Topic Summaries

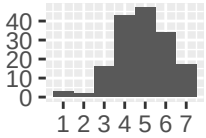
Alyssa Hu

February 3, 2020

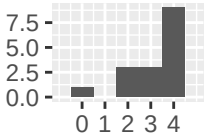
1 Section: Statistical Methods & Theory

1.1 Subsection: Statistical Theory

Distributions of random variables

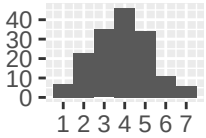


Student Survey: (4.64 , 5.03)

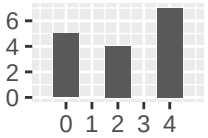


Faculty Survey: (2.38 , 3.56)

Likelihood theory

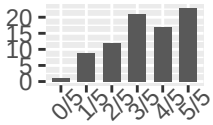


Student Survey: (3.6 , 4.04)



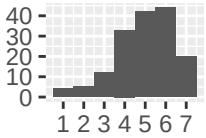
Faculty Survey: (1.25 , 2.88)

Assessment Item: Methods of MLE

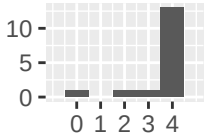


Assessment: (0.61 , 0.73)

Point and interval estimation

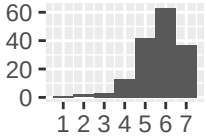


Student Survey: (4.74 , 5.17)

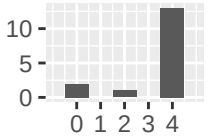


Faculty Survey: (2.62 , 3.88)

Hypothesis testing

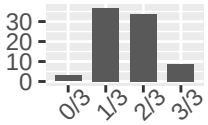


Student Survey: (5.48 , 5.83)



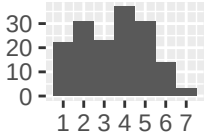
Faculty Survey: (2.25 , 3.75)

Assessment Item: Impact of increased sample size

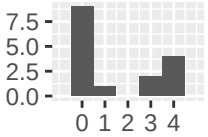


Assessment: (0.47 , 0.58)

Decision theory

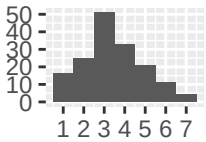


Student Survey: (3.22 , 3.72)

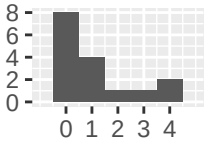


Faculty Survey: (0.62 , 2.31)

Bayesian methods

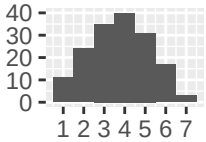


Student Survey: (3.19 , 3.65)

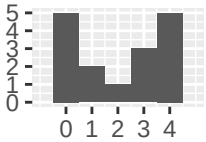


Faculty Survey: (0.44 , 1.88)

Resampling methods



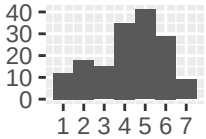
Student Survey: (3.5 , 3.96)



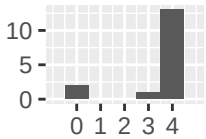
Faculty Survey: (1.19 , 2.81)

1.2 Subsection: Exploratory Data Analysis

Visualization (incl. advanced)

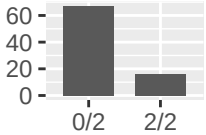


Student Survey: (3.98 , 4.49)



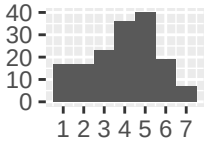
Faculty Survey: (2.38 , 3.81)

Assessment Item: Shoe comparison graph

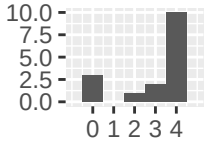


Assessment: (0.11 , 0.28)

Visualization (errors, anomalies)

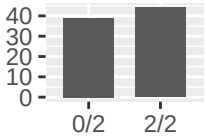


Student Survey: (3.69 , 4.19)



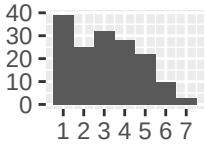
Faculty Survey: (2 , 3.56)

Assessment Item: Initial EDA

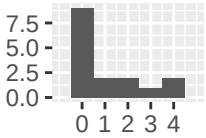


Assessment: (0.41 , 0.63)

Smoothing/ kernel estimation

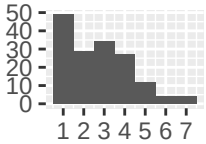


Student Survey: (2.81 , 3.33)

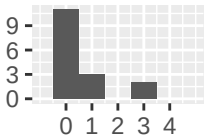


Faculty Survey: (0.44 , 1.81)

Spatial methods

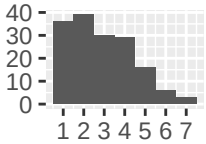


Student Survey: (2.46 , 2.94)

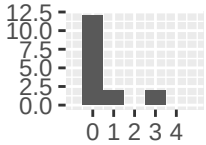


Faculty Survey: (0.19 , 1.19)

Mapping



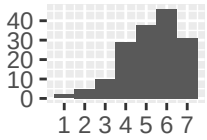
Student Survey: (2.63 , 3.11)



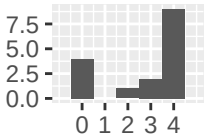
Faculty Survey: (0.12 , 1.12)

1.3 Subsection: Design of Studies

Data collection

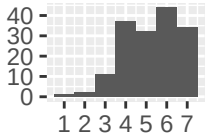


Student Survey:
(4.99 , 5.43)

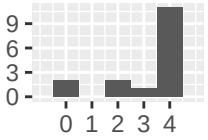


Faculty Survey:
(1.69 , 3.44)

Random assignment

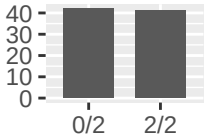


Student Survey:
(5.06 , 5.47)



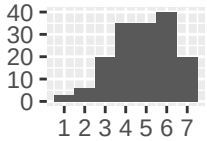
Faculty Survey:
(2.25 , 3.69)

Assessment Item:
Purpose of
random assignment

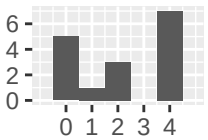


Assessment:
(0.37 , 0.59)

Blocking & stratification

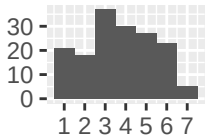


Student Survey:
(4.61 , 5.06)

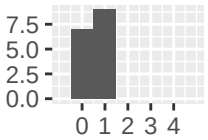


Faculty Survey:
(1.25 , 3)

Adaptive designs

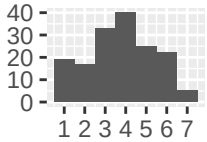


Student Survey:
(3.43 , 3.95)

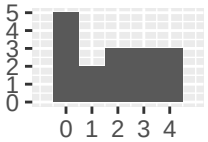


Faculty Survey:
(0.25 , 0.75)

Efficiency (e.g. power)

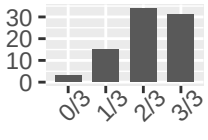


Student Survey:
(3.5 , 4)



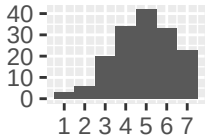
Faculty Survey:
(1 , 2.5)

Assessment Item:
Impact of decreased
sample size

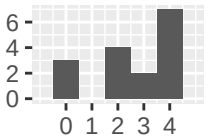


Assessment:
(0.64 , 0.76)

Issues of bias

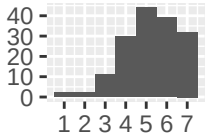


Student Survey:
(4.61 , 5.06)

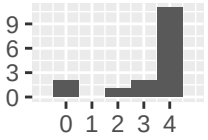


Faculty Survey:
(1.75 , 3.22)

Random selection

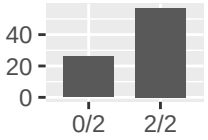


Student Survey:
(5.01 , 5.42)

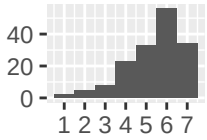


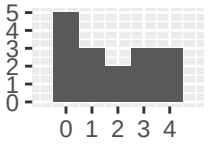
Faculty Survey:
(2.25 , 3.69)

Assessment Item:
Purpose of
random sampling

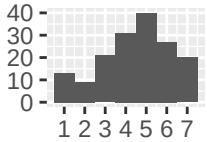


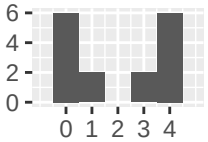
Assessment:
(0.57 , 0.77)

Survey sampling 

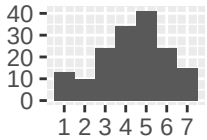
Student Survey: (5.16 , 5.58) 

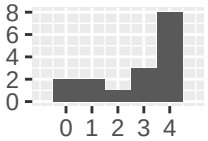
Faculty Survey: (1 , 2.44)

Causality 

Student Survey: (4.2 , 4.72) 

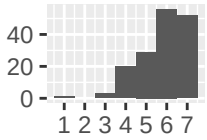
Faculty Survey: (1.06 , 2.81)

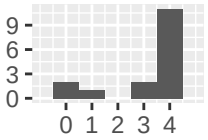
Confounding & coincidence 

Student Survey: (4.05 , 4.56) 

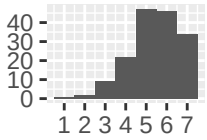
Faculty Survey: (1.88 , 3.38)

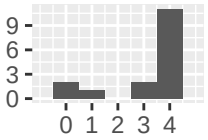
1.4 Subsection: Statistical Models

Simple linear regression 

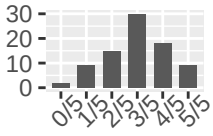
Student Survey: (5.62 , 5.97) 

Faculty Survey: (2.19 , 3.69)

Multiple regression 

Student Survey: (5.2 , 5.58) 

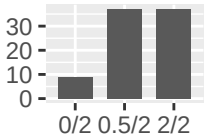
Faculty Survey: (2.12 , 3.69)

Assessment Item: Robust to independence 

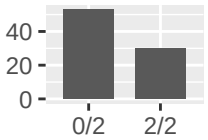
Assessment: (0.53 , 0.64)

Assessment Item: Regress Crossed 

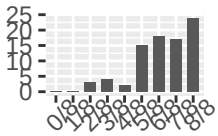
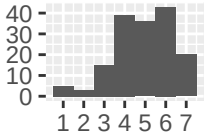
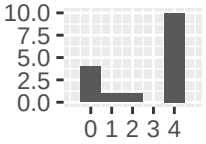
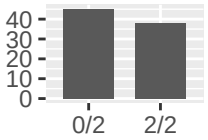
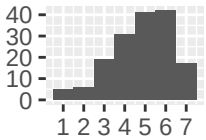
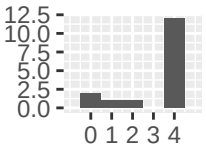
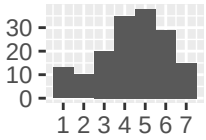
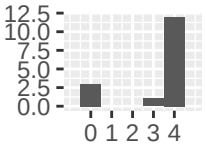
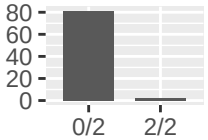
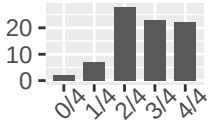
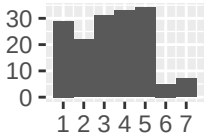
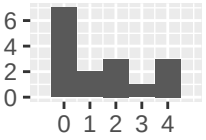
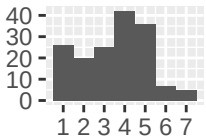
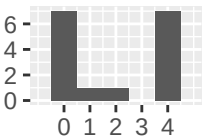
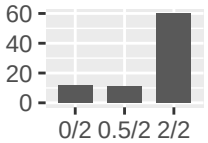
Assessment: (0.34 , 0.54)

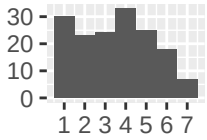
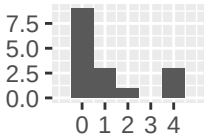
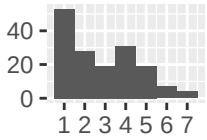
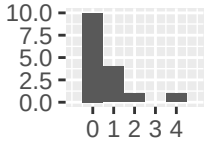
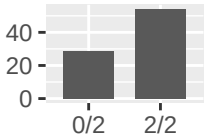
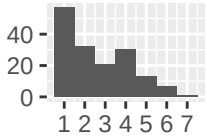
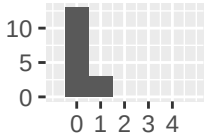
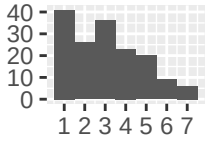
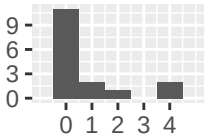
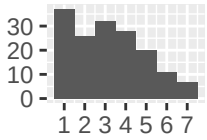
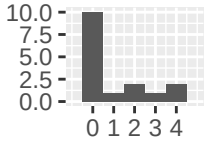
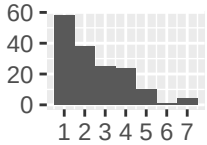
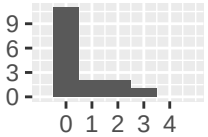
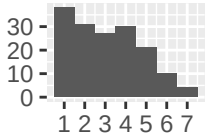
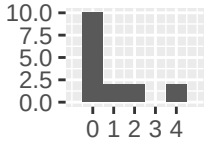
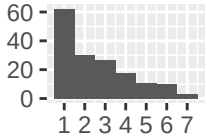
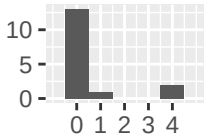
Assessment Item: Regress Parallel 

Assessment: (0.47 , 0.64)

Assessment Item: Interaction model conclusion 

Assessment: (0.25 , 0.46)

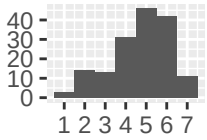
	Assessment Item: OLS Assumptions		Assessment: (0.73 , 0.82)	
Generalized linear models		Student Survey: (4.68 , 5.11)		Faculty Survey: (1.69 , 3.44)
	Assessment Item: Logistic regression tool selection		Assessment: (0.35 , 0.55)	
Model selection		Student Survey: (4.57 , 5.02)		Faculty Survey: (2.19 , 3.75)
Diagnostics		Student Survey: (4.12 , 4.63)		Faculty Survey: (2 , 3.69)
	Assessment Item: Normality violation		Assessment: (0 , 0.06)	
	Assessment Item: Linearity assumptions		Assessment: (0.61 , 0.72)	
Cross−validation		Student Survey: (3.14 , 3.65)		Faculty Survey: (0.69 , 2.19)
Mixed models		Student Survey: (3.25 , 3.75)		Faculty Survey: (1 , 2.81)
	Assessment Item: Mixed−effects tool selection		Assessment: (0.66 , 0.83)	

Time series		Student Survey: (3.23 , 3.79)	 Faculty Survey: (0.38 , 1.94)
Survival analysis		Student Survey: (2.56 , 3.09)	 Faculty Survey: (0.25 , 1.31)
		Assessment Item: Survival Analysis Tool Selection	 Assessment: (0.53 , 0.73)
Generalized additive models		Student Survey: (2.35 , 2.84)	 Faculty Survey: (0 , 0.38)
Regression trees		Student Survey: (2.78 , 3.3)	 Faculty Survey: (0.19 , 1.62)
Statistical and machine learning techniques		Student Survey: (2.91 , 3.45)	 Faculty Survey: (0.38 , 1.81)
Spatial analysis		Student Survey: (2.21 , 2.66)	 Faculty Survey: (0.19 , 1.06)
Multivariate methods		Student Survey: (2.81 , 3.33)	 Faculty Survey: (0.31 , 1.69)
Regularization		Student Survey: (2.3 , 2.82)	 Faculty Survey: (0.06 , 1.38)

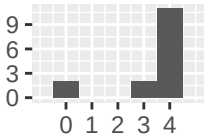
2 Section: Data Wrangling Computation and Data Science

2.1 Subsection: Software and Tools

Use of professional statistical software

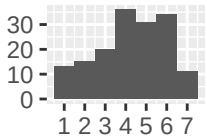


Student Survey: (4.47 , 4.91)

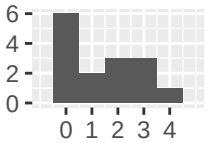


Faculty Survey: (2.2 , 3.8)

Use of multiple tools



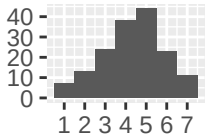
Student Survey: (3.99 , 4.52)



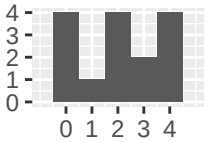
Faculty Survey: (0.73 , 2.07)

2.2 Subsection: Accessing and Wrangling Data

Judge data quality

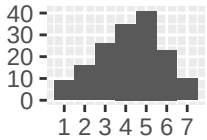


Student Survey: (4.09 , 4.55)

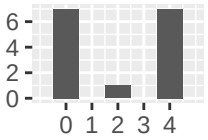


Faculty Survey: (1.2 , 2.73)

Well−documented, reproducible data manipulation

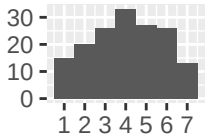


Student Survey: (3.95 , 4.44)

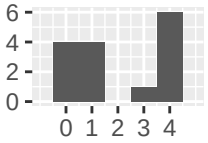


Faculty Survey: (0.93 , 2.93)

Access, manage, & manipulate data in multiple formats

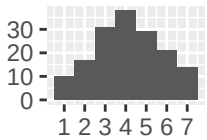


Student Survey: (3.76 , 4.3)

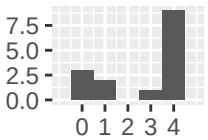


Faculty Survey: (1.13 , 2.87)

Restructure data into form suitable for analysis

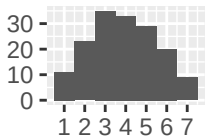


Student Survey: (3.86 , 4.36)

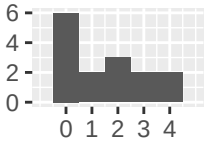


Faculty Survey: (1.67 , 3.4)

Methods for addressing missing data



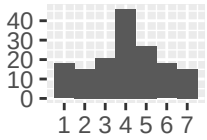
Student Survey: (3.64 , 4.14)



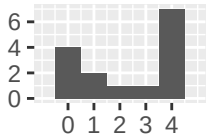
Faculty Survey: (0.73 , 2.2)

2.3 Subsection: Basic Programming Concepts

Breaking down a problem into modular pieces

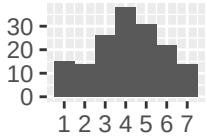


Student Survey: (3.74 , 4.28)

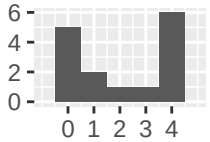


Faculty Survey: (1.33 , 3.13)

Algorithmic thinking

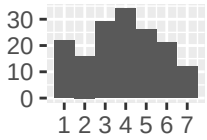


Student Survey: (3.84 , 4.36)

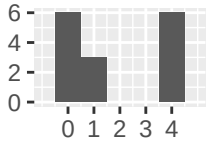


Faculty Survey: (1.13 , 2.87)

Structured programming

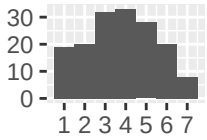


Student Survey: (3.57 , 4.12)

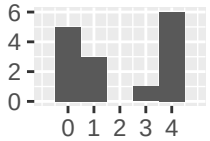


Faculty Survey: (0.87 , 2.73)

Debugging

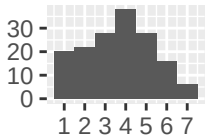


Student Survey: (3.49 , 4.03)

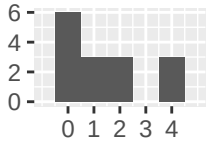


Faculty Survey: (1.07 , 2.8)

Efficiency



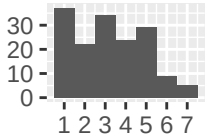
Student Survey: (3.4 , 3.91)



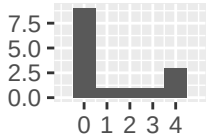
Faculty Survey: (0.67 , 2.2)

2.4 Subsection: Computationally Intensive Statistical Methods

Iterative methods

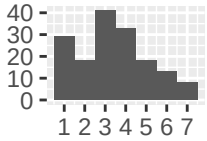


Student Survey: (2.94 , 3.47)

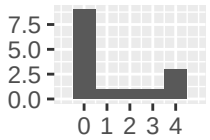


Faculty Survey: (0.47 , 2.13)

Optimization

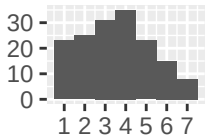


Student Survey: (3.14 , 3.66)

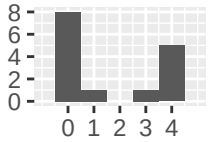


Faculty Survey: (0.47 , 2.07)

Resampling

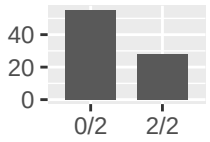


Student Survey: (3.28 , 3.81)

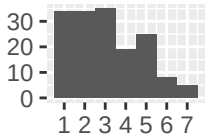
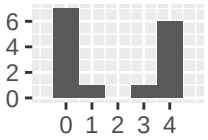


Faculty Survey: (0.67 , 2.53)

Assessment Item: Null distribution

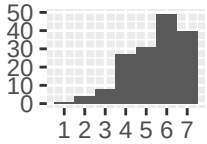
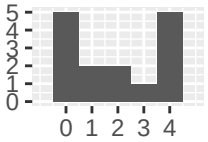
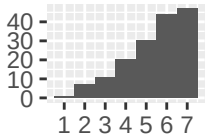
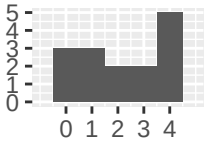


Assessment: (0.23 , 0.43)

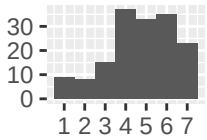
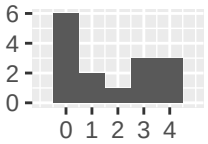
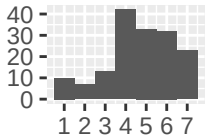
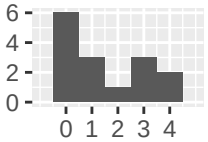
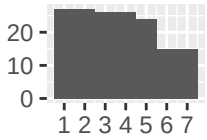
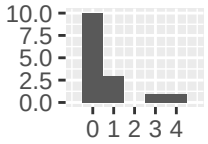
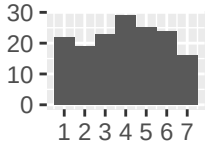
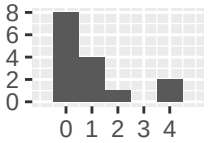
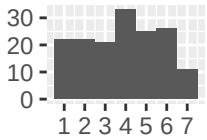
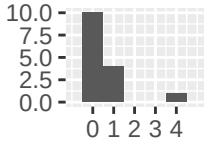
Simulation/ Monte Carlo		Student Survey: (2.82 , 3.33)		Faculty Survey: (0.87 , 2.73)

3 Section: Mathematical Foundations

3.1 Subsection: Calculus

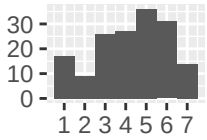
Integration incl. multivariable		Student Survey: (5.21 , 5.63)		Faculty Survey: (1.07 , 2.73)
Differentiation incl. multivariable		Student Survey: (5.19 , 5.65)		Faculty Survey: (1.33 , 2.87)

3.2 Subsection: Linear Algebra

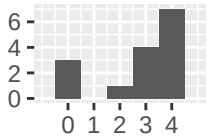
Matrix manipulation		Student Survey: (4.45 , 4.95)		Faculty Survey: (0.8 , 2.47)
Linear transformations		Student Survey: (4.41 , 4.92)		Faculty Survey: (0.73 , 2.2)
Projections in Euclidean space		Student Survey: (3.32 , 3.91)		Faculty Survey: (0.2 , 1.47)
Eigenvalues/ eigenvectors		Student Survey: (3.67 , 4.25)		Faculty Survey: (0.33 , 1.73)
Matrix decomposition		Student Survey: (3.59 , 4.14)		Faculty Survey: (0.13 , 1.27)

3.3 Subsection: Probability

Properties of univariate and multivariate random varaibles

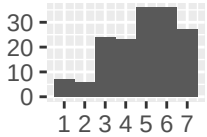


Student Survey: (4 , 4.54)

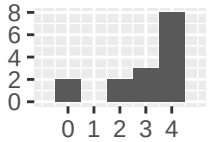


Faculty Survey: (1.8 , 3.4)

Discrete & continuous distributions

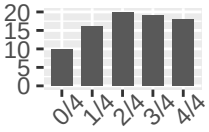


Student Survey: (4.56 , 5.07)



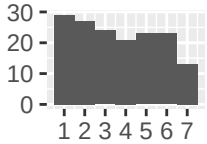
Faculty Survey: (2 , 3.53)

Assessment Item: Probability Distributions

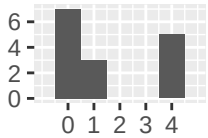


Assessment: (0.48 , 0.62)

Markov chains



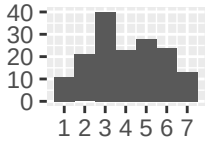
Student Survey: (3.35 , 3.95)



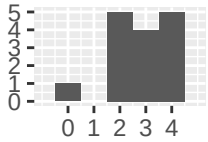
Faculty Survey: (0.67 , 2.53)

3.4 Subsection: Connecting mathematical foundations & applications in statistics

Connections between the above mathematical foundations and their applications in statistics



Student Survey: (3.74 , 4.26)

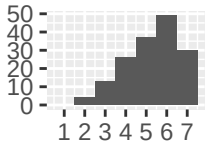


Faculty Survey: (2.07 , 3.2)

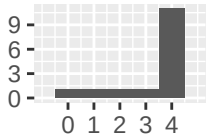
4 Section: Statistical Practice

4.1 Subsection: Communication

Write clearly

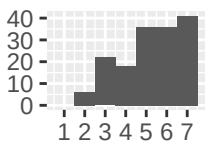


Student Survey: (5.06 , 5.47)

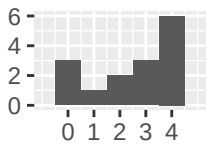


Faculty Survey: (2.33 , 3.73)

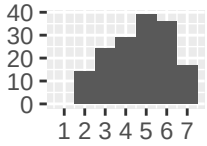
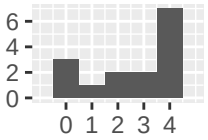
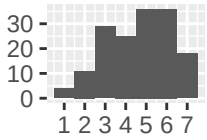
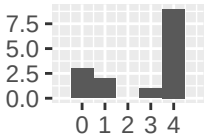
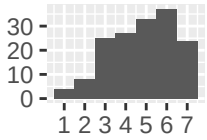
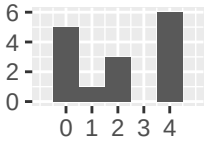
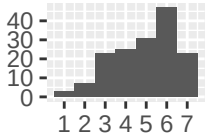
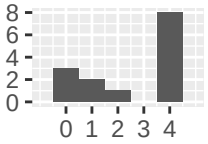
Speak fluently



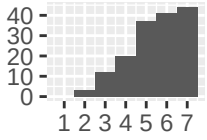
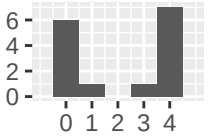
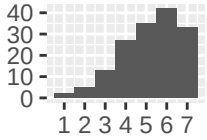
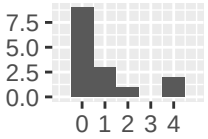
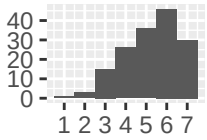
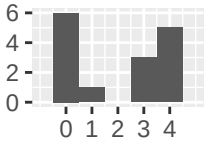
Student Survey: (4.99 , 5.45)



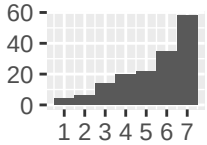
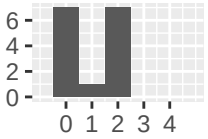
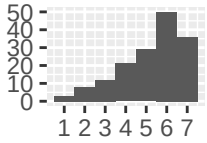
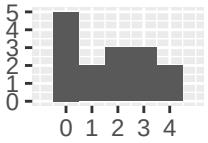
Faculty Survey: (1.6 , 3.2)

Communicate complex statistical methods in basic terms		Student Survey: (4.46 , 4.91)	 Faculty Survey: (1.67 , 3.27)
Construct compelling written summaries / technical writing		Student Survey: (4.37 , 4.86)	 Faculty Survey: (1.67 , 3.4)
Show results in an accesible manner/ presentation skills		Student Survey: (4.54 , 5.03)	 Faculty Survey: (1.13 , 2.87)
Construct effective visual displays		Student Survey: (4.67 , 5.16)	 Faculty Survey: (1.5 , 3.36)

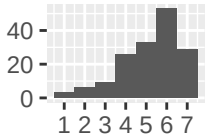
4.2 Subsection: Collaboration

Collaborate / work in teams		Student Survey: (5.25 , 5.68)	 Faculty Survey: (1.07 , 3)
Interact & communicate with a variety of clients and collaborators		Student Survey: (4.97 , 5.41)	 Faculty Survey: (0.27 , 1.73)
Organize and manage projects		Student Survey: (5.02 , 5.44)	 Faculty Survey: (1 , 2.8)

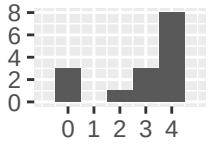
4.3 Subsection: Ethical Issues

Proper treatment of human & animal participants		Student Survey: (5.15 , 5.67)	 Faculty Survey: (0.47 , 1.46)
Assurance of data quality		Student Survey: (5 , 5.48)	 Faculty Survey: (0.93 , 2.33)

Appropriate statistical analysis

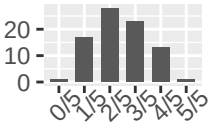


Student Survey: (4.99 , 5.43)



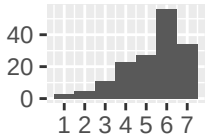
Faculty Survey: (1.8 , 3.47)

Assessment Item: Appending data for significance

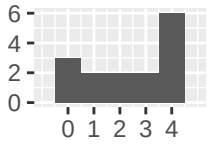


Assessment: (0.43 , 0.52)

Unbiased reporting of results



Student Survey: (5.08 , 5.53)

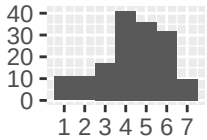


Faculty Survey: (1.47 , 3.07)

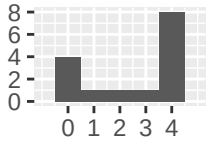
5 Section: Problem Solving

5.1 Subsection: Complex open-ended problems

Tackle real research questions

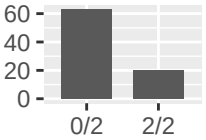


Student Survey: (4.11 , 4.6)



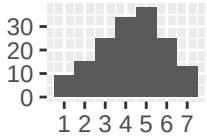
Faculty Survey: (1.53 , 3.27)

Assessment Item: Coral study

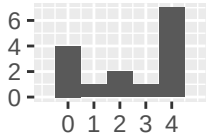


Assessment: (0.14 , 0.33)

Ability to deal with messy or unstructured data



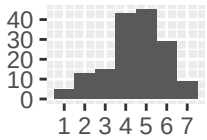
Student Survey: (4.03 , 4.52)



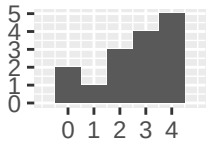
Faculty Survey: (1.4 , 3.13)

5.2 Subsection: Scientific method and statistical problem-solving cycle

Formulating good questions

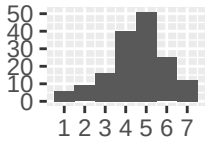


Student Survey: (4.23 , 4.68)

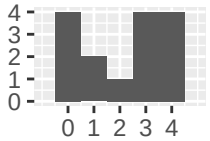


Faculty Survey: (1.73 , 3.13)

Assessing appropriateness of data

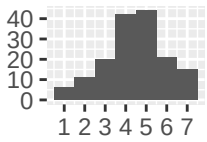


Student Survey: (4.31 , 4.75)

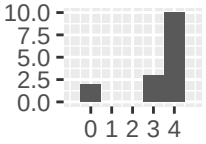


Faculty Survey: (1.27 , 2.87)

Choosing from a set of different tools

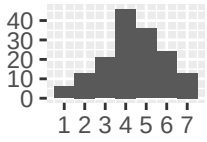


Student Survey: (4.21 , 4.66)

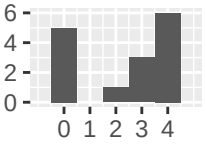


Faculty Survey: (2.14 , 3.73)

Undertaking analysis in a reproducible manner

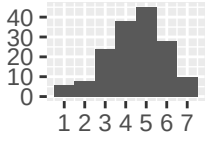


Student Survey: (4.13 , 4.59)

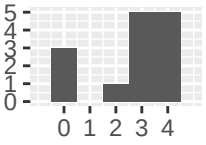


Faculty Survey: (1.33 , 3.07)

Assessing the analytic methods

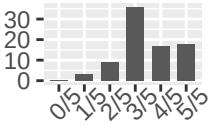


Student Survey: (4.22 , 4.67)



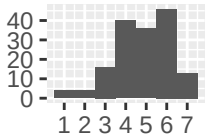
Faculty Survey: (1.64 , 3.21)

Assessment Item: Brake pad experiment

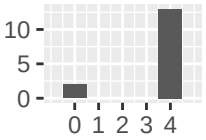


Assessment: (0.64 , 0.73)

Drawing appropriate conclusions

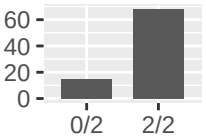


Student Survey: (4.6 , 5.03)



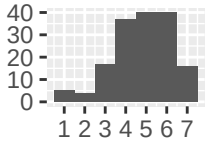
Faculty Survey: (2.11 , 3.73)

Assessment Item: Interpret MR results

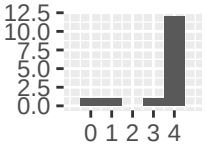


Assessment: (0.71 , 0.88)

Communicating results



Student Survey: (4.57 , 5.01)

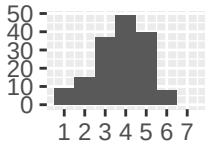


Faculty Survey: (2.4 , 3.87)

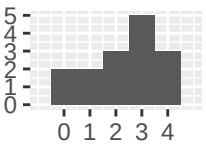
6 Section: Discipline-Specific Knowledge

6.1 Subsection: Discipline-Specific Knowledge

Apply statistical reasoning to domain specific questions

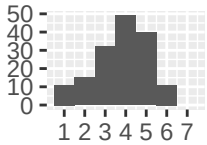


Student Survey: (3.56 , 3.94)

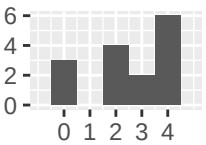


Faculty Survey: (1.53 , 2.87)

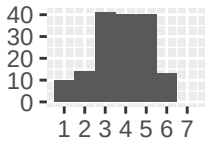
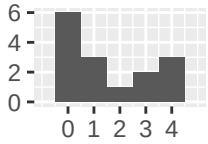
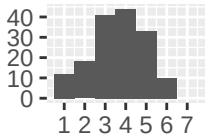
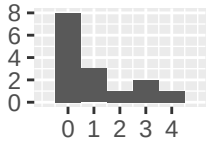
Translate research questions into statistical questions



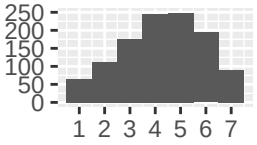
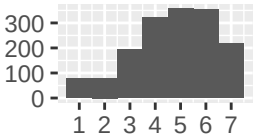
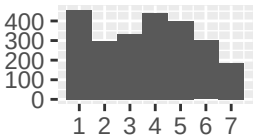
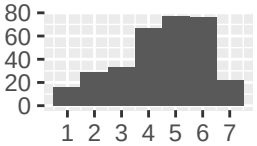
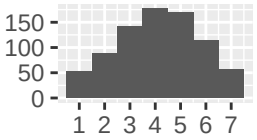
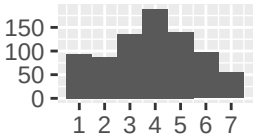
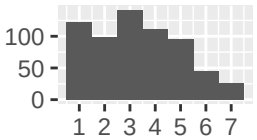
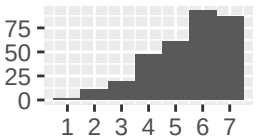
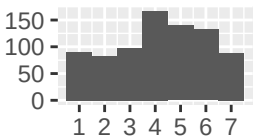
Student Survey: (3.58 , 3.98)

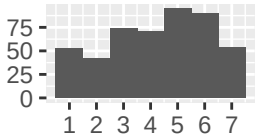
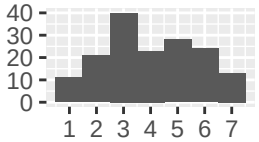
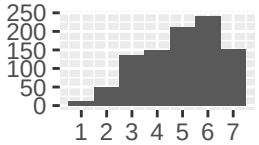
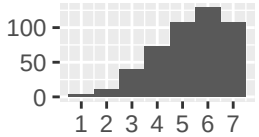
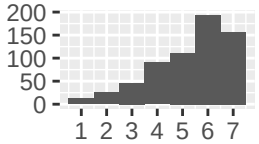
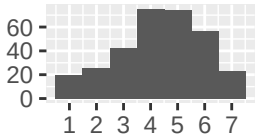
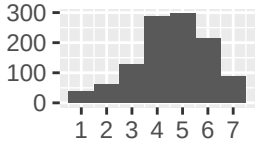
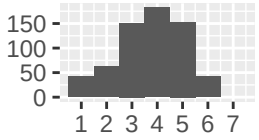


Faculty Survey: (1.6 , 3.13)

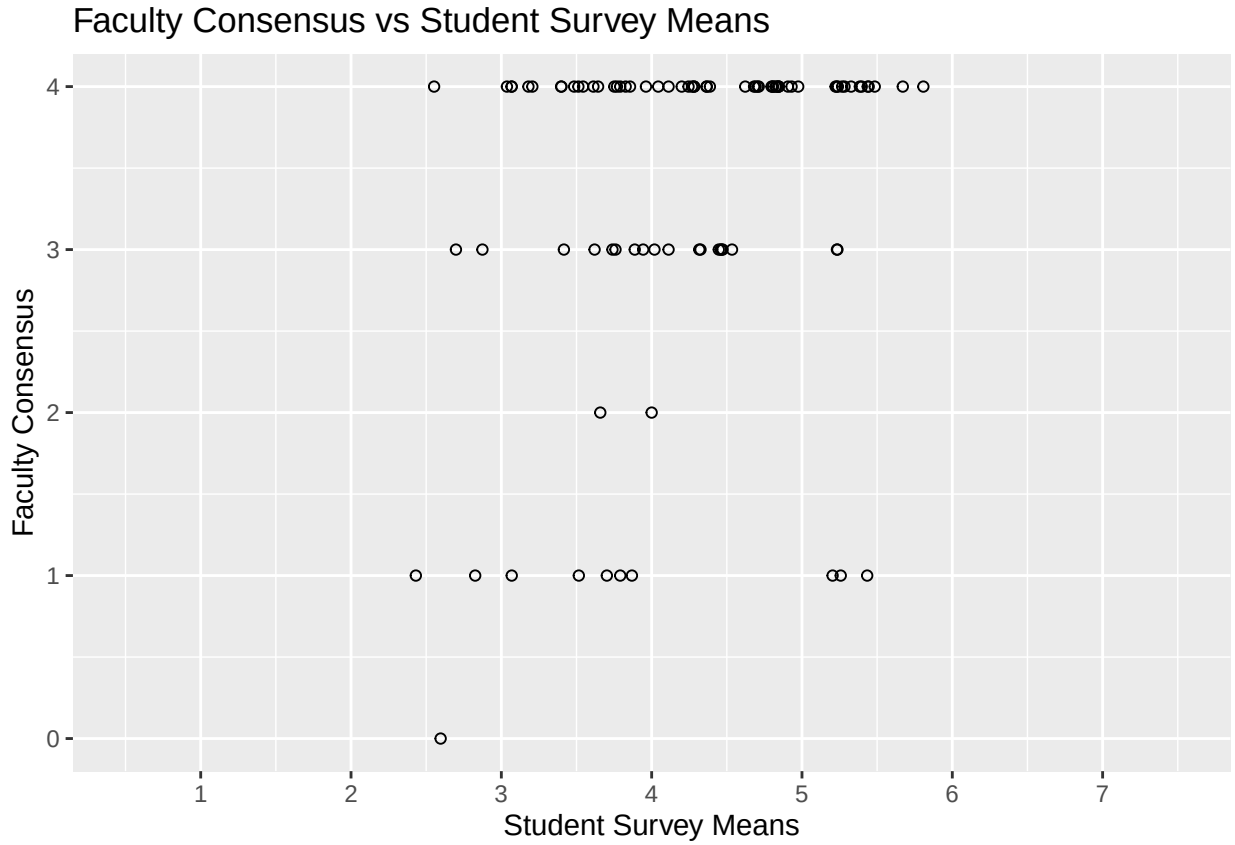
Communicate results to different disciplinary audiences		Student Survey: (3.58 , 3.99)		Faculty Survey: (0.73 , 2.33)
Study a substantive area of application		Student Survey: (3.41 , 3.82)		Faculty Survey: (0.4 , 1.73)

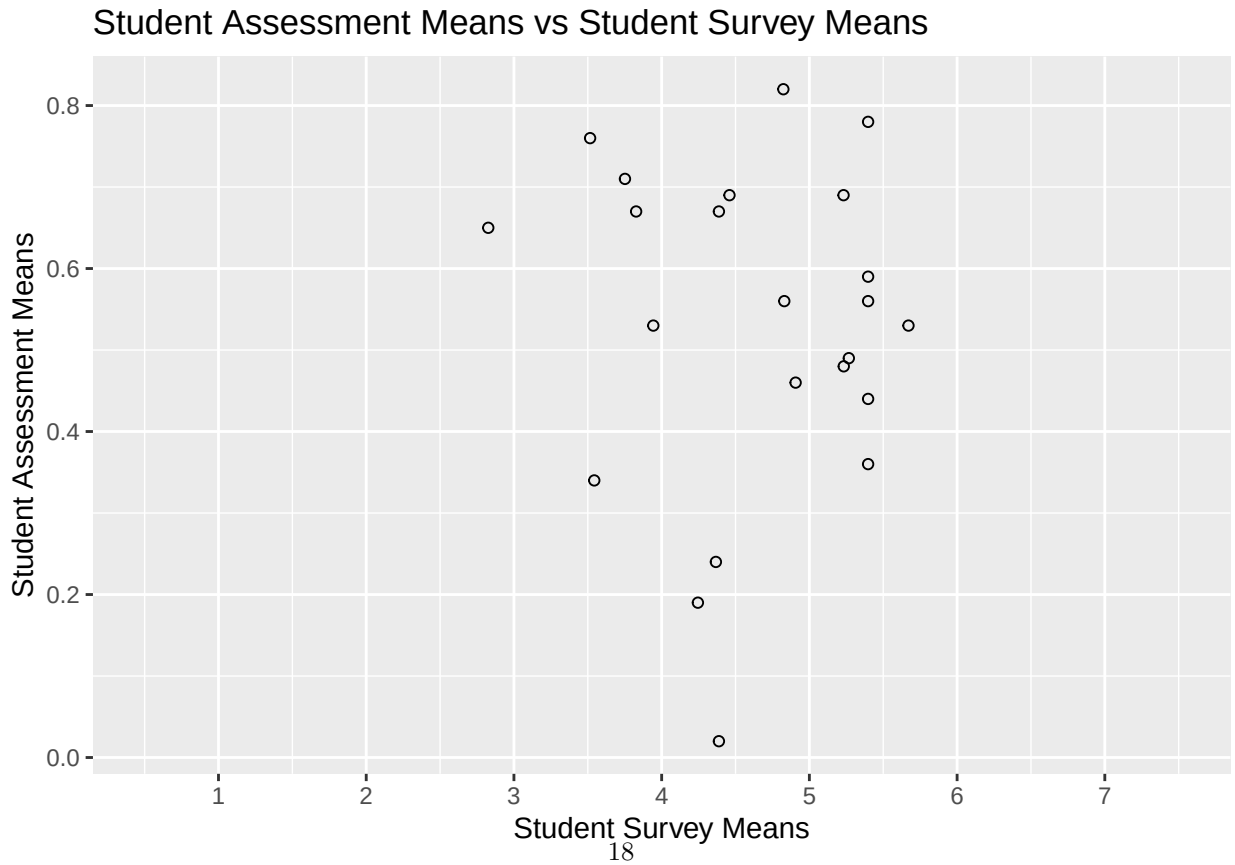
7 Subsection Summaries!

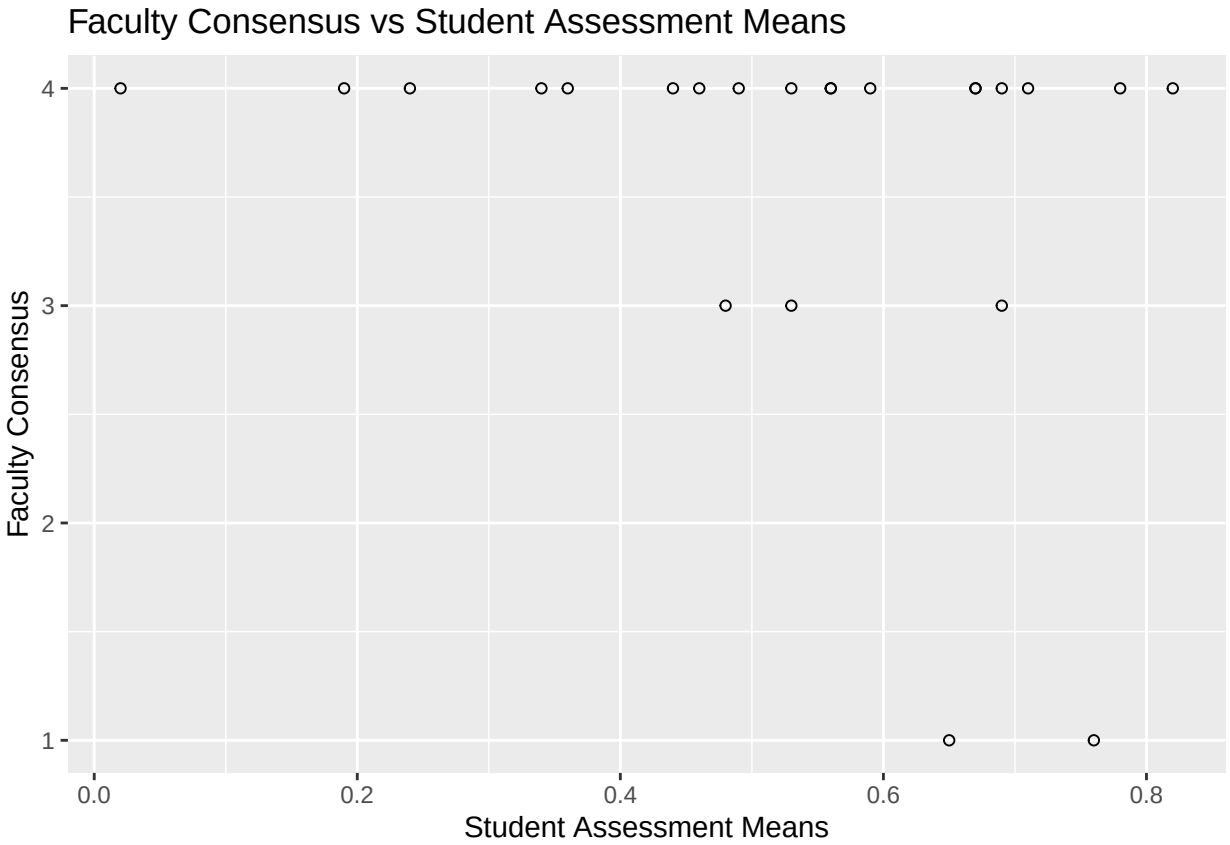
Statistical Theory		Student Survey: (4.18 , 4.37)	Faculty Assessed: 7/7
EDA		Student Survey: (3.25 , 3.48)	Faculty Assessed: 3/5
Design of Studies		Student Survey: (4.62 , 4.78)	Faculty Assessed: 9/10
Statistical Models		Student Survey: (3.62 , 3.77)	Faculty Assessed: 13/15
Software and Tools		Student Survey: (4.31 , 4.65)	Faculty Assessed: 2/2
Accessing and Wrangling Data		Student Survey: (4 , 4.22)	Faculty Assessed: 5/5
Basic Programming Concepts		Student Survey: (3.76 , 4)	Faculty Assessed: 5/5
Computationally Intensive Statistical Methods		Student Survey: (3.17 , 3.44)	Faculty Assessed: 4/4
Calculus		Student Survey: (5.28 , 5.58)	Faculty Assessed: 2/2
Linear Algebra		Student Survey: (4.04 , 4.29)	Faculty Assessed: 5/5

Probability		Student Survey: (4.08 , 4.42)	Faculty Assessed: 3/3
Connecting Math and Statistics		Student Survey: (3.73 , 4.26)	Faculty Assessed: 1/1
Communication		Student Survey: (4.83 , 5.02)	Faculty Assessed: 6/6
Collaboration		Student Survey: (5.18 , 5.42)	Faculty Assessed: 3/3
Ethical Issues		Student Survey: (5.19 , 5.42)	Faculty Assessed: 3/4
Complex open−ended problems		Student Survey: (4.15 , 4.5)	Faculty Assessed: 2/2
Scientific Method		Student Survey: (4.47 , 4.64)	Faculty Assessed: 7/7
Discipline−specific Knowledge		Student Survey: (3.64 , 3.84)	Faculty Assessed: 4/4

8 Scatterplots!



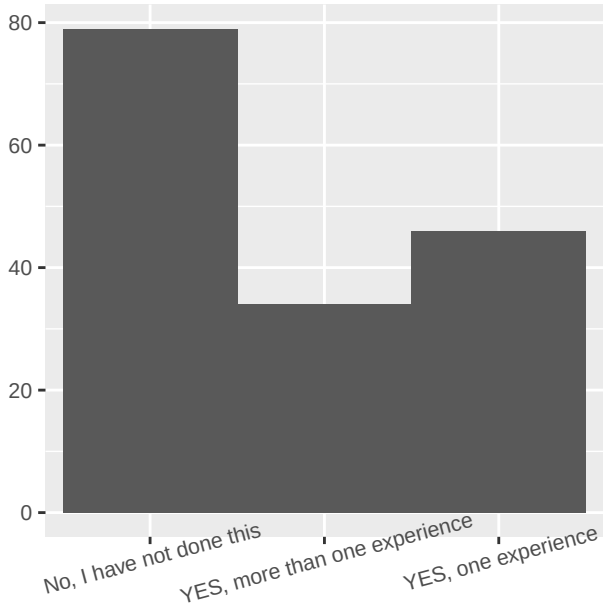



Faculty Consensus vs Student Assessment Means
Faculty Consensus
4
3
2
1
0.0
0.2
0.4
0.6
0.8
Student Assessment Means

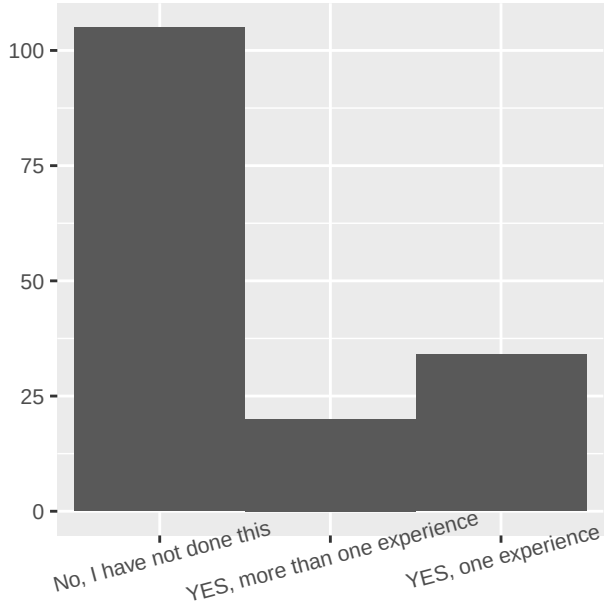
9 Section: Misc

9.1 Subsection: Opportunities for Authentic Practice

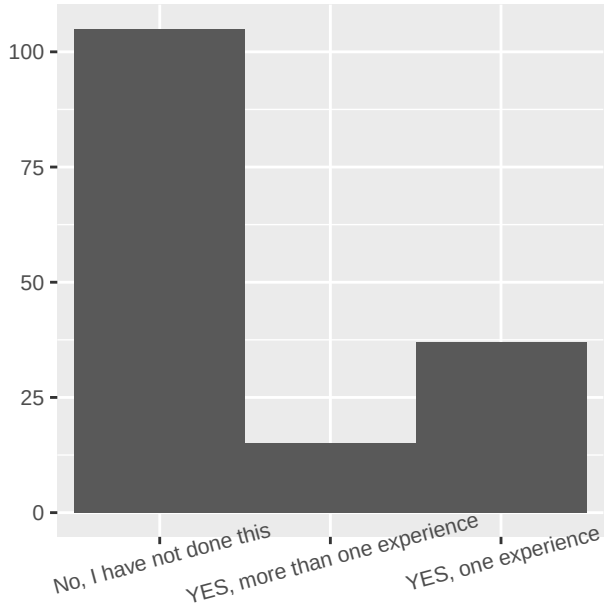
Internship(s)



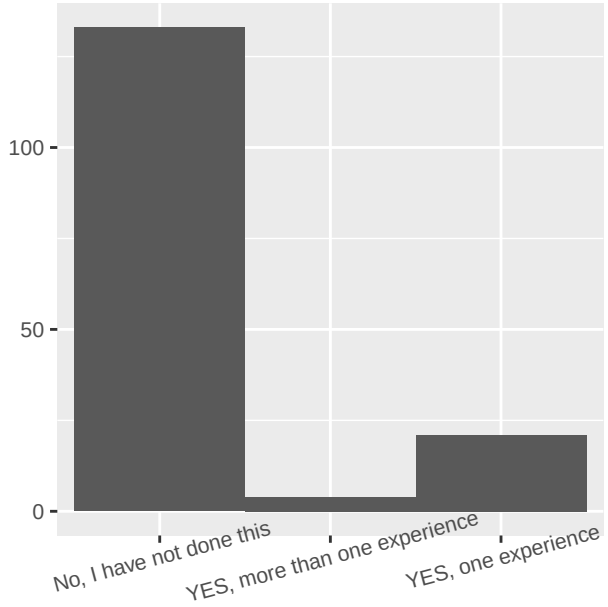
Research experience(s)



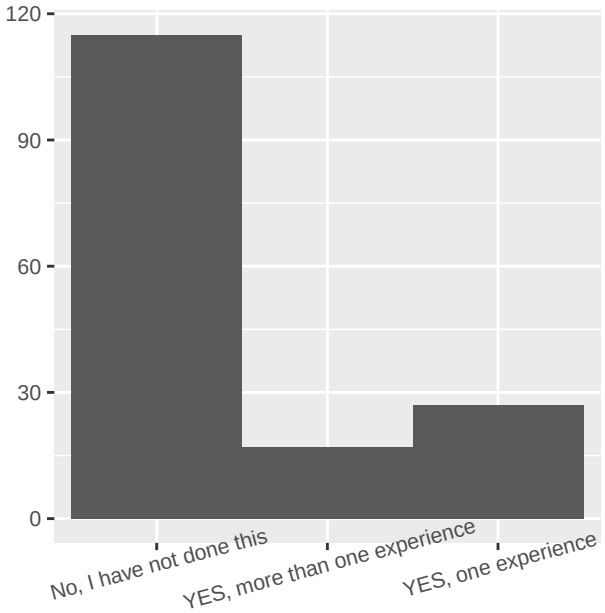
Senior−level capstone course



Consulting experience(s)

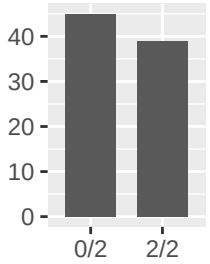


Other extracurriculars experiences posing and answering statistical questions



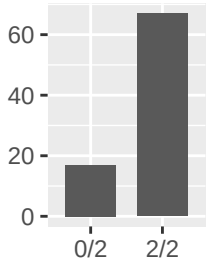
9.2 CAOS

Assessment Item: CAOS 9



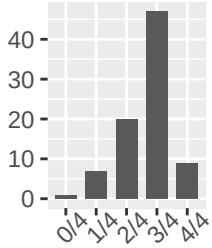
Assessment: (0.35 , 0.56)

Assessment Item: CAOS 15



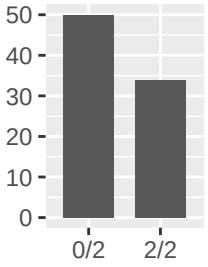
Assessment: (0.69 , 0.87)

Assessment Item: CAOS 28−31



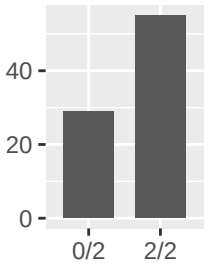
Assessment: (0.62 , 0.71)

Assessment Item:
CAOS 37



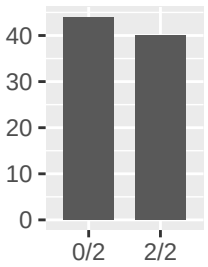
Assessment:
(0.29 , 0.5)

Assessment Item:
CAOS 38



Assessment:
(0.54 , 0.74)

Assessment Item:
CAOS 39



Assessment:
(0.36 , 0.57)