
SQUIRREL-NET: IMPROVING RESEARCH SKILLS BY INVOLVING STUDENTS IN A NATIONAL STUDY OF SQUIRREL BEHAVIOR

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Job Outlook 2019 – National Association of Colleges and Employers

We want our students to get jobs!

Employers were asked which skills - beyond strong GPA - they most want to see on a student's resume. I include the most current NACE top 10 skills list on all of my course syllabi. While the list does not change much from year to year, Leadership dropped from number one in 2017 to number eight in 2019, and Written Communication increased from number three to number one in 2019.



Undergraduate Research

Research experiences are critical elements of undergraduate science education. They provide an opportunity for students to learn about inquiry, gain confidence in overcoming obstacles, and self-identify as scientists¹⁻³. However, gaining extra-curricular research experience is not often feasible for many students either as a result of financial or time limitations⁴, lack of awareness of opportunities, or institutional structure and resource limitations. This is particularly the case for STEM students from under-represented groups⁵. Furthermore, university culture and/or current STEM pedagogy can make these students feel they do not belong in academia, leading to higher dropout rates⁶.

CUREs (Course-based Undergraduate Research Experiences)



Course-based undergraduate research experiences (**CUREs**) are a strategic way to introduce more students to authentic research⁴; however, many barriers limit their widespread adoption^{7,8}. Development of a CURE can be time consuming⁹ and may seem daunting to faculty that lack pedagogical training. Additionally, it is difficult to collect sufficient data for meaningful analyses in a semester, particularly at smaller institutions or in field-based courses⁸. This restricts student opportunities to engage in research, master data analysis¹⁰, and prepare for graduate school or data-driven careers¹¹. Finally, most CUREs target large-enrollment introductory courses⁹, limiting exposure to mentoring opportunities. Rarely do students return to the same topic within their undergraduate program, even though repeated exposure promotes deeper engagement and long-term gains in skills and content knowledge¹².



Story of Liz Westerberg
and Johanna Varner



Squirrel-Net

Exploring biology through the
squirrely lives of squirrels

[Review Teaching Materials](#)

[Join our Research!](#)

[CourseSource Publications](#)

[Visit our YouTube Channel](#)

We received NSF funding to study how our CURE network affects student gains, and we are looking for collaborators! [Learn more by clicking here!](#)




WHAT IS SQUIRREL- NET?

SQUIRRELNED GUD DATASHEET

Please fill in each white field completely! This sheet will serve as a template for entering your observation at (<https://goo.gl/forms/lwaNaAzKTbCqxfGy2>)

I. OBSERVER INFORMATION

| | | | |
|-------------------------------|--|---|--------------------|
| Name of observer | |  | Data Entry QR Code |
| Name of partner or team-mates | | | |
| Institutional affiliation | | | |
| Email address | | | |

II. EXPERIMENTAL CONDITIONS

| | Date | Time | What kind of species did you target? (circle 1) | | Did it rain during your experiment? (circle one) | |
|----------------|------|------|---|---------|--|----|
| Tray Deployed | | | Nocturnal | Diurnal | Yes | No |
| Tray Recovered | | | | | | |

II. LOCATION INFORMATION

| Site Name | Location (decimal degrees, 5 decimal places) | | | | | Latitude | Longitude | | |
|---|--|------------------|-------------------|--------------------------|--------------------------------|--------------------------------|---------------------------------|----------------|---------------------------|
| Habitat Type (where trays were deployed: circle one) | Desert | Grassland | Coastal Shrubland | Coniferous forest | Deciduous forest | Riparian | Agricultural | College campus | Other urban (within city) |
| Proximity of tray to human structures (circle all that apply) | Next to sidewalk | 3m from sidewalk | >3m from sidewalk | | | | | | |
| Microhabitat features at tray (circle all that apply) | Under or next to "cover" | 3m from "cover" | >3m from "cover" | There is no "cover" here | Next to ground squirrel burrow | 3m from ground squirrel burrow | >3m from ground squirrel burrow | | |
| Did you make any modifications to the habitat near tray? | No modifications | Scent added | Artificial light | Sound | Predator decoy or simulation | Temperature | | | |

III. EXPECTED SPECIES

| | | | | | | | |
|--|-----|----|---|---|---|--|--|
| Did you deploy camera traps? | Yes | No | | | | | |
| Species observed in camera trap or expected on tray | | | | | | | |
| If you did not use cameras, how confident are you in the above estimate: 1 = totally positive; 5 = totally guessing: | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | | |

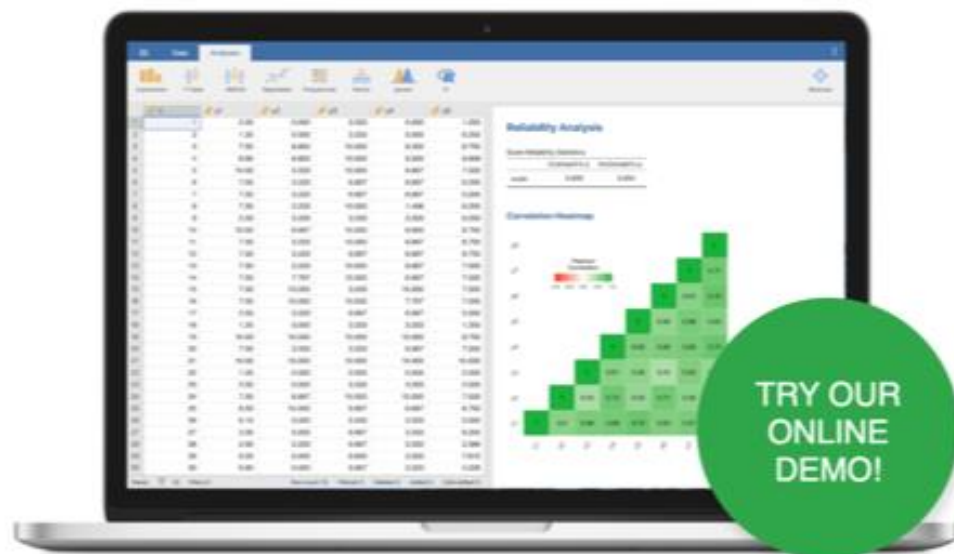
IV. GUD DATA

| Seed Type/Bait used (circle one) | Shelled sunflower seed | Granulated Peanut | Other: | Beginning Seed Dry Mass | Ending Seed Dry Mass (g) | 10g | Other: |
|----------------------------------|------------------------|-------------------|--------|-------------------------|--------------------------|-----|--------|
| | | | | | | | |

Student datasheet for the Giving Up Density Module. The QR code links to a Google Sheet where students enter this into a national dataset.

Home Insert Draw Page Layout Formulas Data Review View Tell me
Paste Arial 10 B I U Merge & Center General Conditional Formatting Format as Table Cell Styles Insert Delete Format Sort & Filter Find & Select Ideas Sensitivity

Table with 13 columns: Institution/College Name, Latitude, Longitude, Biome, Proximity of focal animal to nearest "edge", Proximity of focal animal to "safety", Proximity to human structures, Date, Time (beginning of observation), Cloud cover, Precipitating?, Wind, Focal Species (Genus species). Rows include data for various institutions like Agnes Scott College and Auburn University.



free and open statistical software to bridge the gap between researcher and statistician



STATS MADE SIMPLE

jamovi is a new "3rd generation" statistical spreadsheet. designed from the ground up to be easy to use, jamovi is a compelling alternative to costly statistical products such as SPSS and SAS.



R INTEGRATION

jamovi is built on top of the R statistical language, giving you access to the best the statistics community has to offer. would you like the R code for your analyses? jamovi can provide that too.



FREE AND OPEN

jamovi will always be free and open - that's one of our core values - because jamovi is made by the scientific community, for the scientific community.



Data

Analyses

Edit



Exploration



T-Tests



ANOVA



Regression



Frequencies



Factor



Modules

| | Year | Timestamp | Files | Institution... | Latitude (...) | Longitude... | Biome | Proximity ... |
|----|------|-----------------|-------|---------------------|----------------|--------------|-------------------|---------------|
| 1 | 2020 | 2020-04-24 1... | | 1 California Sta... | 36.656 | -121.768 | Core college ... | > 10m |
| 2 | 2020 | 2020-04-25 1... | | 1 California Sta... | 36.658 | -121.769 | Grassland | 0 - 3m |
| 3 | 2020 | 2020-04-25 1... | | 1 California Sta... | 36.657 | -121.769 | Grassland | 0 - 3m |
| 4 | 2020 | 2020-04-25 2... | | 1 California Sta... | 36.691 | -121.627 | Grassland | 3 - 10m |
| 5 | 2020 | 2020-04-26 1... | | 1 California Sta... | 36.653 | 121.794 | Core college ... | 3 - 10m |
| 6 | 2020 | 2020-04-26 1... | | 1 California Sta... | 36.653 | 121.794 | Core college ... | 3 - 10m |
| 7 | 2020 | 2020-04-26 2... | | 1 California Sta... | 36.652 | -121.790 | Core college ... | > 10m |
| 8 | 2020 | 2020-04-27 0... | | 1 California Sta... | 36.652 | 121.798 | Core college ... | 3 - 10m |
| 9 | 2020 | 2020-04-27 2... | | 1 California Sta... | 36.588 | -121.881 | Grassland | 3 - 10m |
| 10 | 2020 | 2020-04-27 2... | | 1 California Sta... | 36.657 | -121.770 | Desert | 3 - 10m |
| 11 | 2020 | 2020-05-04 1... | | 1 California Sta... | 36.654 | 121.795 | Core college ... | 0 - 3m |
| 12 | 2018 | 2018-10-24 2... | | 1 Colorado Me... | 39.180 | -108.831 | Desert | 3 - 10m |
| 13 | 2019 | 2019-10-24 1... | | 1 Colorado Me... | 39.550 | -107.983 | Deciduous fo... | 3 - 10m |
| 14 | 2019 | 2019-07-10 1... | | 1 Colorado Me... | 39.255 | -119.970 | Coniferous fo... | 3 - 10m |
| 15 | 2020 | 2020-10-18 1... | | 1 Auburn Unive... | 32.726 | 85.946 | Riparian | 0 - 3m |
| 16 | 2020 | 2020-10-18 1... | | 1 Auburn Unive... | 32.361 | -88.013 | Riparian | 0 - 3m |
| 17 | 2019 | 2019-03-27 1... | | 1 University of ... | 44.537 | -89.562 | Deciduous fo... | > 10m |
| 18 | 2019 | 2019-05-11 1... | | 1 University of ... | 44.982 | 89.618 | Deciduous fo... | 3 - 10m |
| 19 | 2019 | 2019-07-28 1... | | 1 University of ... | 45.841 | -89.678 | Coniferous fo... | > 10m |
| 20 | 2020 | 2020-08-08 1... | | 1 University of ... | 44.324 | -89.797 | Deciduous fo... | 3 - 10m |
| 21 | 2020 | 2020-10-21 1... | | 1 University of ... | 44.491 | -89.507 | Other urban (...) | 0 - 3m |
| 22 | 2020 | 2020-10-08 1... | | 1 University of ... | 35.208 | -97.447 | Core college ... | 0 - 3m |
| 23 | 2020 | 2020-10-08 1... | | 1 University of ... | 35.208 | -97.447 | Core college ... | 0 - 3m |
| 24 | 2020 | 2020-04-30 1... | | 1 University of ... | 44.533 | -88.156 | Riparian | 3 - 10m |
| 25 | 2020 | 2020-05-06 1... | | 1 University of ... | 42.924 | -88.065 | Other urban (...) | 3 - 10m |
| 26 | 2020 | 2020-10-13 1... | | 1 University of ... | 44.414 | -89.263 | Deciduous fo... | 0 - 3m |
| 27 | 2020 | 2020-09-10 1... | | 1 Agnes Scott ... | 37.256 | -121.942 | Other urban (...) | > 10m |
| 28 | 2020 | 2020-09-11 0... | | 1 Agnes Scott ... | 33.508 | -84.403 | Coniferous fo... | 0 - 3m |

Results

Descriptives

Descriptives

- N
- Missing
- Mean
- Median
- Standard deviation
- Minimum
- Maximum

Descriptives

Descriptives

- N
- Missing
- Mean
- Median
- Standard deviation
- Minimum



Data

Analyses

Edit



Exploration



T-Tests



ANOVA



Regression



Frequencies



Factor

Descriptives



- Observation length (answer only ...)
- Total vigilance (out of 16 timepoi...)
- Total foraging (out of 16 timepoin...)
- Total social (out of 16 timepoints, ...)
- Total other (out of 16, enter num...)
- Total NA/Out of Sight (out of 16 t...)
- Notes and comments
- Number of conspecifics present (...)



Variables

 Total alert foraging (out of 16 timep...


Split by

 Frequency tables

 Statistics

 Plots

Histograms

- Histogram
- Density

Q-Q Plots

- Q-Q

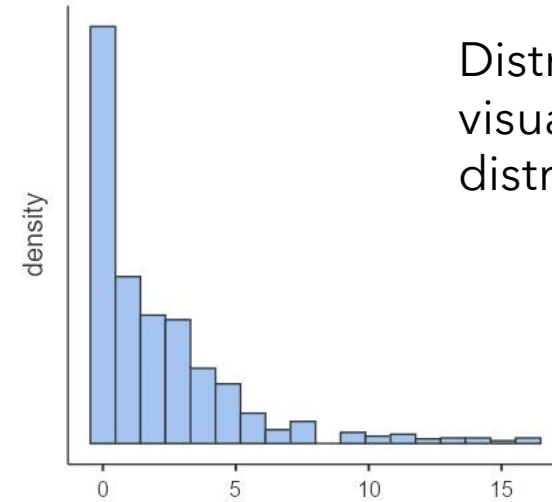
Box Plots

- Box plot
- Violin
- Data

Jittered ▾

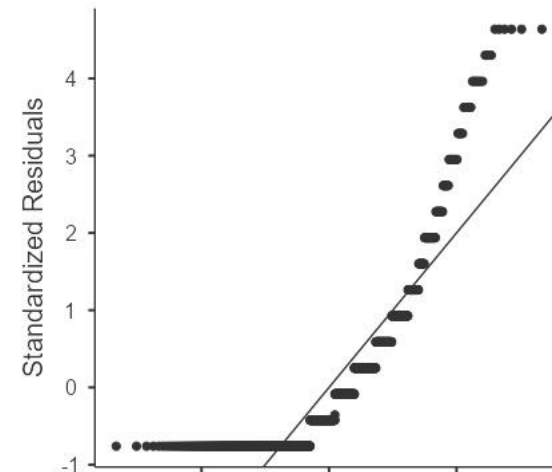
Bar Plots

- Bar plot



Distribution plots to visualize normal distributions

al alert foraging (out of 16 timepoints, enter numbe





Data

Analyses

Edit



Exploration



T-Tests



ANOVA



Regression



Frequencies



Factor

Statistical tests for normality

Descriptives



- Total social (out of 16 timepoint...
- Total other (out of 16, enter nu...
- Total NA/Out of Sight (out of 16...
- Notes and comments
- Number of conspecifics present ...

Split by

 Frequency tables

Statistics

Sample Size

 N Missing

Percentile Values

 Cut points for equal groups Percentiles

Dispersion

 Std. deviation Minimum Variance Maximum Range S. E. Mean

Central Tendency

 Mean Median Mode Sum

Distribution

 Skewness Kurtosis

Normality

 Shapiro-Wilk

Descriptives

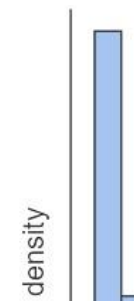
Descriptives

Total alert foraging (out of 16 timepoints, enter number only)

| | |
|--------------------|--------|
| N | 1187 |
| Missing | 0 |
| Mean | 2.25 |
| Median | 1.00 |
| Standard deviation | 2.96 |
| Minimum | 0.00 |
| Maximum | 16.0 |
| Shapiro-Wilk W | 0.755 |
| Shapiro-Wilk p | < .001 |

Plots

Total alert foraging (out of 16 timepoints, enter number only)





Data

Analyses

Edit



Exploration



T-Tests



ANOVA



Regression



Frequencies



Factor



Modules

One-Way ANOVA (Non-parametric)



- Files
- Institution/College Name
 - Latitude (Decimal degrees; 5 deci...
 - Longitude (Decimal degrees; 5 de...
 - Biome
 - Proximity of focal animal to neare...
 - Proximity of focal animal to "safet...
 - Proximity to human structures



Dependent Variables

Total alert foraging (out of 16 timep...



Grouping Variable

Year



- Effect size
- DSCF pairwise comparisons

Students can quickly analyze behaviors (Dependent variables) and grouping variables (Independent variables)

N
Missing
Mean
Median
Standard deviation
Minimum
Maximum

One-Way ANOVA (Non-parametric)

Kruskal-Wallis

| | χ^2 | df | p |
|--|----------|----|--------|
| Total alert foraging (out of 16 timepoints, enter number only) | 19.3 | 2 | < .001 |

Dwass-Steel-Critchlow-Fligner pairwise comparisons

>

Pairwise comparisons - Total alert foraging (out of 16 timepoints, enter number only)

| | | W | p |
|------|------|-------|--------|
| 2018 | 2019 | -4.85 | 0.002 |
| 2018 | 2020 | -1.49 | 0.544 |
| 2019 | 2020 | 5.47 | < .001 |





Intro C

GUD and Behavior modules C/B

Jamovi and data analysis/handling B

Tangible learning outcomes/ artifacts B/C

Recruiting other institutions C

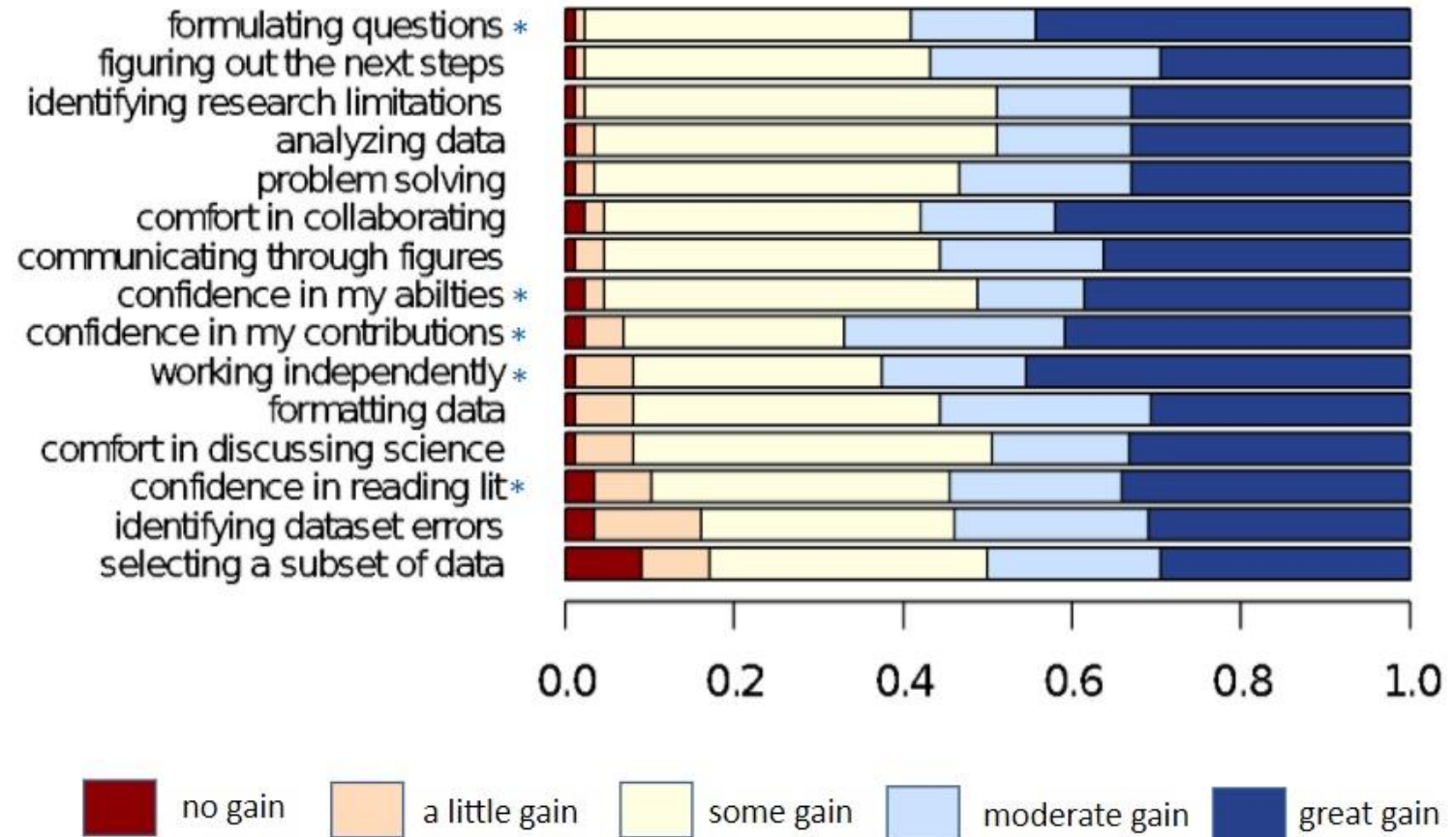
Thank You

Research gains

How much did you GAIN in the following areas as a result of your most recent research experience? In other words, how much easier is it for you to perform the tasks described below since participating in your most recent research experience?

Some-to-strong gains reported in >80% of students. There were no differences here by course level (i.e., lower vs. upper division).

However, students who indicated higher levels of connectivity (Q7.2_7; see slide 11) also indicated significantly greater gains on the starred questions.

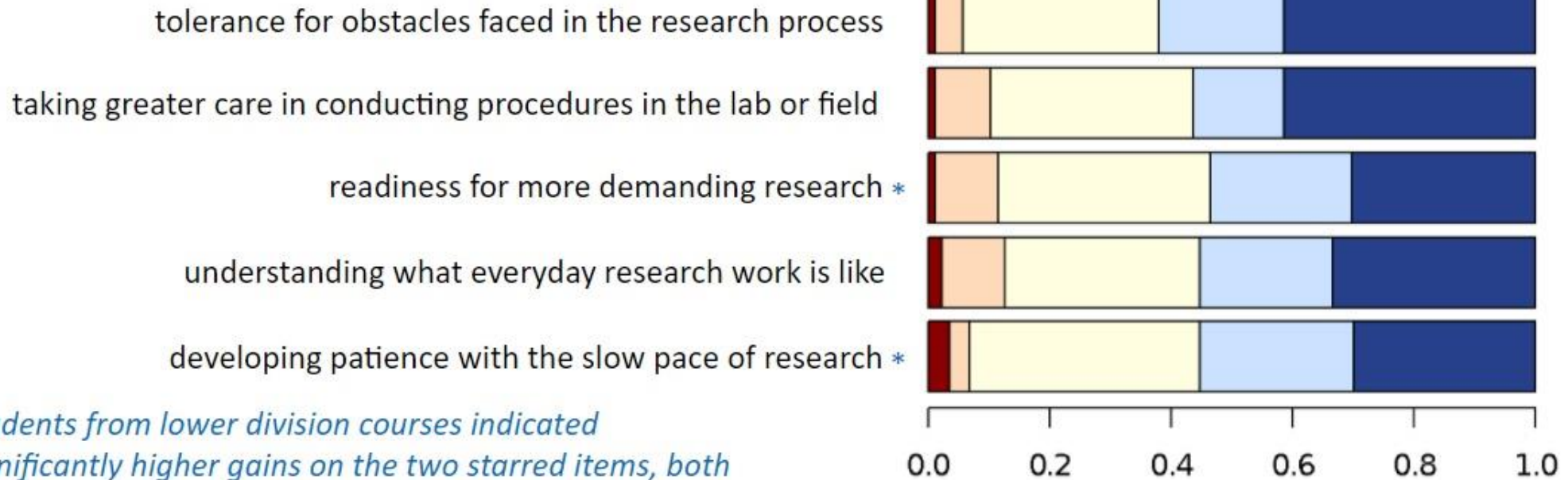


Significance assessed with a Chi-Sq test of independence

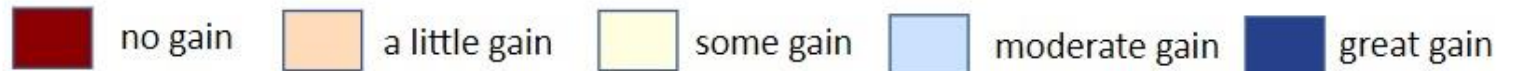
Research gains

Also some-to-strong gains reported in >80% of students for these questions related to conduct of research and persistence.

How much did you GAIN in the following areas as a result of your most recent research experience:



Students from lower division courses indicated significantly higher gains on the two starred items, both relate to a better understanding of the research process.



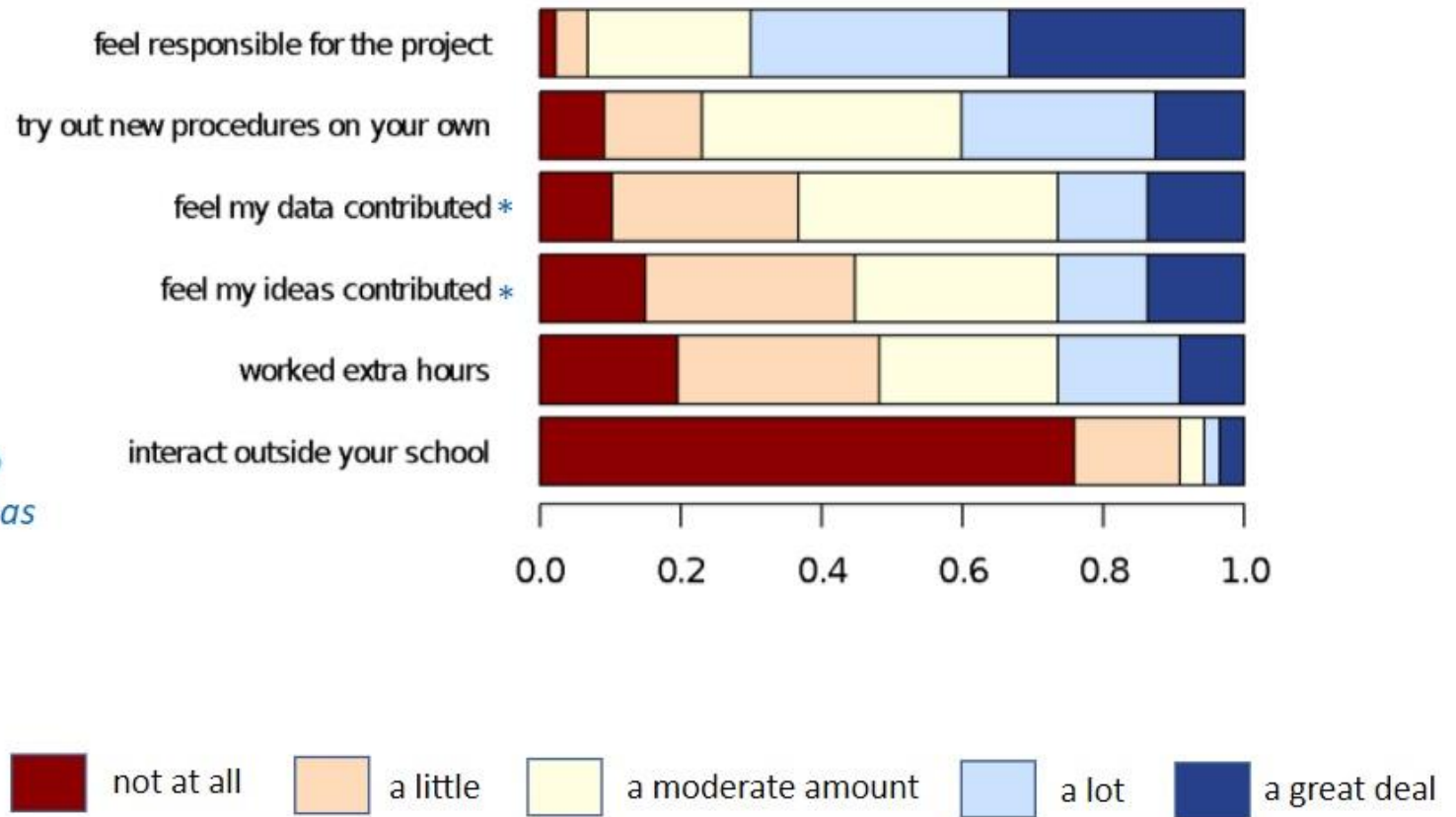
Significance assessed with a Chi-Sq test of independence

CURE activities and perceptions

Students seemed to report a feeling of ownership and that their ideas and contributions mattered. However, most did not report interacting outside their institution (not too surprising given who responded to the survey).

Students who reported greater connectivity (Q7.2_7; see slide 11) also reported greater feelings that their ideas and data contributed to the scientific community.

During your most recent research experience HOW MUCH did you:



Question 4 of 10

What are you most passionate about?



Your review for this question

Self review for this question

Answers the question well ?



Conveys relevant qualifications ?



Communicates enthusiasm ?



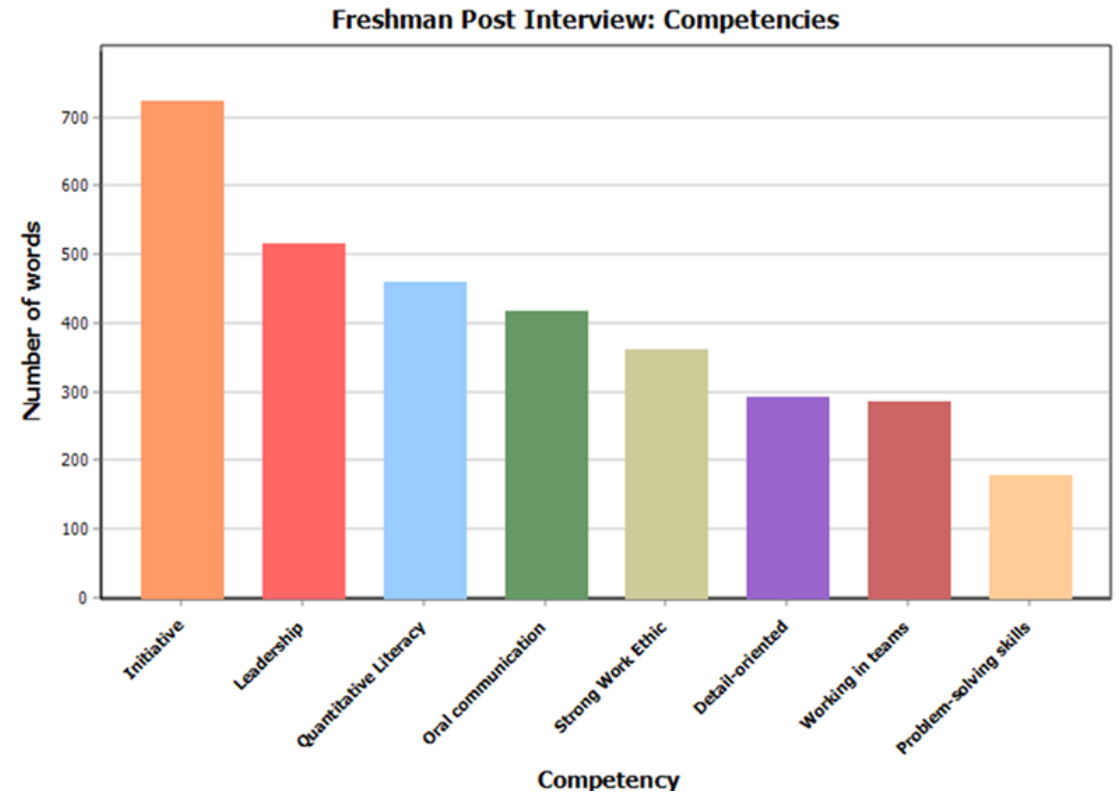
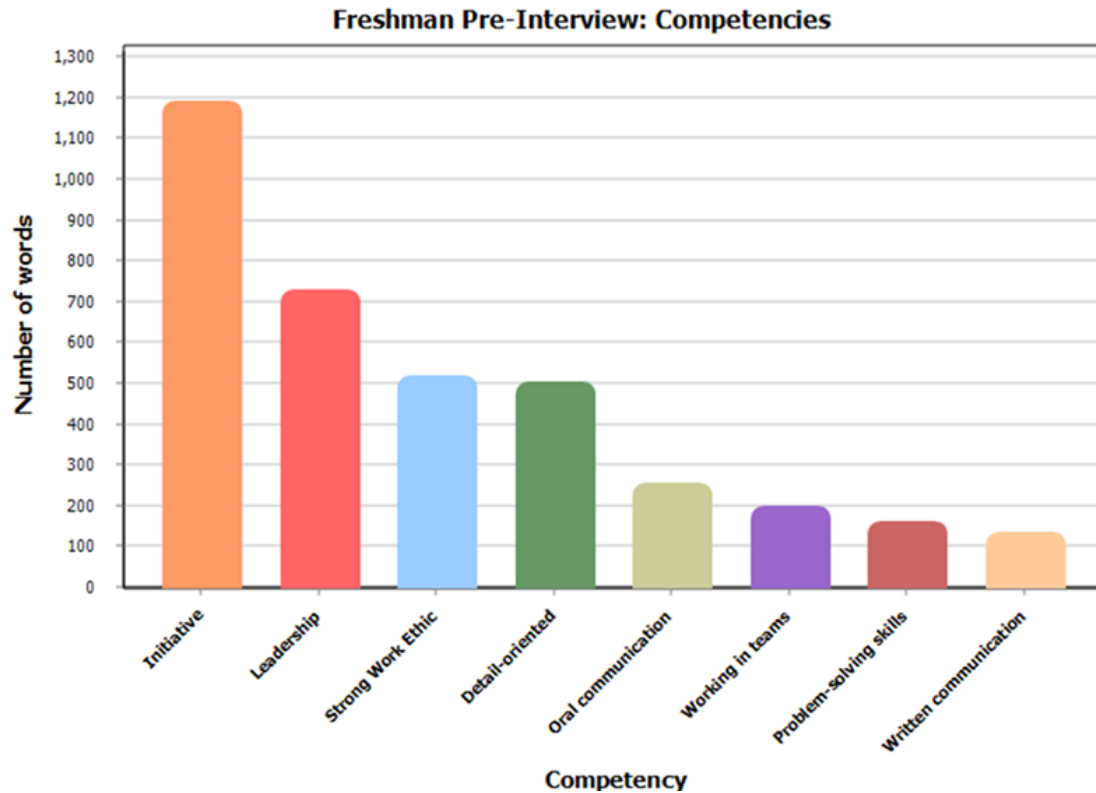
Keeps answer concise ?



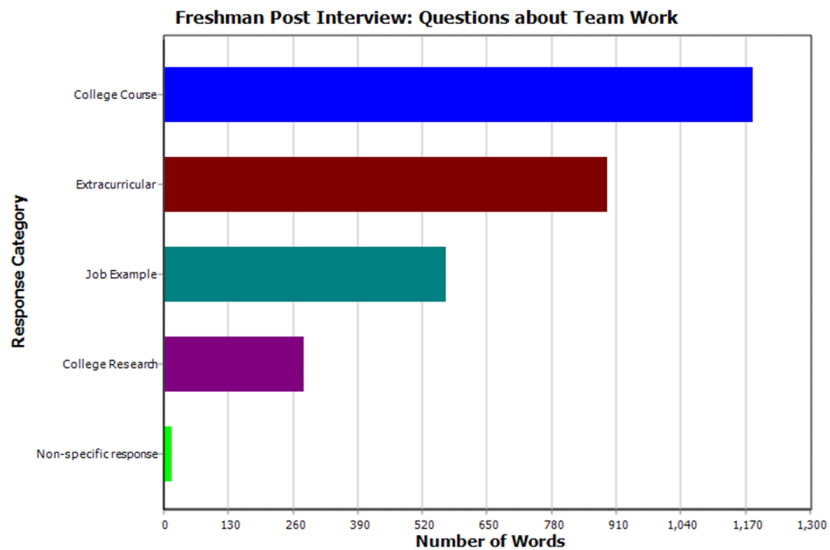
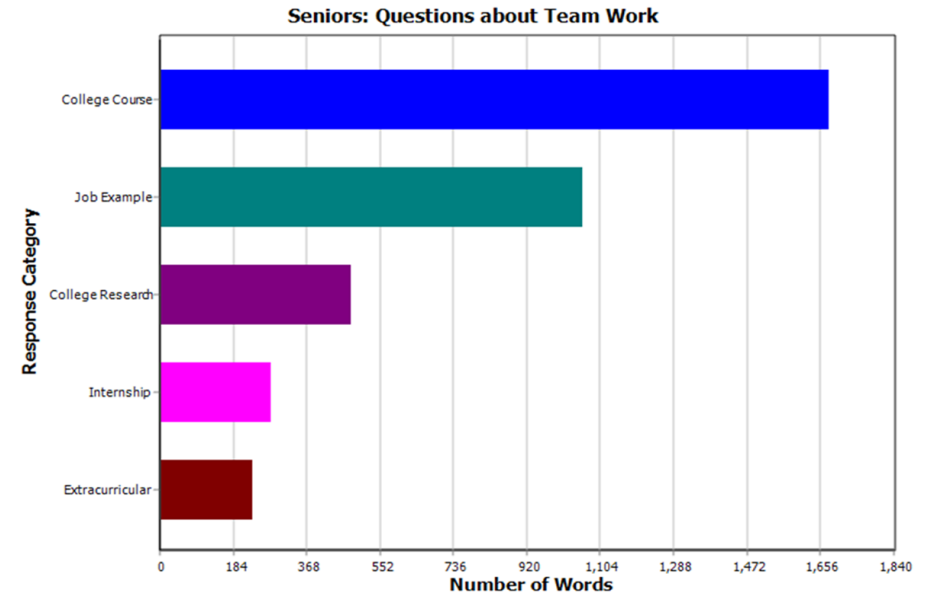
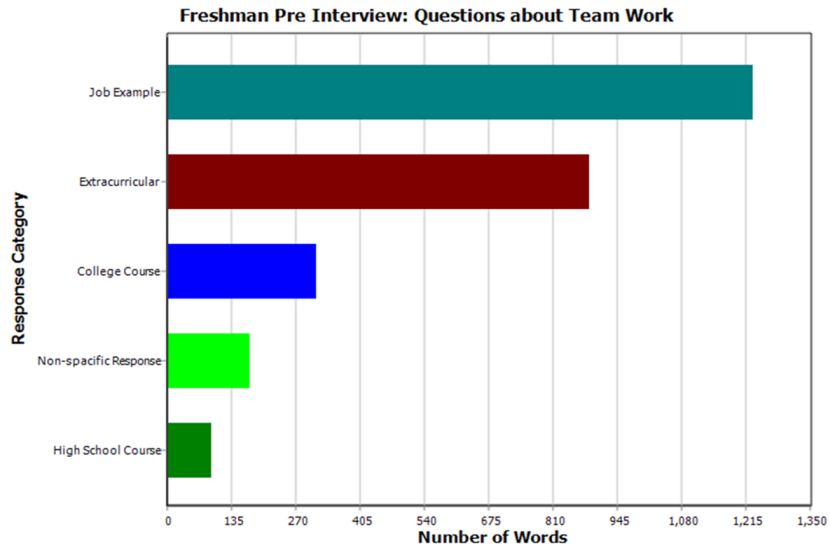
Wisconsin Teaching Fellows and Scholars Project

Can an intervention using a Squirrel-Net Cure improve student responses on job interview questions?

- Used Big Interview and had first semester Biology students answer ten mock interview questions.
- Pre and Post interviews were conducted using the same 10 questions, one given at the beginning of the semester and one towards the end.
- All students participated in the Squirrel-Net GUD CURE during the semester.
- Student interviews were transcribed and coded using QDA Miner.



Initiative and Leadership were the two competencies that were highlighted most in first year student responses. After the Squirrel-Net CURE activity more students included examples of quantitative literacy and oral communication in their interview responses.



First year students quickly incorporated examples from college courses and college research into their interview responses. There were still many examples from extramural activities, particularly relating to questions about working on teams. Extramural examples declined dramatically in the senior responses. Student mock interviews using Big Interview were transcribed and coded using QDA Miner.

Below are some of the benefits to participating in this research for you and your students!

| Benefits to Instructors | Benefits to Students |
|---|--|
| Participation in a national science community! | Participation in a national science community! |
| Evidence of service outreach and teaching development for merit and retention decisions. | Field and/or behavioral observation experience with small mammals to use on a resume or job interview. |
| Participation in Squirrel-Net's equipment loan program for running modules. | Experience with data analysis and interpretation. |
| Access to a national database of student-collected data, allowing students to test broader hypotheses compared to data collected in one place or at one time. | Access to a national database of student-generated data, enabling the testing of creative and interesting student-driven hypotheses. |
| New teaching lab(s) to add to your curriculum that is fully developed and vetted at numerous institutions. | Through exposure to data from local/regional/national squirrels, an increased awareness of species and ecosystem diversity. |
| Connection to a national community of instructors, including authors of the modules, who can provide additional support. | Connection to a national community of other students working on the same research project. |
| Access to four labs, readily adaptable to online teaching. | A hands-on scientific lab experience, even when learning remotely. |
| Course-based Undergraduate Research Experiences (CUREs) involve more students in authentic research, advancing STEM pedagogy. | An authentic research experience, not a "cookie-cutter" lab activity. |



Join our Research Team!

Squirrel-Net has received NSF funding and is looking for collaborators! We need your help in assessing the value of our teaching modules and, more generally, Course-based Undergraduate Research Experiences (CUREs). All you need to do is use one of our modules, ask your students to complete the 10-minute pre- and post-assessment surveys, and take a 15-minute instructor survey. By participating, you will gain access to: an extensive set of teaching materials, assistance from the Squirrel-Net team, a national network of students and student-collected data, and our equipment loan program.

Please [click here](#) for more information or to sign-up!

Below are some of the benefits to participating in this research for you and your students!

| Benefits to Instructors | Benefits to Students |
|--|--|
| Participation in a national science community! | Participation in a national science community! |

HOW DO WE RECRUIT INSTRUCTORS?

- Society list-servs (Mammal-L, Ecolog, SABER)
- Professional meetings (ASM, SICB, TWS, ESA)
- Website and CourseSource Publications
- Word of Mouth