the entire workbook so that you can check your work. Of course, multiple answers are likely possible so your work does not have to match.

2. **Statistical investigations:** During weeks 2, 3, and 4 you will use the tools that you have learned in the course to conduct a statistical investigation. In weeks 3, 4, and 5 you will provide peer review on a peer's investigation.

The statistical investigations will involve social issues. Statistics can help us use data to see things that we may not see otherwise. This is especially important when we confront contemporary social issues, which are often dominated by ideology and opinion. These issues are controversial, and statistical reasoning with sound data can serve as a disciplined way to bring clarity to the controversies. That said, data are never neutral. Numbers are never just numbers. They are saturated in human subjectivities and biases, and the conclusions that follow are a result of many human decisions. You should engage in the investigations and the conclusions that follow from the statistical reasoning process. But you can also critique the data and the methods through which they were collected and analyzed.

Deliverable: Each week you will submit your investigations to Moodle and to a peer for peer-review. I will participate in the peer review, and will provide detailed peer feedback on one investigation for each person in the course. I will also provide detailed guidelines and rubrics for the investigations and peer reviews, and I will provide a peer review schedule.

In week 5, you will revise your investigations in response to your peer reviews and assemble a portfolio of your two best investigations to submit for grading.

3. **Pedagogical readings:** During weeks 2, 3, 4 and 5, you will have brief pedagogical readings that describe *statistical reasoning* and ways that it develops in the classroom. We will discuss these readings on Moodle.

Deliverable: Each week there will be a Moodle discussion on the assigned reading

4. **Independent reading:** In the background you should read one book related to the role of uncertainty and chance in our world. There is no deliverable associated with this reading. You should just read and reflect on the book in whatever way is most beneficial for you.

Grading

You grade is based on the following:

- **Participation in mathematical practices 60%:** This will be assessed using weekly self- assessments. At the end of each week, you will complete a brief self- assessment, in which you assess the extent to which you participated in the class activities that week.
- **Evidence of sound statistical reasoning 40%:** This will be assessed using your final portfolio. Your final portfolio should provide your best evidence of sound statistical reasoning. I will provide a rubric for the portfolio.

Time commitment

Because we are condensing a 15-week course into five weeks, there is a lot of work each week.

Please keep this in mind.

You should expect to spend ~3 hours per day (~15 hours per week) on the course. I structured the schedule with flexibility in mind. Each week there is a mid-week due date (on Weds at midnight) and an end-of-the-week due date (on Sunday at midnight). Within those fixed due dates, you can structure the activity in whatever way is most convenient for you. You can use the weekends to work if that is convenient, but that is not an expectation.

Schedule

The schedule below is tentative. We will probably follow it, but it is subject to change based on the progress of the course. Each week I will post the expectations and schedule for the week on Moodle. You should defer to that schedule.

		Lab work	Investigation	Pedagogical reading
Week 1	Part a (through Wed)	pp. 15-40 (<i>skip</i> pp. 22-29)	(none)	(none)
	Part b (through Sun)	pp. 41-92 (<i>skip</i> p. 72) (<i>optional</i> : pp. 92-94)		
Week 2	Part a (through Wed)	pp. 95-138 (<i>skip</i> pp. 106-122)	Investigation 1	Read: GAISE, Intro and ch. 1
	Part b (through Sun)	pp. 139-158 (<i>skip</i> pp. 140-151)		Participate in discussion
Week 3	Part a (through Wed)	pp. 159-171	Peer review of Investigation 1	Read: NCTM article (provided on course website)
	Part b (through Sun)	pp. 172-197 (<i>optional</i> : pp. 198-204)	Investigation 2	Participate in discussion
Week 4	Part a (through Wed)	pp. 205-217 <i>plus</i> : Football kick activity	Peer review of Investigation 2	Read: GAISE ch 2, 3, or 4 (choose 1)
	Part b (through Sun)	Video (see Moodle) pp. 223-224	Investigation 3	Participate in discussion
Week 5	Part a (through Wed)	pp. 225-246 (red line) (<i>skip</i> : pp. 234-241)	Peer review of Investigation 3	(none)
	Part b (through Fri)	pp. 246 (red line)- 254 (<i>optional</i> : pp. 255-259)	Assemble portfolio	

Texts

The lab workbook and pedagogy book are available as free PDFs on the course webpage. Note that the lab workbook is specially modified by my colleague Prof. Fred Peck for M595, which was a trial for our course. These texts will be supplemented these with other readings and/or activities, which will be provided on the class website.

Lab workbook

Zieffler, A., & Catalysts for Change. (2015). *Statistical Thinking: A simulation approach to uncertainty* (3rd ed. M595 edition). Minneapolis, MN: Catalyst Press.

Pedagogy book

Franklin, C. A., Kader, G. D., Mewborn, D. S., Moreno, J., Peck, R., Perry, M., & Scheaffer, R. L. (2005). *Guidelines for assessment and instruction in statistics education (GAISE) report: A pre-k– 12 curriculum framework*. Alexandria, VA.

Independent reading

A secondary requirement is to choose a popular book on statistics and uncertainty and read it. Choose one of the following:

1. *Innumeracy* by John Paulos
2. *Fooled by randomness* by Nassim Taleb

You can find each of these books in a variety of formats online for under \$10. There is no rush to get the book, the only requirement is that you read it by the end of the course.

Software

We will use TinkerPlots software. You can download the software from the URL below:

<https://www.tinkerplots.com>

The cost is \$7 for a one-year license, or \$20 for a lifetime license. You should purchase at least the one-year license so that you can use it for this course.

Asking for and providing help

The nature of an online course is that there is a lot of independent work. As you work

through the lab workbook, you may have questions, including questions related to statistical practices and content, and questions related to using Tinkerplots software.

In a community of learners, we all have a responsibility to ask for and to provide help.

When you have a question, please post it to the course “Q and A” discussion forum. Everyone should monitor this forum, and we should see responding to questions as a collective responsibility. If you can help a colleague who has a question, please do. As a member of the community, I will also monitor the forum and I will try to respond to questions in a timely manner. Others should do the same.

Meeting

If you would like to meet with me, with can do so via Skype (wukemontana) or Google Hangout (ke.wu@mso.umt.edu). I can also set up a Zoom link that allows video or phone conference. Please email me to schedule a meeting.

Other policies

Communicating: Email is the best way to reach me. UM policy states that I must use your UM email account when I correspond with you. Please email me from your UM account—that makes it easy to follow the policy!

Classroom and testing accommodations: The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

Academic honesty: All students need to be familiar with the Student Conduct Code. You can find it in the “A to Z Index” on the UM home page. All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.