**Original Variables**

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| **Variable Name** | Description |
| instructor | the instructor number |
| section | the section number the instructor taught |
| instructor.section | the instructor number, with the corresponding section number, semester they taught in, and year |
| opt.out.pre | did student allow their pre test answers to be used for analysis (0 = they opted out, 1 = consented). All opt outers have been removed but NA can be used to subset by those who didn’t take pre/post (year 3) |
| opt.out.post | did the student allow their post test answers to be used for analysis (0 = they opted out, 1 = consented). All opt outers have been removed but NA can be used to subset by those who didn’t take pre/post (year 3) |
| test.time.pre | how long student spent on pre test (computed from time stamps, may want to cap at 100 min, may want to exclude less than 10 min) |
| test.time.post | how long student spent on post test (computed from time stamps, may want to cap at 100 min, may want to exclude less than 10 min) |
| **Concept Inventory questions** (modified version of CAOS, delMas et al.) | |
| q16a.pre.c.1415 –  q16c.pre.c.1415 | q16 changed format during the study: student responses to questions 16, 17, and 18 on the pre test in the year 14-15 (where NA = not answered, blank = invalid, checked = valid) |
| q16a.pre.c – q16d.pre.c | q16 changed format during the study: student responses to question 16 on the pre test in years 15-16 and 16-17 are checked or blank |
| q16.pre.rw | Merged across the years |
| q16a.post.c.1415 –  q16c.post.c.1415 | q16 changed format during the study: student responses to questions 16, 17, and 18 on the post test in the year 14-15 (where NA = not answered, blank = invalid, checked = valid) |
| q16a.post.c – q16d.post.c | q16 changed format during the study: student responses to question 16 on the post test in years 15-16 and 16-17 are checked or blank |
| q17.post.c – q47.post.c | student responses to questions 17 through 46 on the post test for all years |
| **Attitude Survey** (SATS-36, with permission, C. Schau) | |
| q6a.pre.a – q9f.pre.a | student responses to SATS-36 on the pre test (1 = Very Strongly Disagree, 2 = Strongly Disagree, 3 = Disagree, 4 = Neutral, 5 = Agree, 6 = Strongly Agree, 7 = Very Strongly Agree) |
| q6a.post.a – q9f.post.a | student responses to SATS-36 on the post test (1 = Very Strongly Disagree, 2 = Strongly Disagree, 3 = Disagree, 4 = Neutral, 5 = Agree, 6 = Strongly Agree, 7 = Very Strongly Agree) |
| math.perf.pre | student response to how well they have done in previous math courses on the pre test (1 = Very Poorly, 2 = Poorly, 3 = Below Average, 4 = Average, 5 = Above Average, 6 = Well, 7 = Very Well) |
| math.perf.post | student response to how well they have done in previous math courses on the post test (1 = Very Poorly, 2 = Poorly, 3 = Below Average, 4 = Average, 5 = Above Average, 6 = Well, 7 = Very Well) |
| math.comp.pre | student response to how good they are at math on the pre test (1 = Very Poor, 2 = Poor, 3 = Below Average, 4 = Average, 5 = Above Average, 6 = Good, 7 = Very Good) |
| math.comp.post | student response to how good they are at math on the post test (1 = Very Poor, 2 = Poor, 3 = Below Average, 4 = Average, 5 = Above Average, 6 = Good, 7 = Very Good) |
| stats.career.usage.pre | student response to how much they think they will use statistics in the field in which they hope to be employed on the pre test (1 = Not at All, 2 = Very Little, 3 = Less Than Average, 4 = Average, 5 = Greater Than Average, 6 = Large Amount, 7 = Great Deal) |
| stats.career.usage.post | student response to how much they think they will use statistics in the field in which they hope to be employed on the post test (1 = Not at All, 2 = Very Little, 3 = Less Than Average, 4 = Average, 5 = Greater Than Average, 6 = Large Amount, 7 = Great Deal) |
| mastering.confidence.pre | student response to how confident they are in mastering the introductory statistics material on the pre test (1 = Not at All Confident, 2 = Very Little Confidence, 3 = Little Confidence, 4 = Some Confidence, 5 = Fairly Confident, 6 = Confident, 7 = Very Confident) |
| mastering.confidence.post | student response to how confident they are in mastering the introductory statistics material on the post test (1 = Not at All Confident, 2 = Very Little Confidence, 3 = Little Confidence, 4 = Some Confidence, 5 = Fairly Confident, 6 = Confident, 7 = Very Confident) |
| choice.likelihood.pre | student response to how likely it is that they would have chosen to take any course in statistics if the choice had been theirs on the pre test (1 = Not at All Likely, 2 = Unlikely, 3 = Fairly Unlikely, 4 = Average, 5 = Likely, 6 = Fairly Likely, 7 = Very Likely) |
| choice.likelihood.post | student response to how likely it is that they would have chosen to take any course in statistics if the choice had been theirs on the post test (1 = Not at All Likely, 2 = Unlikely,  3 = Fairly Unlikely, 4 = Average, 5 = Likely, 6 = Fairly Likely, 7 = Very Likely) |
| why.take.pre | student response to why they took this course on the pre test, where they could select all that apply (1 = It sounded  interesting, 2 = For a general education requirement, 3 = For my major) |
| why.take.post | student response to why they took this course on the post test, where they could select all that apply (1 = It sounded interesting, 2 = For a general education requirement, 3 = For my major) |
| is.major.course | whether or not the course is a “major course” (why.take.pre = 3) or a “not major” course |
| field.major | student’s primary field of interest/study/major (Social sciences, Natural and applied sciences, Arts and humanities, Other) |
| gpa | student’s self-reported current GPA on 4.0 scale (merging of pre/post reports) |
| grade.expectation.pre | student’s response to the grade they think they will receive in the course on the pre test (A+, A, A-, B+, B, B-, C+, C, C-, D+, D, D-, F) |
| grade.expectation.post | student’s respsonse to the grade they think they will receive in the course on the post test (A+, A, A-, B+, B, B-, C+, C, C-, D+, D, D-, F) |
| **Student Demographics** | |
| gender | student’s gender (Male or Female) (merging of student response on the pre test and the post test) |
| age | reported age (merging of student response on the pre test and the post test) |
| has.taken.stat.course | whether or not the student has taken a high school level or college level Statistics course prior to this course (Yes or No) (merging of student response on the pre test and the post test) |
| prev.stat.course | classification of which level Statistics course the student has taken prior to this course (No, Yes (Not AP), Yes (AP)) |
| status | student’s response to their status in school (High School Student, Freshman in college, Sophomore in college, Junior in college, Senior in college, Fifth or more year in college, Non-traditional/part-time student in college, Other) |
| firstgen | whether or not student is first generation. Nore, data is only available for years 15-16 and 16-17 (Yes, No, NA) |
| race.origin | student’s orginal response to the race(s) they classify as where they could select all that apply from categories. Note, data is only available for years 15-16 and 16-17 (1 = White, 2 = Black, African American or Negro, 3 = Hispanic, Latino or Spanish origin, 4 = American Indian or Alaska Native, 5 =  Asian, 6 = Native Hawaiian or Other Pacific Islander, 7 = Some other race or origin) |
| is.white | whether or not the student is white. Note, data is only available for years 15-16 and 16-17 (True or False) |
| test.order.pre | whether the student took the concept or attitude portion of the pre test first. Note, data is only available for years 15-16 and 16-17 (Attitudes First or Concepts First) |
| test.order.post | whether the student took the concept or attitude portion of the post test first. Note, data is only available for years 15-16 and 16-17 (Attitudes First or Concepts First) |

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| **Instructor/Institution Variables** | |
| instructor.gender | the gender of the instructor (Male or Female) |
| carnegie.classification | the Carnegie classification of the student’s institution (Community College, Baccalaureate College, Master’s, Doctoral Universities) |
| department.type | the type of department (Math, Stats, Other) |
| is.stats.department | whether the department is Stats or not (Yes or No) |
| position.classification | the type of instructor (Lecturer PT or Lecturer FT, Tenured or Tenured Track, Graduate Student, Other) |
| years.teaching.intro.stats | years teaching intro stat |
| years.teaching.intro.stats.binned | years teaching intro stat binned into the following categories (0-5, 5-10, 10-20, 20-30, 30+) |
| years.teaching.experience | years teaching total. Note, data is only available years 15-16 and 16-17 |
| years.teaching.experience.binned | years teaching total binned into the following categories (0-5, 5-10, 10-20, 20-30, 30+). Note, data is only available years 15-16 and 16-17 |
| morecourses | whether or not instructor has an taken advanced courses in statistics (Yes or No) |
| graduate.theoretical.stats | self reported number of graduate theoretical statistics courses taken. Note, data is only available in year 14-15. (0, 1, 2, 3, 4, 5 or more) |
| graduate.applied.stats | self reported number of graduate applied statistics courses taken. Note, data is only available in year 14-15. (0, 1, 2, 3, 4,  5 or more) |
| advanced.stats.degree.type | the type of advanced degree the instructor has in statistics. Note, data is only available in years 15-16 and 16-17. (No, Masters, Masters Other, PhD, Masters/PhD Other, PhD Other) |
| semester | whether the course was in Fall or Spring |
| year | the year in which the student took the pre and post test (14-15, 15-16, 16-17) |
| institution | the name of the institution the student attended anonymized |
| days.meet | the days of the week the course met. Note the data is only available for years 15-16 and 16-17. (MTR, MTRF, MTWF, MTWR, MTWRF, MW, MWF, MWR, Online, Other, TR, TRF, TWR, WF) |
| time.meet | the times course met categorized (8-10, 10-12, 12-2, 2-6) |
| class.session.length | the typical class session length in minutes (short, medium, long, block, online) |
| class.size.start | instructor reported class size at the beginning of the semester |
| class.size.end | instructor reported class size at the end of the semester |
| class.size.start.ind | instructor reported class size at the beginning of the semester classified as Small, Medium, Large, or Very Large |
| class.size.end.ind | instructor reported class size at the end of the semester classified as Small, Medium, Large, or Very Large |
| class.meet.weeks | the number of weeks of course |
| class.meet.weeks.ind | whether the course met for a full year, semester, or quarter |
| textbook.used | text describing which textbook used or the name of the textbook. Note, data is only available for years 15-16 and 16-17 |
| textbook.classification | course textbook classification (ISI, ISI 1st, OtherSBI, NotSBI, NotSBI2)  ISI = *Introduction to Statistical Investigations*  ISI 1st = new instructor to *ISI*  Other SBI = other simulation-based inference texts (e.g., *Unlocking the Power of Data*)  Not SBI = not simulation-based, gaise compliant  Not SBI2 = not gaise compliant  ISCAM = *Investigating Satistcal Concepts, Applications, and Methods* (calc/pre-calc prerequisite) |
| supplemental.material | text describing whether instructor used supplemental materials |
| math.prereq | the math prerequisite of the course (Calculus, College Algebra, High School Algebra, None, Other, Precalculus) |
| student.type | instructor response to the course type for students. Note, data is only available for years 15-16 and 16-17 (LowerGE, LowerReq, UpperGE, UpperReq) |
| TA | whether or not the course had a TA that lead lab, recitation, or discussion sections of the course |
| lecture.type | the primary model of delivery of new content. Note, the data is only available for years 15-16 and 16-17 (Overview Lecture, Reading Assignment, Guided Activity, Other) |
| reading.quiz | whether or not the instructor gave students reading quizzes. Note, the data is only available for years 15-16 and 16-17 |
| graded.homework | whether or not the instructor had students complete homework for a grade. Note, the data is only available for years 15-16 and 16-17 |
| graded.lab.activities | whether or not the instructor graded lab activities. Note, the data is only available for years 15-16 and 16-17 |
| accountability.assignments.other | text describing if instructors assigned readings, homework, quizzes, etc. Note, the data is only available for years 15-16 and 16-17 |
| percent.lecture | instructor self-reported what percentage of class time was lecture |
| percent.lecture.binned | instructor self-reported what percentage of class time was lecture binned into the following categories (0-25, 25-50, 50-75, 75-100) |
| admin.pre.location | how the pre test was administered (In class, Out of class, Did not give) |
| admin.post.location | how the post test was administered (In class, Out of Class, Did not give) |
| admin.pre.time | the time when the pre test was administered (After first week of classes, Before first class meeting, Did not give, During first week of classes) |
| admin.post.time | the time when post test was administered (After finals week, Before last week of classes, Did not give, During finals week, Last week of classes) |
| incentive.pre | whether or not there was an incentive offered for taking the pre test (High stakes, Low stakes, Required) |
| incentive.post | whether or not there was an incentive offered for taking the post test (High stakes, Low stakes, Required) |
| isi.workshop | whether or not the instructor had attended an ISI workshop (Yes or No) |
| analyzing.data.experience | self-report of how much experience the instructor has analyzing data (A lot of Experience, Very Little Experience, Some Experience, No Experience) |
| gaise.familiar | how familiar the instructor is with Guidelines for Assessment and Instruction in Statistics Education (GAISE) (Completely, Mostly, Some, Unsure, I am not familiar with GAISE) |

**Created Variables** (Recreating Variables.Rmd)

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| dc.pre | the total number of data collection questions correct divided by the 4 data collection questions on the pre test  (q16.pre.c.rw, q42.pre.c.rw, q22.pre.c.rw, q25.pre.c.rw) |
| dc.post | the total number of data collection questions correct divided by the 4 data collection questions on the post test  (q16.post.c.rw, q42.post.c.rw, q22.post.c.rw, q25.post.c.rw) |
| ds.pre | the total number of descriptive statistics questions correct divided by the 7 descriptive statistics questions on the pre test (q17.pre.c.rw, q21.pre.c.rw, q32.pre.c.rw, q33.pre.c.rw, q36.pre.c.rw, q40.pre.c.rw, q41.pre.c.rw) |
| ds.post | the total number of descriptive statistics questions correct divided by the 7 descriptive statistics questions on the post test (q17.post.c.rw, q21.post.c.rw, q32.post.c.rw, q33.post.c.rw, q36.post.c.rw, q40.post.c.rw, q41.post.c.rw) |
| ci.pre | the total number of confidence interval questions correct divided by the 7 confidence interval questions on the pre test  (q18.pre.c.rw, q19.pre.c.rw, q20.pre.c.rw, q26.pre.c.rw, q45.pre.c.rw, q46.a.pre.c.rw, q46.b.pre.c.rw) |
| ci.post | the total number of confidence interval questions correct divided by the 7 confidence interval questions on the post test (q18.post.c.rw, q19.post.c.rw, q20.post.c.rw, q26.post.c.rw, q45.post.c.rw, q46.a.post.c.rw, q46.b.post.c.rw) |
| st.pre | the total number of significance testing questions correct divided by the 10 significance testing questions on the pre test (q23.pre.c.rw, q24.pre.c.rw, q27.pre.c.rw, q28.pre.c.rw, q29.pre.c.rw, q30.pre.c.rw, q31.pre.c.rw, q43.pre.c.rw, q44.pre.c.rw, q47.pre.c.rw) |
| st.post | the total number of significance testing questions correct divided by the 10 significance testing questions on the post test (q23.post.c.rw, q24.post.c.rw, q27.post.c.rw, q28.post.c.rw, q29.post.c.rw, q30.post.c.rw, q31.post.c.rw, q43.post.c.rw, q44.post.c.rw, q47.post.c.rw) |
| sim.pre | the total number of simulation questions correct divided by the 5 simulation questions on the pre test (q34.pre.c.rw, q35.pre.c.rw,q37.pre.c.rw, q38.pre.c.rw, q39.pre.c.rw) |
| sim.post | the total number of simulation questions correct divided by the 5 simulation questions on the post test (q34.post.c.rw, q35.post.c.rw, q37.post.c.rw, q38.post.c.rw,  q39.post.c.rw) |
| q181920.pre.c | student’s average score on this question set on the pre test (q18.pre.c.rw, q19.pre.c.rw, q20.pre.c.rw) |
| q181920.post.c | student’s average score on this question set on the post test (q18.post.c.rw, q19.post.c.rw, q20.post.c.rw) |
| q28293031.pre.c | student’s average score on this question set on the pre test (q28.pre.c.rw, q29.pre.c.rw, q30.pre.c.rw, q31.pre.c.rw) |
| q28293031.post.c | student’s average score on this question set on the post test (q28.post.c.rw, q29.post.c.rw, q30.post.c.rw, q31.post.c.rw) |
| q3233.pre.c | student’s average score on this question set on the pre test (q32.pre.c.rw, q33.pre.c.rw) |
| q3233.post.c | student’s average score on this question set on the post test (q32.post.c.rw, q33.post.c.rw) |
| q373839.pre.c | student’s average score on this question set on the pre test (q37.pre.c.rw, q38.pre.c.rw, q39.pre.c.rw) |
| q373839.post.c | student’s average score on this question set on the post test (q37.post.c.rw, q38.post.c.rw, q39.post.c.rw) |
| q4041.pre.c | student’s average score on this question set on the pre test (q40.pre.c.rw, q41.pre.c.rw) |
| q4041.post.c | student’s average score on this question set on the post test (q40.post.c.rw, q41.post.c.rw) |
| affect.pre | the student’s average score on the 6 affect questions of the SATS-36 questions on the pre test (q6c.pre.a, q6d.pre.a, q7e.pre.a, q7h.pre.a, q7i.pre.a, q8h.pre.a) |
| affect.post | the student’s average score on the 6 affect questions of the SATS-36 questions on the post test (q6c.post.a, q6d.post.a, q7e.post.a, q7h.post.a, q7i.post.a, q8h.post.a) |
| cognitive.competence.pre | the student’s average score on the 6 competence questions of the SATS-36 questions on the pre test (q6e.pre.a,  q7a.pre.a, q8f.pre.a, q9a.pre.a, q9b.pre.a, q9e.pre.a) |
| cognitive.competence.post | the student’s average score on the 6 competence questions of the SATS-36 questions on the post test (q6e.post.a,  q7a.post.a, q8f.post.a, q9a.post.a, q9b.post.a, q9e.post.a) |
| difficulty.pre | the student’s average score on the 7 difficulty questions of the SATS-36 questions on the pre test (q6f.pre.a, q6h.pre.a, q8b.pre.a, q8d.pre.a, q8j.pre.a, q9d.pre.a, q9f.pre.a) |
| difficulty.post | the student’s average score on the 7 difficulty questions of the SATS-36 questions on the post test (q6f.post.a, q6h.post.a, q8b.post.a, q8d.post.a, q8j.post.a, q9d.post.a, q9f.post.a) |
| effort.pre | the student’s average score on the 4 effort questions of the SATS-36 questions on the pre test (q6a.pre.a, q6b.pre.a, q7d.pre.a, q8g.pre.a) |
| effort.post | the student’s average score on the 4 effort questions of the SATS-36 questions on the post test (q6a.post.a, q6b.post.a, q7d.post.a, q8g.post.a) |
| interest.pre | the student’s average score on the 4 interest questions of the SATS-36 questions on the pre test (q7b.pre.a, q7j.pre.a,  q8c.pre.a, q8i.pre.a) |
| interest.post | the student’s average score on the 4 interest questions of the SATS-36 questions on the post test (q7b.post.a, q7j.post.a, q8c.post.a, q8i.post.a) |
| value.pre | the student’s average score on the 9 value questions of the SATS-36 questions on the pre test (q6g.pre.a, q6i.pre.a,  q6j.pre.a, q7c.pre.a, q7f.pre.a, q7g.pre.a, q8a.pre.a, q8e.pre.a, q9c.pre.a) |
| value.post | the student’s average score on the value questions of the SATS-36 questions on the 9 post test (q6g.post.a, q6i.post.a, q6j.post.a, q7c.post.a, q7f.post.a, q7g.post.a, q8a.post.a, q8e.post.a, q9c.post.a) |
| c.rr.pre | the response rate on the pre test to concept questions (the proportion of concept questions answered out of 33 on the pre test) |
| c.rr.post | the response rate on the post test to concept questions (the proportion of concept questions answered out of 33 on the post test) |
| a.rr.pre | the response rate on the pre test to attitude questions (the proportion of attitude questions answered out of 36) |
| a.rr.post | the response rate on the post test to attitude questions (the proportion of attitude questions answered out of 36 on the post test) |
| math.satact.flag | indication of whether student response was SAT or ACT |
| satact.zscore | standardized SAT or ACT score based on all responses each year |
| pre.perc.33 | pre test percentage correct (out of 33)\* |
| pre.perc.24 | pre test percentage correct (out of 24) |
| post.perc.33 | post test percentage correct (out of 33) |
| post.perc.24 | post test percentage correct (out of 24) |
| gain.33 | post test percentage correct – pre test  percentage correct ( |
| gain.24 | post test percentage correct – pre test  percentage correct ( |
| ach.gain.33 | achievable gain = |
| ach.gain.24 | new achievable gain = |
| dc.gains | the difference in the proportion of data collection questions correct between the post test and the pre test  () |
| ds.gains | the difference in the proportion of descriptive statistics questions correct between the post test and the pre test  () |
| ci.gains | the difference in the proportion of confidence interval questions correct between the post test and the pre test  () |
| st.gains | the difference in the proportion of signifcance testing questions correct between the post test and the pre test  () |
| sim.gains | the difference in the proportion of simulation questions correct between the post test and the pre test () |
| overall.attitude.pre | the student’s overall mean attitude with respect to affect, cognitive competence, interest, and value on the pre  test |
| overall.attitude.post | the student’s overall mean attitude with respect to affect, cognitive competence, interest, and value on the  post test |
| affect.change | the difference between a student’s post test affect score and pre test affect score () |
| cognitive.competence.change | the difference between a student’s post test cognitive competence score and pre test cognitive competence score  () |
| difficulty.change | the difference between a student’s post testdifficulty score and pre test difficulty score () |
| effort.change | the difference between a student’s post test effort score and pre test effort score () |
| interest.change | the difference between a student’s post test interest score and pre test interest score () |
| value.change | the difference between a student’s post test value score and pre test value score () |
| answered.pre | whether or not the student took the pre test (0 = No, 1 = Yes) |
| answered.post | whether or not the student took the post test (0 = No, 1 = Yes) |
| answered.both | whether or not the student took the pre test and the post test (0 = No, 1 = Yes) |

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| **Section Level variables** | |
| section.num.responded | the number of students that responded in each section |
| section.pre.responded | the number of students that took the pre test |
| section.post.responded | the number of students that took the post test |
| section.both.responded | the number of students that took the pre test and the post test |
| section.c.rr | the number of students that took both the pre test and post test divided by the instructor reported class size at the beginning of the term |
| section.ach.gain.24 | the average new achievable gain for each section |
| section.pre.perc.24 | the average pre test percentage correct (out of 24) for each section |
| section.post.perc.24 | the average post test percentage correct (out of 24) for each section |
| section.gpa | the average 4.0 scale gpa for each section |
| section.satact.zscore | the average standardized SAT/ACT score for each section |
| section.affect.pre | the average affect score for each section on the pre test |
| section.affect.post | the average affect score for each section on the post test |
| section.cognitive.competence. pre | the average cognitive competence score for each section on the pre test |
| section.cognitive.competence. post | the average cognitive competence score for each section on the post test |
| section.difficulty.pre | the average difficulty score for each section on the pre test |
| section.difficulty.post | the average difficulty score for each section on the post test |
| section.effort.pre | the average value score for each section on the pre test |
| section.effort.post | the average value score for each section on the post test |
| section.interest.pre | the average interest score for each section on the pre test |
| section.interest.post | the average interest score for each section on the post test |
| section.value.pre | the average value score for each section on the pre test |
| section.value.post | the average value score for each section on the post test |
| section.overall.attitude.pre | the average overall attitude score for each section on the pre test |
| section.overall.attitude.post | the average overall attitude score for each section on the post test |
| var.pre | the variance of each section’s percentage correct (out of 24) on the pre test |
| var.post | the variance of each section’s percentage correct (out of 24) on the post test |
| d | Cohen’s *d* statistic (section level post perc - section level pre perc 24)/(average of variances) |

\*There are 33 concept items on the inventory, but several are related (e.g., a series of valid/invalid statements interpreting the same confidence interval). When these are combined, there are 24 question sets. The table below describes the question sets involving multiple questions.

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| Confidence interval interpretation | q18-q20 |
| p-value interpretation | q28-31 |
| Histogram shapes | q32-q33 |
| Simulation | q37-q39 |
| Largest/smallest variabilty | q40-q41 |