

Promoting Student Engagement in Online Statistics Courses





ABSTRACT

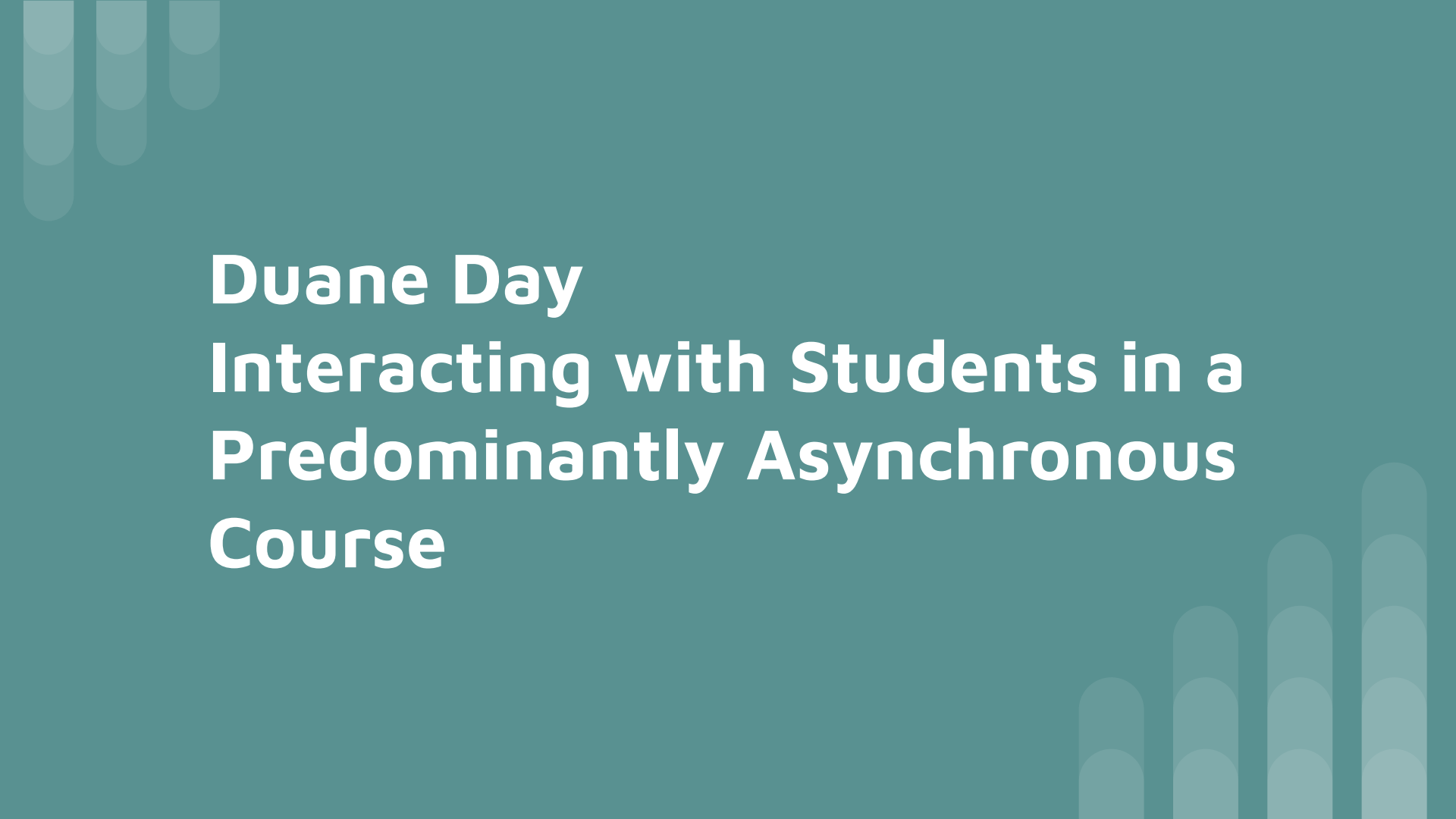
In this webinar, the presenters will share information on how to use various techniques to promote student interaction and active learning in online Introductory Statistics classes. Participants will be given the opportunity to ask questions and interact with the presenters.

Speakers

Duane: *Engagement within an asynchronous course*

Anelise: *Collaboration on an online course*

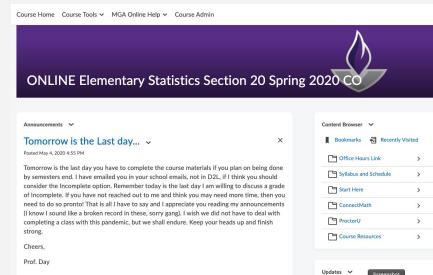
Dan: *Interactions through a final project*



Duane Day
Interacting with Students in a
Predominantly Asynchronous
Course

My Courses

- MGA is a four-year University
- Elementary Statistics is taught in a traditional style in both:
 - Face-to-face
 - Online
- Statistics is a required course for most of our majors
- The design of our online courses is evolving
- Online & F2F Statistics is a huge part of enrollment.



Problems with Online

- Our courses are predominantly Asynchronous
- Students in this environment are:
 - less likely to reach out for help
 - will procrastinate
 - have a higher probability of failing

My Personal Belief:
Students like to hide
behind their glasses...



Question: How can I get my students to interact with me in this type of course design?

Interaction Tools for the Asynchronous Course

- Email
- LMS Announcements Tool
- Virtual Office Hours
- Question & Answer Sessions

The screenshot shows an LMS interface with an 'Inbox' section containing several email entries from 'ONLINE Elementary Statistics Section 20 Spring 2020 CO'. An 'Announcements' dropdown is open, displaying a message titled 'Tomorrow is the Last day...' dated 'Posted Mar 4, 2020 4:55 PM'. The announcement text reads: 'Tomorrow is the last day you have to complete the course materials if you plan on being done by semesters end. I have emailed you in your school emails, not in D2L, if I think you should consider the Incomplete option. Remember today is the last day I am willing to discuss a grade of Incomplete. If you have not reached out to me and think you may need more time, then you need to do so pronto! That is all I have to say and I appreciate your reading my announcements (I know I sound like a broken record in these, sorry gang). I wish we did not have to deal with completing a class with this pandemic, but we shall endure. Keep your heads up and finish strong. Cheers, Prof. Day'.

Handwritten work for a division problem: 'Let $m = 79$ and $n = 12$, find the quotient q and remainder r when you divide m by n .' The calculations are: $q = \lfloor \frac{m}{n} \rfloor = \lfloor \frac{79}{12} \rfloor = \lfloor 6.58\bar{3} \rfloor = 6$, $r = m - n \lfloor \frac{m}{n} \rfloor = 79 - 12(6) = 7$. A second example is shown: $m = -37$ and $n = 4$, $q = \lfloor \frac{-37}{4} \rfloor = \lfloor -9.25 \rfloor = -10$, $r = m - n \lfloor \frac{m}{n} \rfloor = -37 - 4(-10) = 3$.

The screenshot shows a virtual office hour session. The main content is a truth table for the logical expression $(\sim Q) \Rightarrow (\sim P)$. The table has columns for P , Q , $\sim P$, $\sim Q$, $P \Rightarrow Q$, $Q \Rightarrow P$, and $(\sim Q) \Rightarrow (\sim P)$. The rows represent the combinations of truth values for P and Q . The final column, representing the truth value of the expression, has a blue arrow pointing to the right. The values in the final column are T, T, F, T. A red arrow points to the top row. A video feed of Prof. Day is visible in the bottom right corner.

P	Q	$\sim P$	$\sim Q$	$P \Rightarrow Q$	$Q \Rightarrow P$	$(\sim Q) \Rightarrow (\sim P)$
T	T	F	F	T	T	T
T	F	F	T	F	F	F
F	T	T	F	T	T	T
F	F	T	T	T	T	T

Q & A Sessions

- Students can ask questions about course content or homework problems
- You and your students can work out problems together using a whiteboard
- You can give mini lectures over content
- You can share your screen to share applications, such as:
 - Graphing Calculator
 - Excel
 - Class Notes or other documents
- You can record these sessions to upload for the students who could not attend.

Q & A Sessions

- How often were the Q & A sessions held?
- I have tried holding the Q & A sessions at different day/time settings:
 - I picked a day/night and held the session at that day/time for the entire semester.
 - I had the students vote on a day/time that worked for them.
 - I have held them 2 nights a week on days/times that benefited the students.
- I currently do not require that they come to these sessions.

Does This Work?

- Did the pass rates rise and the DWF rates Fall after using the Q&A sessions?

Avg. Pass Rate Without Q&A	Avg. Pass Rate With Q&A	P-value ($\mu_{\text{with}} > \mu_{\text{without}}$)
67.75%	83.83%	0.05458

- There is marginal evidence that the pass rates are higher when the Q&A sessions are held versus when they are not.



Questions?

Duane Day
duane.day@mga.edu





Anelise Sabbag
**Interaction and collaboration in
an online setting**



My Course



- Introductory statistics course for social sciences students
- Quarter (10 weeks) - Cal Poly
- Face-to-Face
 - Working in groups every class
 - Active learning
 - Cooperative learning
- Online version

Weekly Schedule

ASSIGNMENTS:

- reading quiz
- activities
- collaborative keys
- wrap-up videos
- homework


ASSESSMENT:

- 1 midterm
- 1 final exam
- 1 project

 [What's Due Week 1](#)

Part 1: Reading and Videos _____

 [Reading - Chapter 1 \(Significance: How strong is the evidence?\)](#)

 [Videos - Chapter 1](#)

Part 2: Practice (Activities & Quizzes) _____

 [Readiness Quiz - Week 1](#)

 [Activity 1.1: Basics of Data and Terminology](#)


 [Activity 1.1 - please upload activity here](#)

 Collaborative Key (Activity 1.1)

Restricted Not available unless: The activity [Activity 1.1 - please upload activity here](#) is marked complete

 [Wrap-up Videos - Activity 1.1](#)

 [Activity 1.2: Dogs and Human Cues & Tasting Water](#)

 [Activity 1.2 - please upload activity here](#)

 Collaborative Key (Activity 1.2)

Restricted Not available unless: The activity [Activity 1.2 - please upload activity here](#) is marked complete

 [Wrap-up Videos - Activity 1.2](#)

Part 3: Assess _____

 [End of Unit Quiz - Week 1](#)

Question Forum _____

 [Week 1 Questions](#)

Weekly Schedule

ASSIGNMENTS:

- reading quiz
- activities
- collaborative keys
- wrap-up videos
- homework

ASSESSMENT:

- 1 midterm
- 1 final exam
- 1 project

Assignment	Percentage
Readiness quizzes	10%
Activities, Collaborative Keys & Wrap-up Videos	10%
End of Unit Quiz	20%
Project	20%
Midterm	20%
Final Exam	20%

Collaborative Keys

- Student interaction through Collaborative Keys

The screenshot shows a Google Docs interface for a document titled "Activity 1: Dogs and Human Cues & Tasting Water". The document content is as follows:

Part 1: Can Dogs Understand Human Cues?

1. Identify the variable in the study. Is this variable quantitative or categorical? What are the possible levels of this variable?

13. Consider the graph from #11.

a) **Using the context of the problem**, explain what a dot on the plot represents.

b) Where does 9 heads fall in the distribution? Would you consider it an unusual outcome or a fairly typical outcome for the number of heads in 10 flips?

c) Based on your answer to the previous question, do you think it is plausible (believable) that Harley was just guessing which cup to choose?

14. Sketch the plot with 1000 different simulated samples.

17. Do the results of this study appear to be statistically significant? *Statistical significance* means that the observed result is unlikely to have occurred by chance alone.

Collaborative Keys

OPTION 1

1 Collaborative Key per class

All questions from activity

- 1) 1st contribution
- 2) Professor's feedback
- 3) 2nd contribution

Graded on completion

Interactions: STUDENT X PROFESSOR

OPTION 1

20. Are you comfortable with concluding from this study that the diet used causes a difference in BMI change? Justify your answer.

Izzy: Yes, because the evidence we found suggests there is a correlation between a specific diet resulting in women's BMIs going down.

PROFESSOR: Answer is not correct. Finding a statistically significant result is not enough to make a causal claim.

Izzy, what else is needed in the design of the study to allow you to make a causal claim?

Izzy: I am not 100% sure, can you point me in the right direction? I know a causal claim is any assertion that invokes causal relationships between variables?

Kaitlyn: Isn't it that we can make a causal claim because random assignment was used in the study which nullifies any potential confounding variables from affecting the results?

PROFESSOR: Yes, random assignment does tend to balance out confounding variables and this allows you to make a causal claim.

We have evidence that the Atkins diet causes a higher change in BMI, when compared to ORNISH, LEARN, and ZONE because this is a randomized experiment (random assignment was used in the design of the study). When random assignment is used confounding variables tend to be balanced out between groups.

OPTION 1 - example

19. Based on this analysis, are you convinced that Harley can understand human cues? Why or why not?

Madilyn: Yes I am because if Harley were just guessing he very likely would have only chosen the correct cup somewhere in the 3-7 time range. Choosing heads 9 times is so rare (and at the tail end of the distribution) that there must be something else driving Harley to choose the cups besides chance alone.

Sarah: I agree with Madilyn because Based on the analysis I can confidently say that I believe Harley Understands human cues because her answers are much higher than the “of chance model” shows with the coin toss model.

PROFESSOR: This is very good, Sarah and Madilyn. :) I agree with you that it is very unlikely to get Harley’s result just by chance!

I have a follow-up question: Are you 100% sure that Harley can understand human cues?

Drew: I can’t say with 100% certainty that Harley can understand human cues. There still is a very small possibility that Harley could have guessed 9 out of 10 correctly by chance. While I can’t be 100% certain that Harley can understand human cues I think it is very likely that Harley does understand them because of how unlikely it is to randomly guess 9 out of 10 correct.

PROFESSOR: nice answer Drew!

Collaborative Keys

OPTION 1

1 Collaborative Key per class

All questions from activity

- 1) 1st contribution
- 2) Professor's feedback
- 3) 2nd contribution

GRADUATE STUDENTS!

Graded on completion

Interactions: STUDENT X PROFESSOR

Collaborative Keys

OPTION 1	OPTION 2
1 Collaborative Key per class	1 Collaborative Key per group
All questions from activity	Some questions from activity
1) 1st contribution 2) Professor's contribution 3) 2nd contribution	1) Initial answer 2) Discussion Resource: Watch Wrap-up videos 3) Final group answer
Graded on completion	Graded on correctness
Interactions: STUDENT X PROFESSOR	Interactions: STUDENT X STUDENT

GRADUATE STUDENTS!

OPTION 2 - Initial Answers

9. Use the applet to find the p-value. Sketch or take a screen shot of the plot with the highlighted area used to calculate the p-value. Make sure the screen shot shows the p-value. Report the p-value.

Hannah: The p-value I obtained is 0.530.

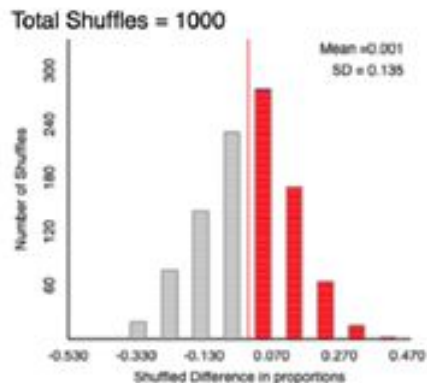
Number of Shuffles: 999 OK

Shuffle Cards Data Plot

Most Recent Shuffle

Group A
Success: 10
Failure: 24

Group B
Success: 4
Failure: 12

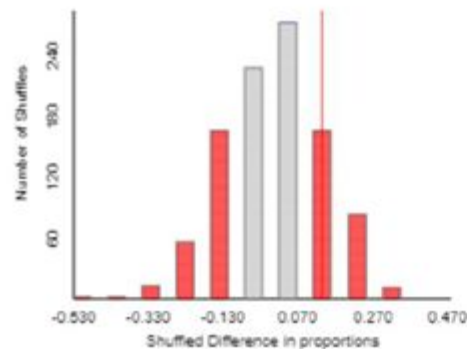


Show previous

Count Samples: Greater than \geq 0 Count

Count = 530/1000 (0.5300)

Overlay normal distribution



Show previous

Count Samples: Beyond $>$ 0.136

Count

Count = 499/1000 (0.4990)

Overlay normal distribution

Elise:

OPTION 2 - Discussion

Hannah: Both of our distributions are correct in the sense that we both obtained a p-value close to 0.5. However, in my distribution, I was confused about whether or not it was 2-sided, so I did not make my distribution 2-sided which led me to an incorrect answer.

Elise: I think you also put in the wrong statistic? The null hypothesis is 0, but the statistic is not.

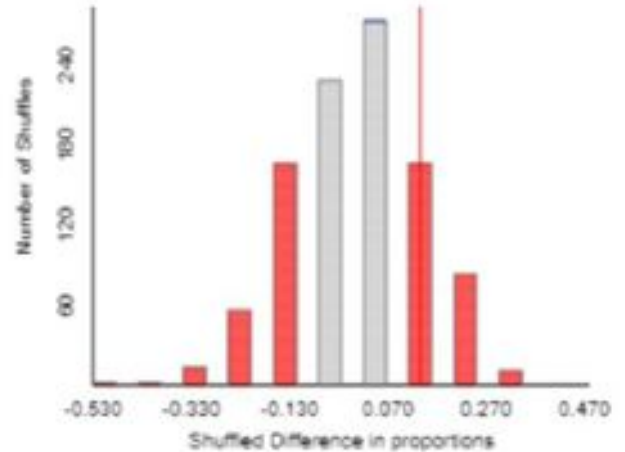
Hannah: I agree, I think my statistic may be wrong as well. I was confused about how to make the distribution for this question and I think I assumed to put the null hypothesis as the statistic I guess, I was pretty confused. I think your graph looks correct. Now I see from the wrap-ups that the statistic should in fact be 0.136.

Elise: Yeah, I did that as well too and first tried to put in the number 0 but realized that it was not a statistic.

OPTION 2 - Final Group Answer

FINAL GROUP ANSWER

Elise: the p-value would be around 0.5



Show previous

Count Samples

OPTION 2 - Another example (Initial Answers)

4. State the appropriate null and alternative hypotheses. *Tip: You can write the null hypothesis in symbols, but the alternative hypothesis can only be written in words.*

INITIAL ANSWERS

Patrick: $H_0: \pi(\text{none}) = \pi(\text{guest}) = \pi(\text{room}) = \pi(\text{citizen}) = \pi(\text{gender})$

Ha: At least 1 population proportion of guest reusing towels (π) is different, from the others, for guests in this hotel or similar guests staying in similar hotels to the one in this study.

Alice: $H_0: (\pi(\text{none}) - \pi(\text{guest})) - (\pi(\text{room}) - \pi(\text{guest})) = 0$

Ha: The difference in population proportion of guests reusing towels (π) is different.

Austin: H_0 : Difference in towel reuse based on the message in the bathroom is zero

Ha: Difference in towel reuse based on messages in the bathroom is not zero.

OPTION 2 - Discussion + Final Answer

DISCUSSION

Patrick: Remember to write an equation out for the null guys.

Alice: I see that mine wasn't exactly correct. I needed more elaboration for the alternate.

Also Austin, we were supposed to not use words for the null.

Austin: Yeah I should have made my null hypothesis an equation.

FINAL ANSWER

$H_0: \pi(\text{none}) = \pi(\text{guest}) = \pi(\text{room}) = \pi(\text{citizen}) = \pi(\text{gender})$

H_a : At least 1 population proportion of guest reusing towels (π) is different, from the others, for guests in this hotel or similar guests staying in similar hotels to the one in this study.

OPTION 2

12. Interpret the p-value. Note that I am NOT asking about the strength of evidence against the null hypothesis, I am asking for an *interpretation* of the p-value (e.g. the p-value is the probability/proportion of)

INITIAL ANSWERS

Patrick: The P-Value of .032 is the probability of observing a sample MAD of .055 or greater under the assumption that the null hypothesis is true.

Alice: The p-value of 0.027 is the probability of observation the sample MAD of .055 or greater assuming that the null hypothesis is correct.

Austin: We got a p-value of 0.038 which is the proportion of difference in the reuse of towels between different methods

DISCUSSION

Patrick: We have pretty similar answers. Austin, be sure to include the MAD.

Alice: Patrick, we can go with your answer since we used your answer in the last question and the p-value matches. Austin, remember to include the MAD in your interpretation.

Austin: Your completely right I need to include the MAD statistic. Since I got it wrong in the last my value was a little off . The wrap up videos were alot of help in explaining it and gave the same exact answer as the one the Patrick has posted.

FINAL ANSWER

The P-Value of .032 is the probability of observing a sample MAD of .055 or greater under the assumption that the null hypothesis is true.

Not much discussion, but reflections

13. Use the least squares regression line to predict the height of someone whose foot length is 28 cm. (Simply plug in the value of 28 cm for foot length in the equation of the line.)

Initial Answers:

Daryl [REDACTED]: $\text{Height}^{\wedge} = 38.30 + 1.03(11.0236) = 49.65$

Amy [REDACTED]: 67.14

Discussion:

Daryl [REDACTED]: My answer is wrong. I thought you had to convert 28 cm to inches. It should be... $\text{Height}^{\wedge} = 38.30 + 1.03(28) = 67.14$

Amy [REDACTED]: Yeah all you had to do was plug 28 into the equation.

Final Group Answer:

Daryl [REDACTED]: $\text{Height}^{\wedge} = 38.30 + 1.03(28) = 67.14$

More feedback still needed

34. How would this have affected the p-value? The p-value for the new study would be ...

Circle one: Larger Same Smaller

Elise: larger

Hannah: The p-value would be smaller, since the statistic would be smaller.

DISCUSSION:

Elise: I plugged the numbers into the applet to see what the new p-value would be and I came up with the number of 0.4410. Therefore, I believe the p-value is larger.

Hannah: I was very confused about these questions and how to go about answering them, so if the p-value was 0.4410 after Elise computed them then this would seem like a valid answer.

FINAL GROUP ANSWER

Hannah: The p-value for the new study would be larger than the original p-value of 0.

Deadlines

	SUN	MON	TUES	WED	THUR	FRI	SAT
TIME ALLOCATION	Read book/ Watch videos	Work on Readiness Quiz Complete Activity 1 individually	Group discussion about Activity 1	Finalize group discussion about Activity 1 Complete Activity 2 individually	Group discussion about Activity 2	Finalize group discussion about Activity 2 Work on End of Unit Quiz	Finish End of Unit Quiz
DUE DATES		Readiness Quiz + Upload answers to Activity 1 + Paste answers to Collaborative Key for Activity 1 11pm		Submit Collaborative Key (Activity 1) + Upload answers to Activity 2 + Paste answers to Collaborative Key for Activity 2 11pm		Submit Collaborative Key (Activity 2) + Submit Participation Survey 11pm	Submit End of Unit Quiz 11pm

Lessons Learned

- Grading

 - **Wrap-up Videos**

 - Participation points: did you watch it?
 - Correctness points: did you pay attention to what you watched?

 - **Collaborative Key**

 - Individual points for submission
 - Group points for correctness
 - Participation points for interaction

- Instructor presence

 - Instructor's feedback
 - Forum conversations (extra credit)
 - Check-in

Schedule for OPTION 1

	SUN	MON	TUES	WED	THUR	FRI	SAT
TIME ALLOCATION	Read book/ Watch videos	Readiness Quiz Activity 1	Activity 1	Watch Videos 1 Collab. Key 1 Activity 2	Activity 2	Watch Videos 2 Collab. Key 2 End of Unit Quiz	End of Unit Quiz
DUE DATES		Readiness Quiz 11pm	Upload answers (1 st Activity) 1 st Contribution to Collaborative Key (1 st Activity) 11pm	2 nd Contribution to Collaborative Key (1 st Activity) 11pm	Upload answers (2 nd Activity) 1 st Contribution to Collaborative Key (2 nd Activity) 11pm	2 nd Contribution to Collaborative Key (2 nd Activity) 11pm	End of Unit Quiz 11pm



Questions?

**To contact Anelise Sabbag
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Dan Petrak
Des Moines Area CC



**Using a Final Project to
Promote Interaction**

Statistic at Des Moines Area CC

- DMACC is a large Community College (about 15,000 FTE)
- Statistics is a large enrollment online, hybrid, and F2F
- Signature Course
- Collaborative Efforts for Continuous Improvement

The logo for DMACC Online is displayed on a dark blue rectangular background. The text "DMACC" is in a bold, white, sans-serif font and is enclosed within a white rectangular box. To the right of this box, the word "Online" is written in a white, elegant cursive script font.

DMACC *Online*

Final Project Scaffolded Discussions



Descriptive Statistics Discussion ✓

Is there a disproportionate number of black people arrested in Polk County, Iowa? As part of this semester's discussion board assignments, we are going to conduct our own statistical study in an attempt to answer this question.

For this discussion board assignment, visit the [Polk County Sheriff's Office](#) website and view the arrests recorded.

Polk County Sheriff's Office

Polk County Current Inmates

Polk County Sheriff Home Page | Jail & Arrest Information | Reports | Jail

Disclaimer: Record of an arrest is not an indication of guilt. The Polk County Sheriff's Office does not provide case disposition. Disposition of cases can be searched [here](#).

The Polk County Sheriff's Office does not expressly or by implication warrant that the information or data accessed by the customer is accurate or correct. The Sheriff is not liable for any loss, cost, damage or expense arising directly or indirectly in connection with this access. In no event shall the Sheriff be liable for any special or consequential damages or for any direct damages resulting from the customer's use or application of the information obtained as a result of using this web site. Individuals obtaining information from this web site should verify accuracy through the arresting agency or [Iowa Courts Online](#).

Information provided should not be relied upon for any type of legal action.

Previous 24 Hours | Show: All | Date Bookings | Search:


	First Name	Age	Book Date
Click the Details link to view more information associated with this person's arrest.			

Final Project Scaffolded Discussions



Ch 3 Semester Project Discussion

Let's continue our observational study started with the discussions from chapter 1 and 2. If you have not yet completed the chapter 1 discussion, please take some time to do so. At the very least, you will need the data you collected as part of the chapter 1 discussion to complete the chapter 3 discussion (as well as one more future discussion).

If you do not expect to complete the chapter 1 discussion (**gong** SHAME!) but do not want to fall any further behind, you can use [Joel's Sample Data](#) 

(comma delimited format). Otherwise, please use your own data.

For the sample of arrests we have collected, not a lot of conclusions can be drawn from the raw data alone. Organizing and presenting our data with frequency distributions and their associated graphs are important first steps towards analysis, but we need more ways to summarize and describe our data. For this discussion, we will describe our data's center, variability, and relative position by submitting a post with the following details:

1. First, attach a copy of your sample data from the chapter 1 discussion board. I will use this to verify the measures you will calculate in the parts below.
2. For the sample of arrests you collected, calculate the **mean**, **median**, and **mode** of the weights of those arrested in Polk County. I would recommend using Excel, StatCrunch, or even a TI-graphing calculator to generate these statistics.
3. Based on the sample **mean** and **median** weights calculated from the previous step, what would you predict to be the shape of the distribution of weights of those arrested in Polk County? If you had to choose between the mean and median to characterize the center of your distribution, which would be the most appropriate for this study and why?
4. For the sample of arrests you collected, calculate the **standard deviation**, **5-number summary** (minimum, lower quartile, median, upper quartile, and maximum), and **interquartile range** of the weights of those arrested in Polk County. If you had to choose between the standard deviation and interquartile range to characterize the variability of your distribution, which would be the most appropriate and why?
5. Finally, use the sample mean and standard deviation weights you calculated from parts (2) and (4) to calculate the **z-score** of your own weight, x , relative to the weights of those arrested in Polk County. If you are like me—have packed away some extra pounds due to self-quarantining, and would rather not admit your current weight—find the weight of an actor who plays your favorite criminal. For example, Anthony Hopkins played Hannibal Lecter in *Silence of the Lambs* (1991). Google reports his current weight at 180 pounds. Or maybe Uzo Aduba—she stole every scene as Suzanne "Crazy Eyes" Warren in *Orange is the New Black*. CelebFacts.com reports her weight at 143 pounds.

$$z = \frac{x - \bar{x}}{s}$$

6. Based on your z-score, would someone of your weight (or your favorite actor) be considered to be unusually under or overweight in comparison to your sample of arrests? Why or why not?

For full credit, you also must comment on **at least two** other students' posts.

NOTE: Before you are allowed to view other students' posts to this discussion board, you must first submit your own. Empty submissions (posts with little or no details) followed by subsequent posts later will only be eligible for half-credit. No exceptions will be granted under any circumstances. Thus, you might want to draft your post in Word or Notepad first, and then copy-and-paste your completed submission to the discussion board when you are ready.

Final Project Scaffolded Discussions



Inferences with Proportions Semester Project

IMPORTANT: Empty submissions (posts with no text) followed by subsequent posts later will only be eligible for **half-credit**. **No exceptions** will be granted under any circumstances. Thus, you might want to draft your post in Word or notepad first, and then copy-and-paste your completed submission to the discussion board when you are ready.

Let us conclude our observational study started with the discussions from chapters 1, 2, and 3. In order to complete this discussion, we will need to combine all of our samples in order to obtain a sufficiently large enough sample to perform a hypothesis test. I will complete this sometime after the first week of class. At that time, I'll attach the combined sample data to this discussion for you to use.

Is there a disproportionate number of black people arrested in Polk County, Iowa? Let us test the claim that a disproportionate number of black people are arrested at a 5% significance level by submitting a post with the following details:

1. Use Google to find the **percent of black or African-American people living in Polk County**. What percent did you find?
2. State the **null and alternative hypotheses** of the test of the claim that proportion of black people arrested in Polk County, IA is significantly *different* than the proportion you found from the previous step. Is this test **two-tailed**, **left-tailed**, or **right-tailed**?
3. Using the proportion you found from step 1 as an estimate of \hat{p} , calculate the minimum sample size n needed to test the claim at a significance level $\alpha = 0.05$ and desired margin of error E of 0.03.

$$n = \left(\frac{z_{\alpha/2}}{E} \right)^2 \cdot \hat{p} \cdot \hat{q}$$

Is our sample going to be large enough?

4. Use our sample data to calculate the actual sample proportion \hat{p} of black people arrested in Polk County, IA. Then use this value to calculate the test statistic z of this hypothesis test.

$$z = \frac{\hat{p} - p}{\sqrt{\frac{p \cdot q}{n}}}$$

5. At a 5% significance-level and type of tailed test you specified from step 2, what are the critical value(s) $z_{\alpha/2}$ for this test?
6. Based on the location of your test statistic z relative to the critical value(s) $z_{\alpha/2}$, should the null hypothesis be **rejected** or **not rejected**?
7. Based on the value of your test statistic from step 4, what the corresponding **p-value** of this test?
8. Based on your p-value relative to the level of significance α , should the null hypothesis be **rejected** or **not rejected**?
9. Finally, use your sample proportion \hat{p} and critical values from step 5 to calculate the **confidence interval estimate** of the true proportion p of black people arrested in Polk County, IA.

$$\hat{p} - z_{\alpha/2} \sqrt{\frac{\hat{p} \cdot \hat{q}}{n}} < p < \hat{p} + z_{\alpha/2} \sqrt{\frac{\hat{p} \cdot \hat{q}}{n}}$$

10. Interpret the Confidence Interval from Step 9 in context. Hint: We are 95% Confident...
11. Does your Confidence Interval verify the decision you made in steps 6 and 8? **State the conclusion of your test in terms of the claim.** Remember, you either *reject* or *fail to reject* a null hypothesis; you either *support* or *not support* an alternative hypothesis.

For full credit, you will also need to comment on **at least two** other students' posts.

[Combined Arrest Data.xlsx](#)

Final Project Timeline



Week 7 (10/7 - 10/13)

Availability: Item is hidden from students.

Preparing for the Final Project Discussion

Chapter 10: Correlation and Regression

Chapter 11: Goodness of Fit and Contingency Tables (chi-squared tests)

Chapter 12: Analysis of Variance (ANOVA tests)



Week 8: Final Project and Final Exam (10/14 - 10/20)

Availability: Item is hidden from students.

Comprehensive Final Exam Review Materials and Final Project

Final Project Timeline



Week 13 (11/18 - 11/24)

Availability: Item is hidden from students.
Preparing for the Final Project Discussion

Chapter 10: Correlation and Regression



Week 14 (11/25 - 12/1)

Availability: Item is hidden from students.
Chapter 11: Goodness of Fit and Contingency Tables (chi-squared tests)



Week 15 (12/2 - 12/8)

Availability: Item is hidden from students.
Chapter 12: Analysis of Variance (ANOVA tests)

Submit Final Project and Final Project Discussion



Week 16: Comprehensive Final Exam (12/9 - 12/15)

Availability: Item is hidden from students.
Comprehensive Final Exam Review and Final Exam

Preparing for the Final Project Discussion



Preparing for the Final Project Discussion

You have the opportunity to apply what you have been learning in this class by submitting a Final Project using Inferential Statistical Methods. This Final Project will be submitted during Finals Week. This Final Project will be used as half of your Final Test Grade.

 [Final Statistics Project Directions Summer 2020.docx](#)

The Instructions to the project are attached, but this discussion forum is meant to help you get started and it will be graded for everyone. Here are the first two steps of the project and all you need to do is submit a video response to these and comment on at least two other posts (your reply comments can be in written form, but your initial response to the questions needs to be in video). This will allow us all to have a discussion of potential Final Project Ideas and determine if they are feasible, and make sure you can use video for your final presentation. It will also help others think about projects they would like to complete.

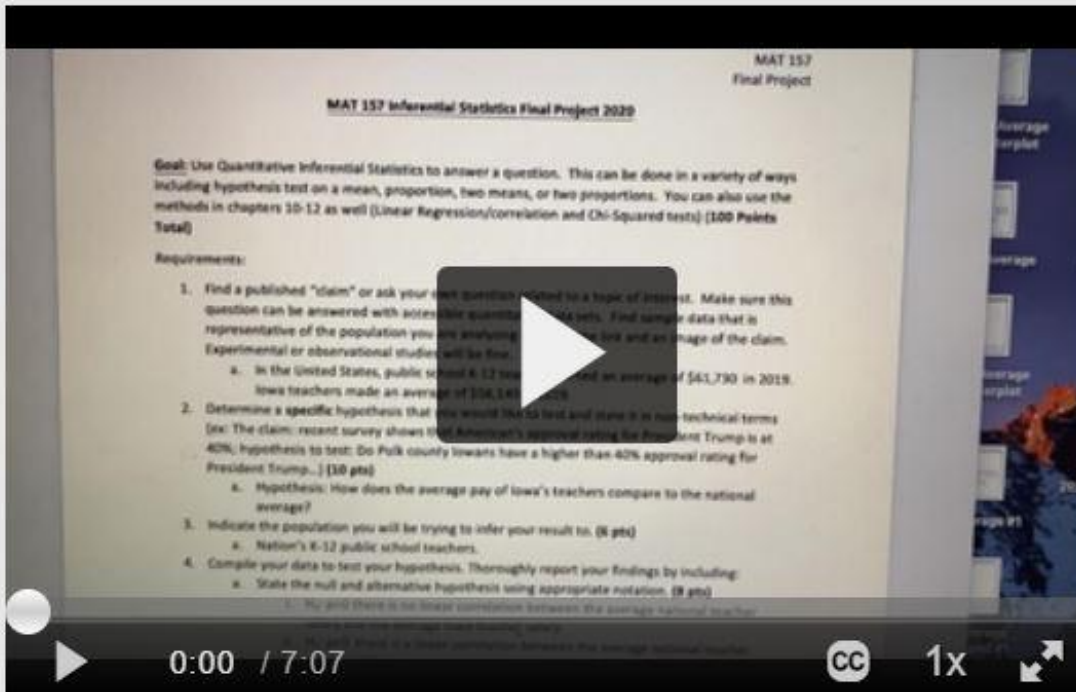
1. Find a published “claim” or ask your own question related to a topic of interest. Make sure this question can be answered with accessible quantitative data sets. Find sample data that is representative of the population you are analyzing and post the link and an image of the claim. Experimental or observational studies will be fine.
2. Determine a specific hypothesis that you would like to test and state it in non-technical terms (ex: The claim: recent survey shows that American’s approval rating for President Trump is at 40%; hypothesis to test: Do Polk county lowans have a higher than 40% approval rating for President Trump...)
3. Indicate the population you will be trying to infer your result to.

Video: Record a short video of you answering these questions. I recommend using your cell phone and then uploading the video into Kaltura. Directions on how to use it can be found below. Post your video to the discussion board.

[Kaltura Upload Video guide](#)

Preparing for the Final Project Discussion

Final Project





MAT 157
Final Project

MAT 157 Inferential Statistics Final Project 2020

Goal: Use Quantitative Inferential Statistics to answer a question. This can be done in a variety of ways including hypothesis test on a mean, proportion, two means, or two proportions. You can also use the methods in chapters 10-12 as well (Linear Regression/correlation and Chi-Squared tests) **(100 Points Total)**

Requirements:

1. Find a published "claim" or ask your own question related to a topic of interest. Make sure this question can be answered with accessible quantitative data sets. Find sample data that is representative of the population you are analyzing. State the claim and an image of the claim. Experimental or observational studies will be fine.
 - a. In the United States, public school K-12 teachers made an average of \$41,790 in 2018. Iowa teachers made an average of \$38,340 in 2018.
2. Determine a specific hypothesis that you would like to test and state it in non-technical terms (ex: The claim: recent survey shows that American's approval rating for President Trump is at 40%; hypothesis to test: Do Polk county Iowans have a higher than 40% approval rating for President Trump...) **(10 pts)**
 - a. Hypothesis: How does the average pay of Iowa's teachers compare to the national average?
3. Indicate the population you will be trying to infer your result to. **(8 pts)**
 - a. Nelson's K-12 public school teachers.
4. Compile your data to test your hypothesis. Thoroughly report your findings by including:
 - a. State the null and alternative hypothesis using appropriate notation. **(8 pts)**

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Final Project

MAT 157 Inferential Statistics Final Project 2020

Goal: Use Quantitative Inferential Statistics to answer a question. This can be done in a variety of ways including hypothesis test on a mean, proportion, two means, or two proportions. You can also use the methods in chapters 10-12 as well (Linear Regression/correlation and Chi-Squared tests) **(100 Points Total)**

Requirements:

1. Find a published “claim” or ask your own question related to a topic of interest. Make sure this question can be answered with accessible quantitative data sets. Find sample data that is representative of the population you are analyzing and post the link and an image of the claim. Experimental or observational studies will be fine. **(10 pts)**
2. Determine a **specific** hypothesis that you would like to test and state it in non-technical terms (ex: The claim: recent survey shows that American’s approval rating for President Trump is at 40%; hypothesis to test: Do Polk county lowans have a higher than 40% approval rating for President Trump...) **(10 pts)**
3. Indicate the population you will be trying to infer your result to. **(6 pts)**

Final Project

4. Compile your data to test your hypothesis. Thoroughly report your findings by including:
 - a. State the null and alternative hypothesis using appropriate notation. **(8 pts)**
 - b. Describe the sampling method and how it was used. **(8 pts)**
 - c. State your sample statistic(s). **(8 pts)**
 - d. Describe the statistical test used and its test statistic value using the appropriate notation. **(12 pts)**
 - e. State the p-value **(4 pts)**
 - f. State conclusion and describe the result in context. **(8 pts)**
 - g. Calculate confidence interval based on sample data. **(8 pts)**
 - h. Interpret this CI in context and determine if it supports the results from the hypothesis test. **(8 pts)**
5. Submit this document with answers to 1-4. Also submit any files with raw data and any screen shots from analysis from StatCrunch in this document or in the assignment. **(10 pts)**

Reminder to make a video presentation to class: Post a short video presenting your project telling everyone your question, data analysis, and your findings. I recommend using your phone and then uploading the video into Kaltura (please don't upload the file into the Discussion board). Kaltura is a video hosting service and you can find instructions in the Discussion Board. Comment on at least 2 others' projects—needs to be more than "I like your project", etc. **(8 pts for your video, 2 pts for comments on others' = 10 pts—this will be scored as a Discussion Board)**

Final Project Rubric



Final Project Rubric

PROBLEM SOLVING VALUE RUBRIC

for more information, please contact value@aacu.org



Definition

Problem solving is the process of designing, evaluating, and implementing a strategy to answer an open-ended question or achieve a desired goal.


Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet benchmark (cell one) level performance.

	Capstone 4	3	Milestones 2	Benchmark 1
Define Problem	Demonstrates the ability to construct a clear and insightful problem statement with evidence of all relevant contextual factors.	Demonstrates the ability to construct a problem statement with evidence of most relevant contextual factors, and problem statement is adequately detailed.	Begins to demonstrate the ability to construct a problem statement with evidence of most relevant contextual factors, but problem statement is superficial.	Demonstrates a limited ability in identifying a problem statement or related contextual factors.
Identify Strategies	Identifies multiple approaches for solving the problem that apply within a specific context.	Identifies multiple approaches for solving the problem, only some of which apply within a specific context.	Identifies only a single approach for solving the problem that does apply within a specific context.	Identifies one or more approaches for solving the problem that do not apply within a specific context.
Propose Solutions/Hypotheses	Proposes one or more solutions/hypotheses that indicates a deep comprehension of the problem. Solution/hypotheses are sensitive to contextual factors as well as all of the following: ethical, logical, and cultural dimensions of the problem.	Proposes one or more solutions/hypotheses that indicates comprehension of the problem. Solutions/hypotheses are sensitive to contextual factors as well as the one of the following: ethical, logical, or cultural dimensions of the problem.	Proposes one solution/hypothesis that is "off the shelf" rather than individually designed to address the specific contextual factors of the problem.	Proposes a solution/hypothesis that is difficult to evaluate because it is vague or only indirectly addresses the problem statement.
Evaluate Potential Solutions	Evaluation of solutions is deep and elegant (for example, contains thorough and insightful explanation) and includes, deeply and thoroughly, all of the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.	Evaluation of solutions is adequate (for example, contains thorough explanation) and includes the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.	Evaluation of solutions is brief (for example, explanation lacks depth) and includes the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.	Evaluation of solutions is superficial (for example, contains cursory, surface level explanation) and includes the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.
Implement Solution	Implements the solution in a manner that addresses thoroughly and deeply multiple contextual factors of the problem.	Implements the solution in a manner that addresses multiple contextual factors of the problem in a surface manner.	Implements the solution in a manner that addresses the problem statement but ignores relevant contextual factors.	Implements the solution in a manner that does not directly address the problem statement.
Evaluate Outcomes	Reviews results relative to the problem defined with thorough, specific considerations of need for further work.	Reviews results relative to the problem defined with some consideration of need for further work.	Reviews results in terms of the problem defined with little, if any, consideration of need for further work.	Reviews results superficially in terms of the problem defined with no consideration of need for further work.

Final Project Rubric

	Capstone 4
Define Problem	Demonstrates the ability to construct a clear and insightful problem statement with evidence of all relevant contextual factors.
Identify Strategies	Identifies multiple approaches for solving the problem that apply within a specific context.
Propose Solutions/Hypotheses	Proposes one or more solutions/hypotheses that indicates a deep comprehension of the problem. Solution/hypotheses are sensitive to contextual factors as well as all of the following: ethical, logical, and cultural dimensions of the problem.
Evaluate Potential Solutions	Evaluation of solutions is deep and elegant (for example, contains thorough and insightful explanation) and includes, deeply and thoroughly, all of the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.
Implement Solution	Implements the solution in a manner that addresses thoroughly and deeply multiple contextual factors of the problem.
Evaluate Outcomes	Reviews results relative to the problem defined with thorough, specific considerations of need for further work.

Final Project Rubric



Final Project Problem Solving Rubric

	A	B	C	D	F
Hypothesis or Problem Statement	Creates a clear and insightful hypothesis or problem statement.	Creates a clear hypothesis or problem statement.	Demonstrates ability to create a hypothesis or problem statement but is lacking in clarity or execution.	Demonstrates limited ability to create a hypothesis or problem statement.	Hypothesis or Problem Statement missing
Problem Solving Approaches	Identifies multiple approaches for solving the problem or testing the hypothesis.	Identifies at least one approach for solving the problem or testing the hypothesis.	Identifies an approach for solving the problem or testing the hypothesis, but lacks clarity.	Identifies an approach, but it is not a logical fit for solving the problem	No problem solving attempted
Solutions or Testing Methods	Proposes one or more solutions or testing methods that indicates deep comprehension of the problem or hypothesis.	Proposes one or more solutions or testing methods that indicates comprehension of the problem or hypothesis.	Proposes one or more solutions or testing methods but may lack comprehension of the problem or hypothesis.	Proposes at least one solution, but it is implausible.	Fails to propose a solution or testing method.
Reviewing Results	Reviews results relative to the problem or hypothesis with thorough consideration to contextual factors.	Reviews results relative to the problem or hypothesis with consideration to contextual factors	Reviews results relative to the problem or hypothesis but with a limited understanding of contextual factors	Reviews results relative to the problem or hypothesis but without understanding the context.	Fails to review results relative to the problem or hypothesis



Questions?

**To contact Dan Petrak
dgpetrak@dmacc.edu**

