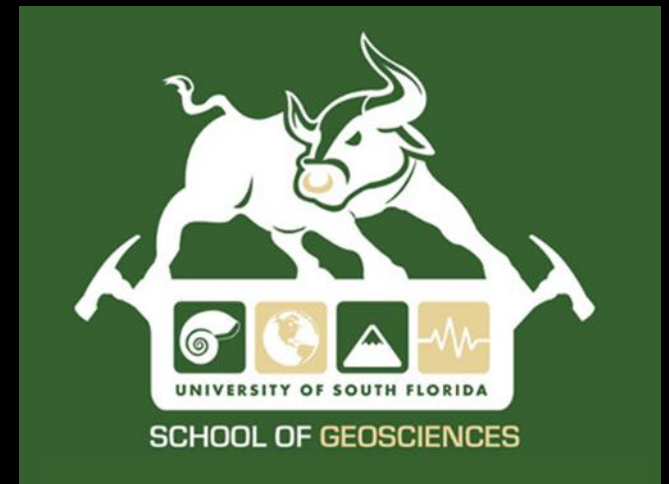


Workforce Data on Quantitative Preparation and Skills of Early Career Geologists: Pilot Results from the Geoscience Quantitative Preparation Survey



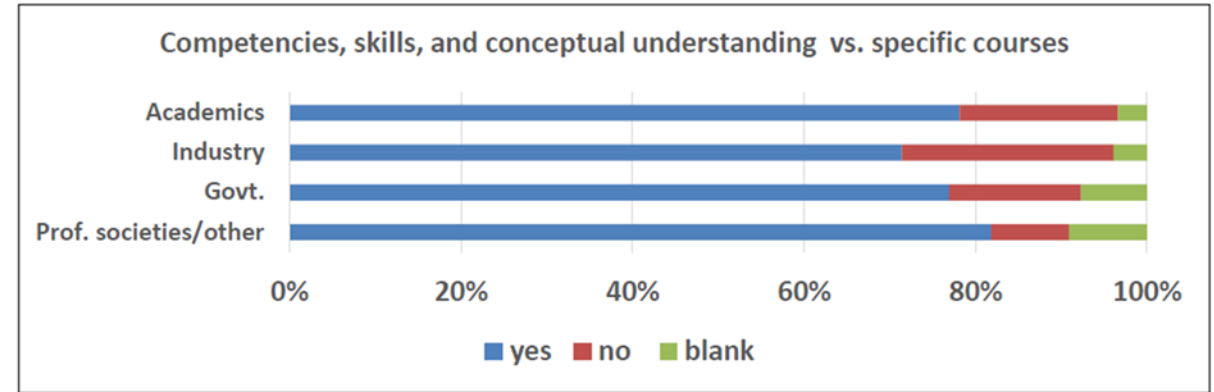
Victor J. Ricchezza, PhD
University of South Florida
School of Geosciences



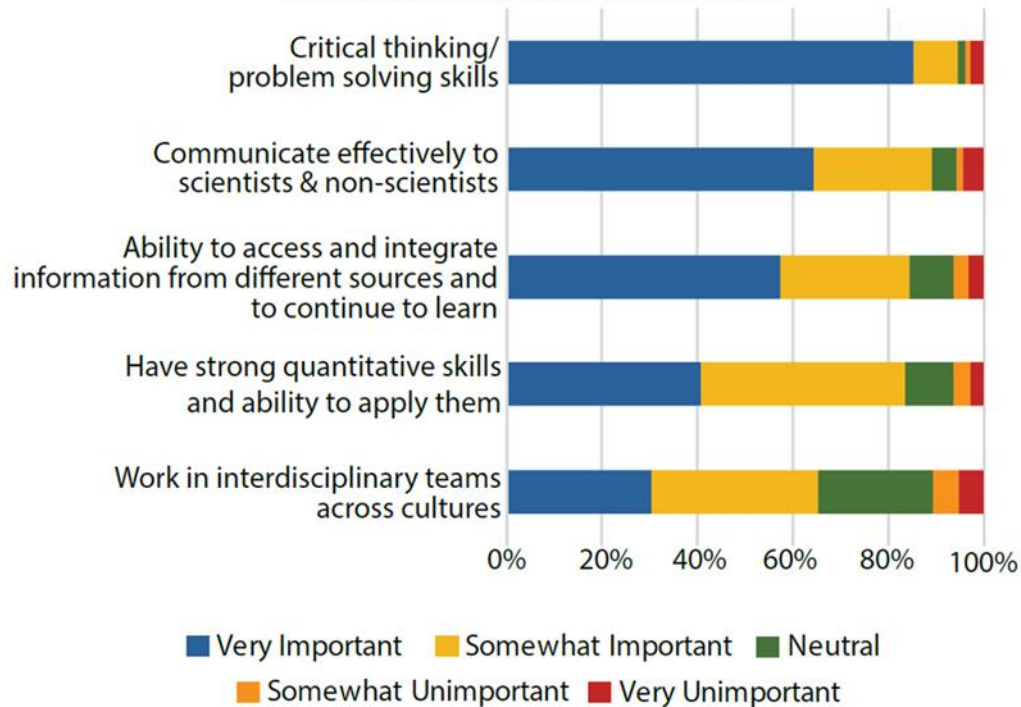
What Quantitative Skills and Competencies are Needed?

Major conclusion of Summit: Developing competencies, skills, and conceptual understanding is more important than taking specific courses

Survey Responses:

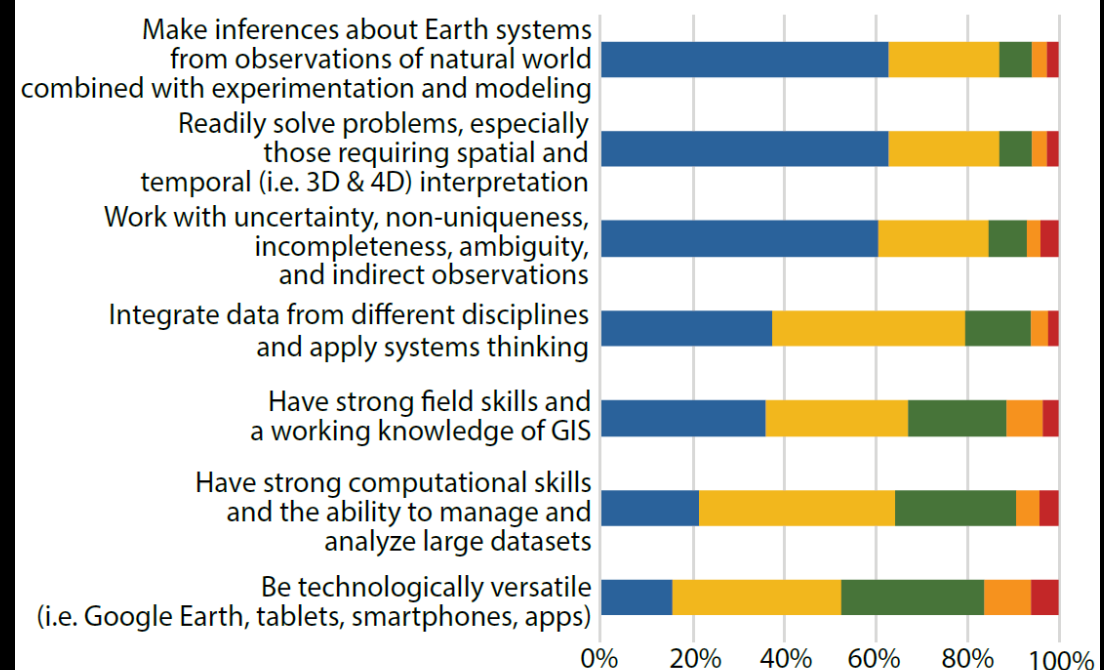


Critical Professional Scientist Skills



Summit survey report/Mosher 2015

Critical Geoscience Skills



The Problem

- Student data plentiful, late career ok
- No data on early career
- Summit and AGI data rarely mention specific math skills needed

Geoscience Quantitative Preparation Survey

- National online anonymous survey
- Targeted to early career geologists:
 - BS/BA in geology 3-10 years ago
 - 3-7 years of related experience (can include grad school)

GQPS Research Questions

To what extent do early career geologists self-identify as quantitatively literate relative to the demands of their careers?

To what extent are early career geologists satisfied with the quantitative preparation they received as undergraduates relative to the demands of their careers?

GQPS Generation

- Confidence:
 - 5Q on math supports (how)
 - 11Q on confidence in math skills (what)
- Work/non-work use (where)
- Satisfaction
- Limited demographics (who)
- 3 experts reviewed; 10 grad students tested

What did we get? (Raw Results)

- 377 complete responses! Yay!
- 178 of these met criteria for “early career geologist”.
- 178/377... 47% of sample is useful (for direct analysis)

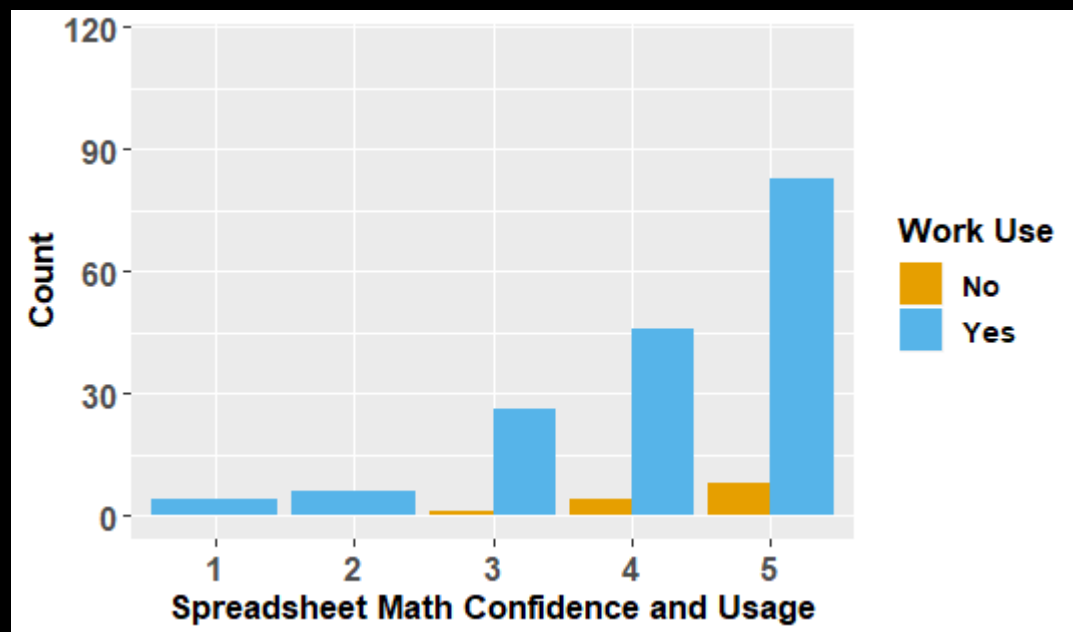
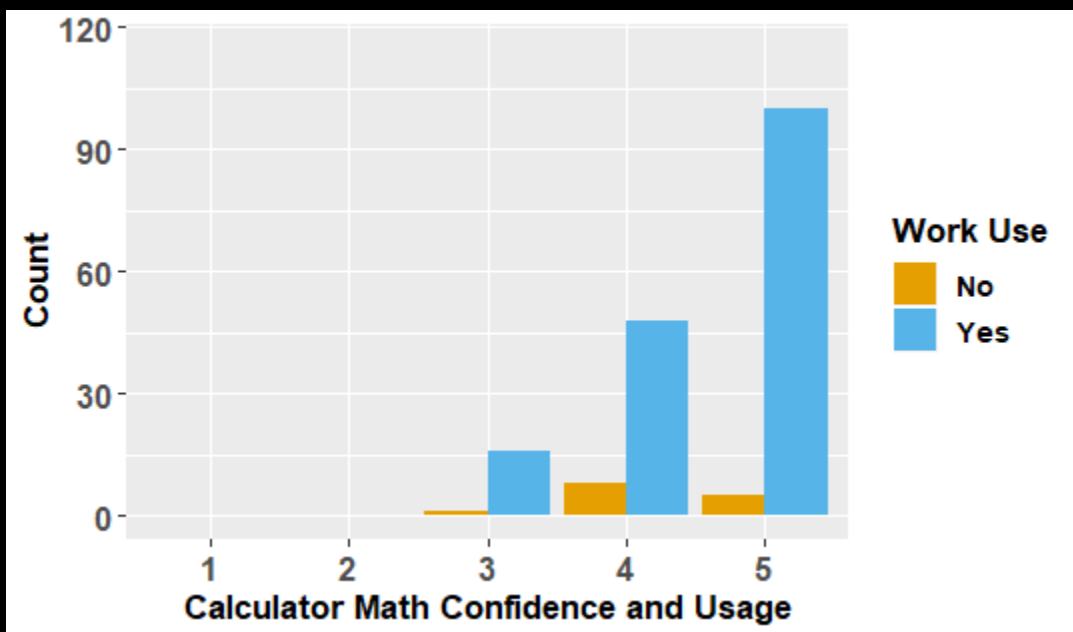
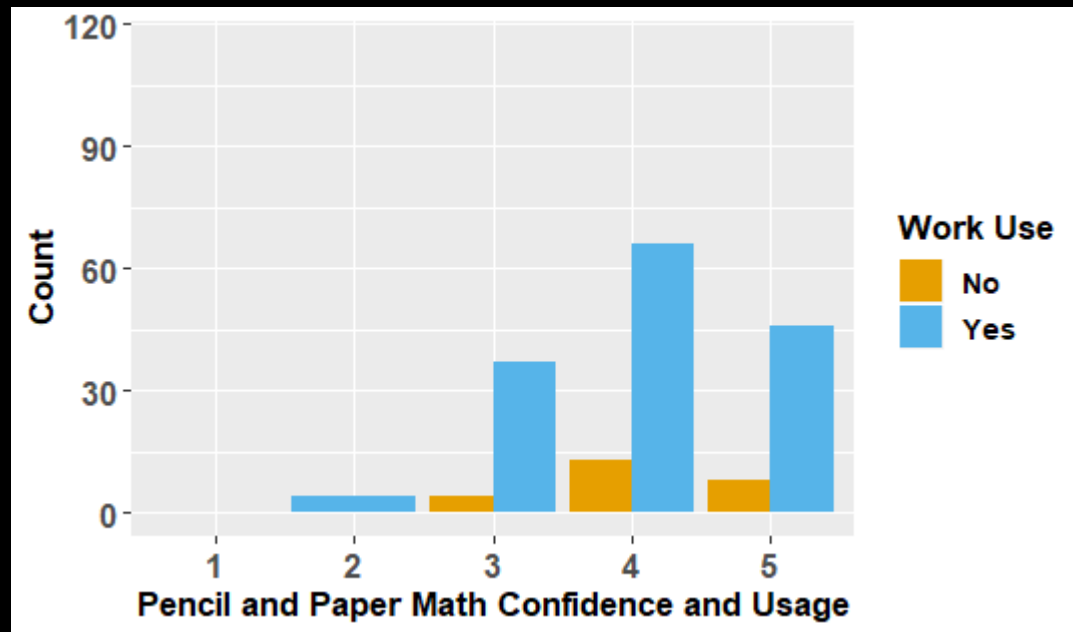
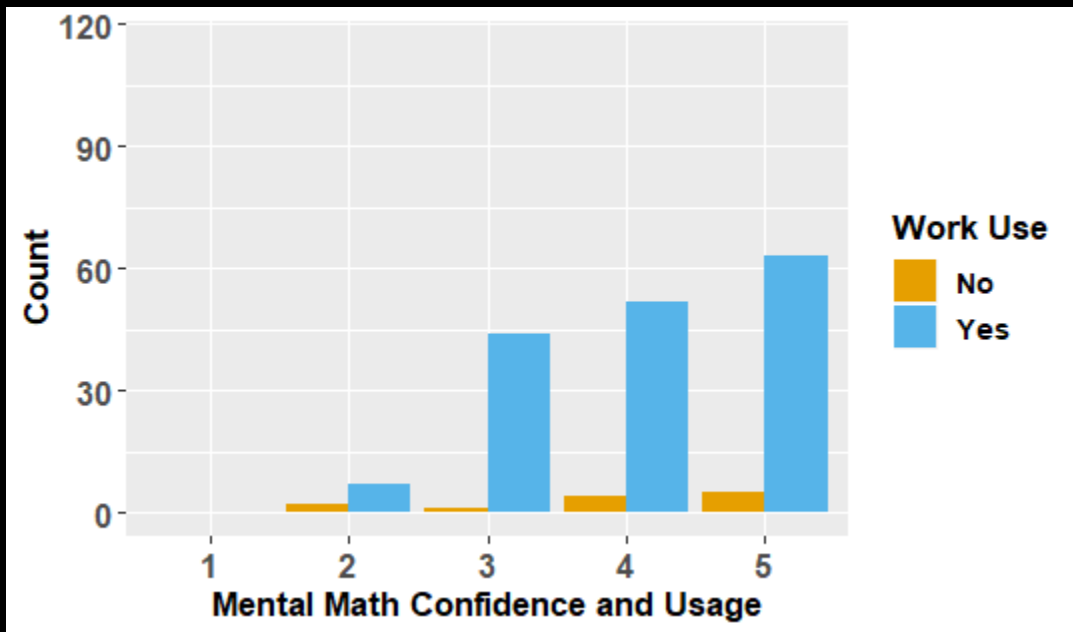
GQPS Research Questions

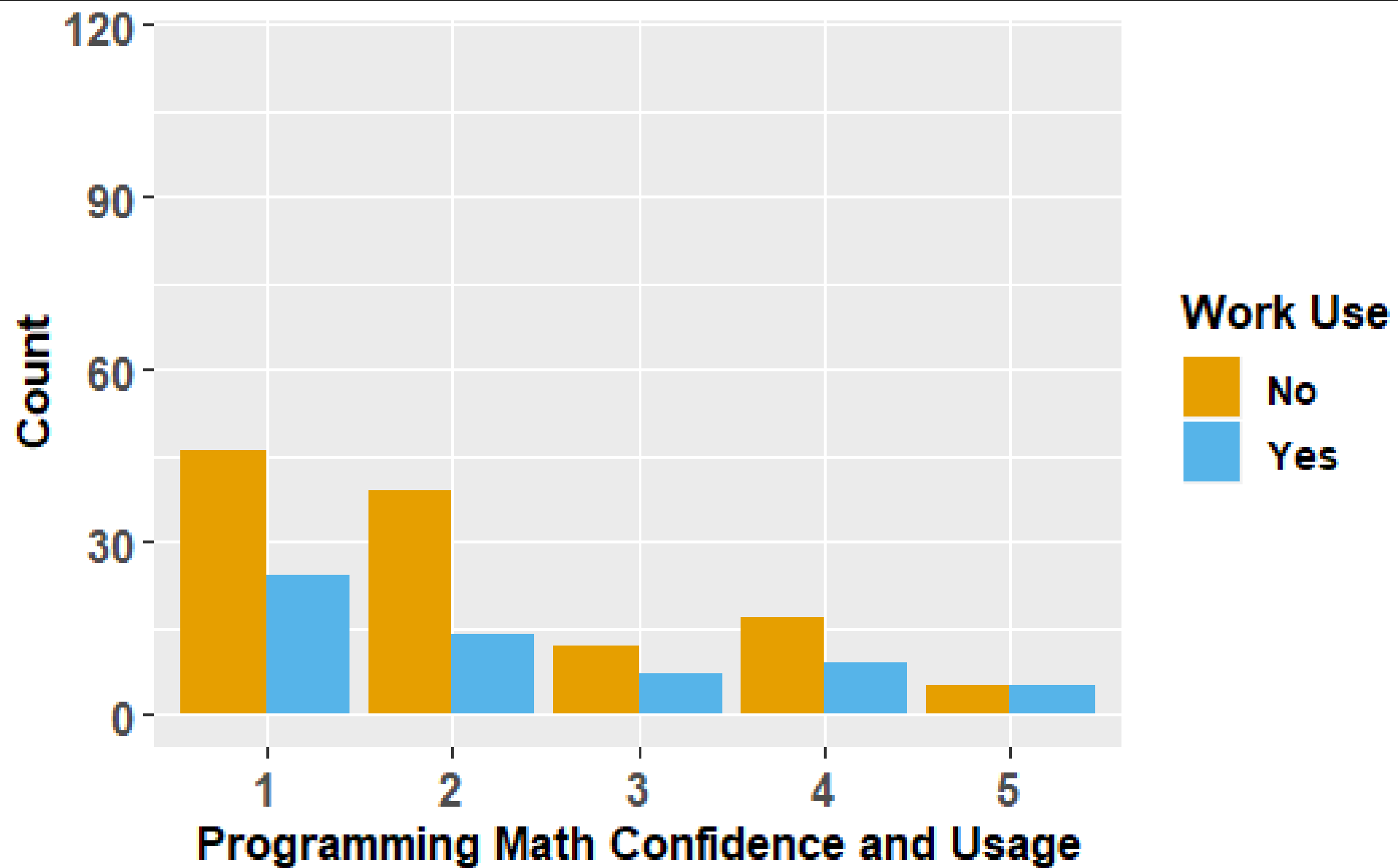
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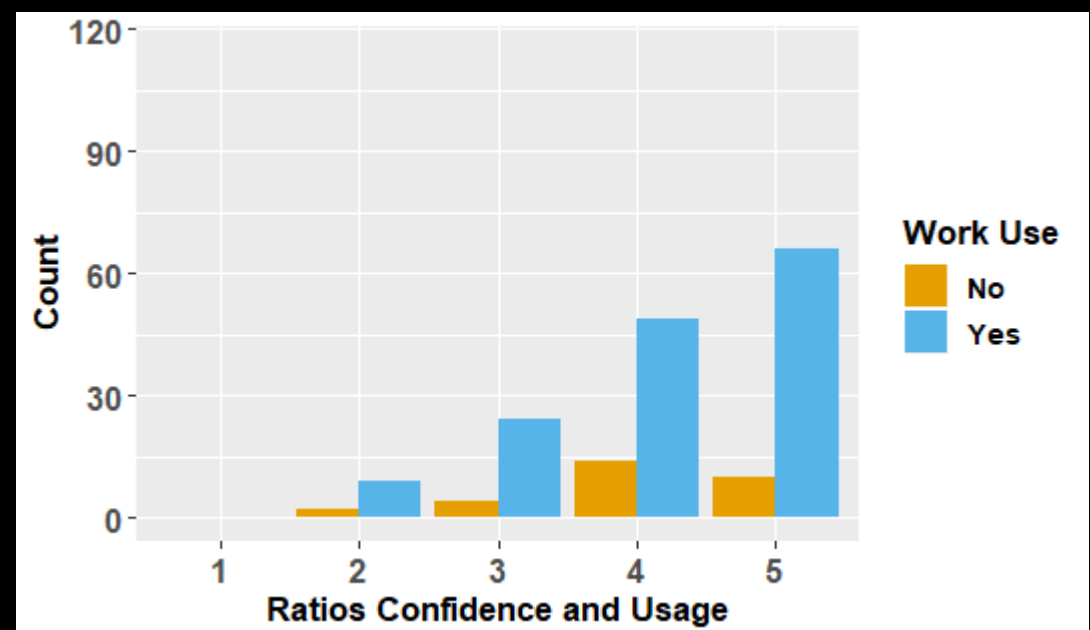
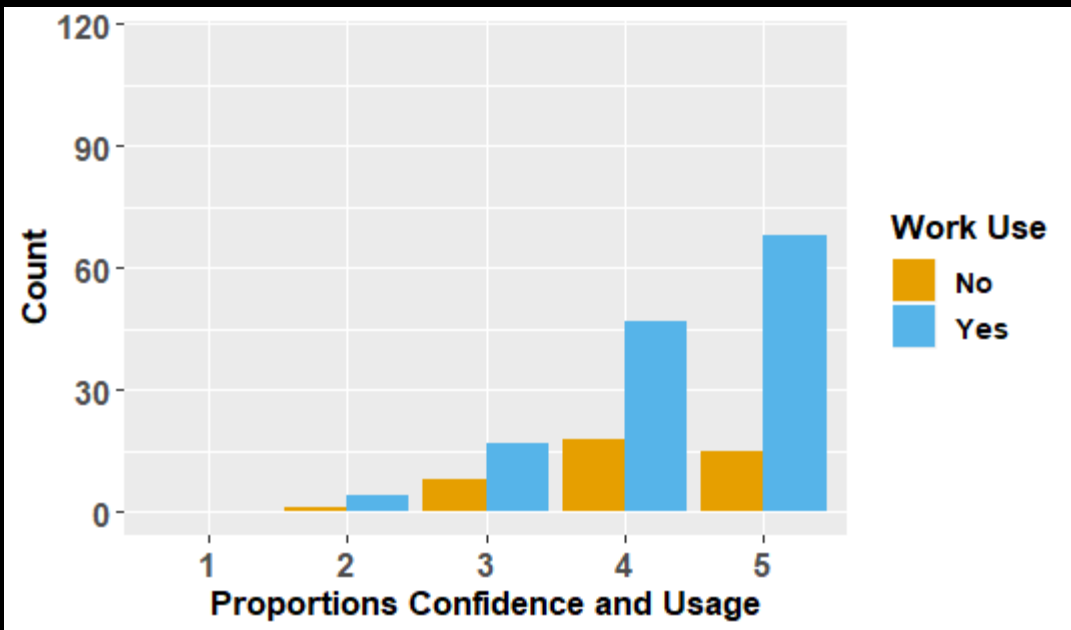
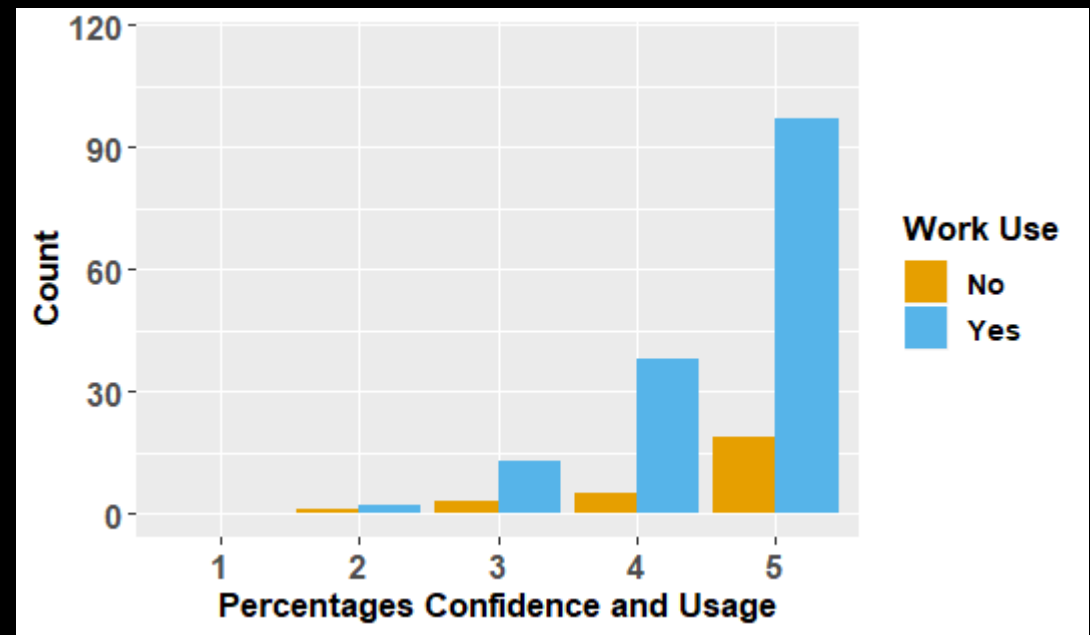
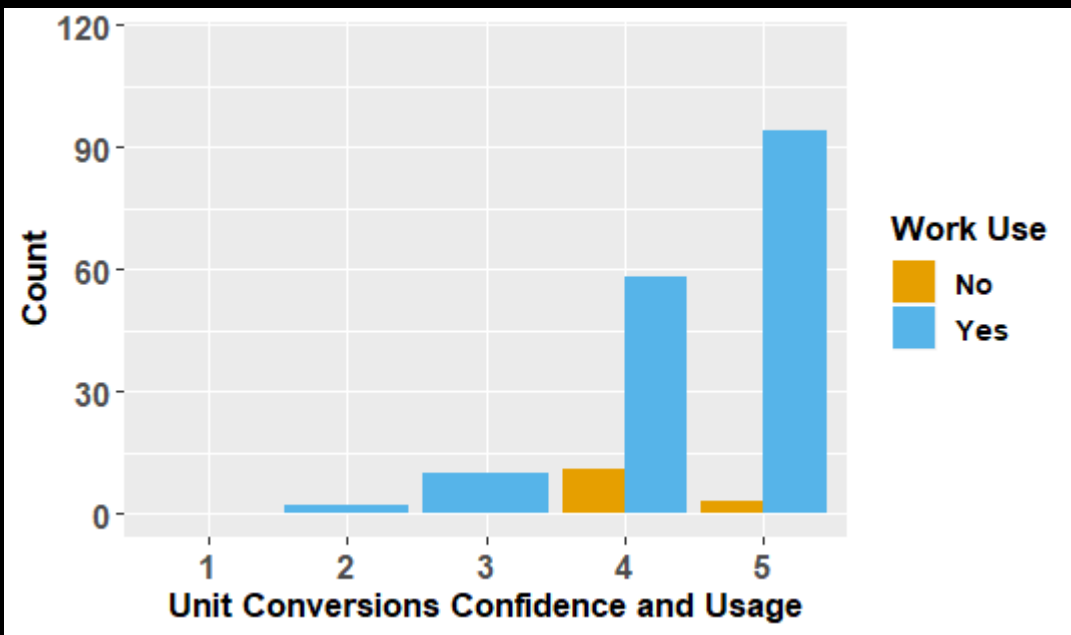
To what extent are early career geologists satisfied with the quantitative preparation they received as undergraduates relative to the demands of their careers?

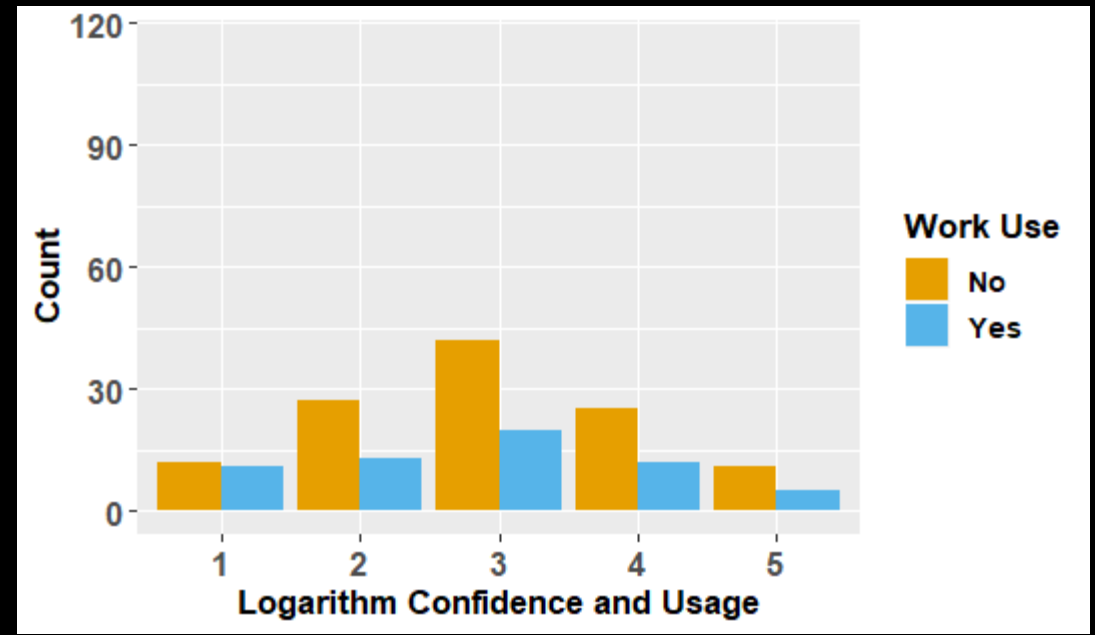
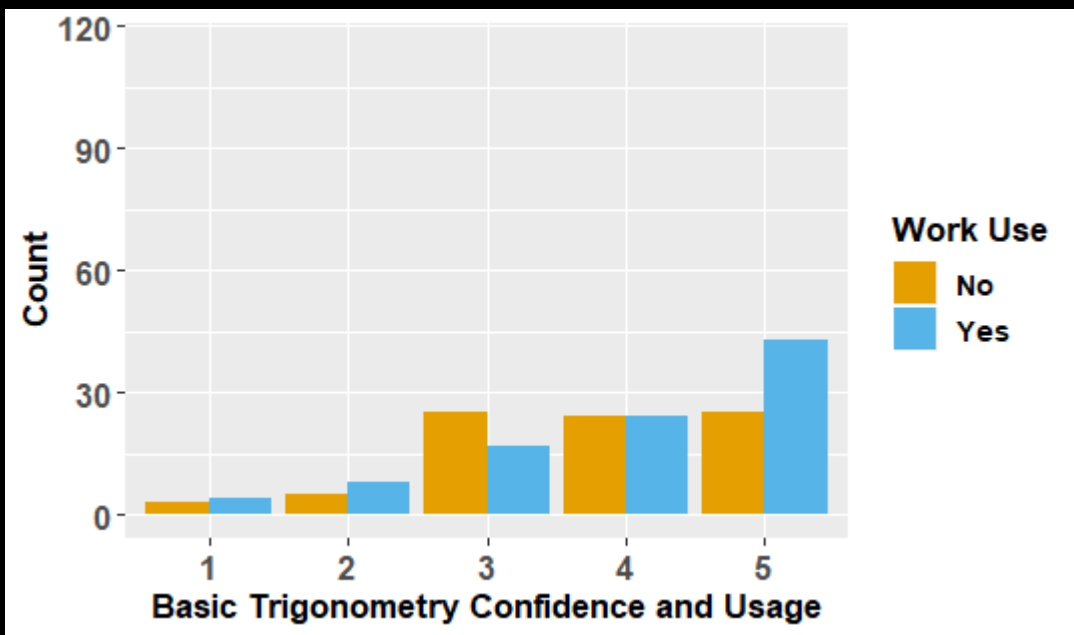
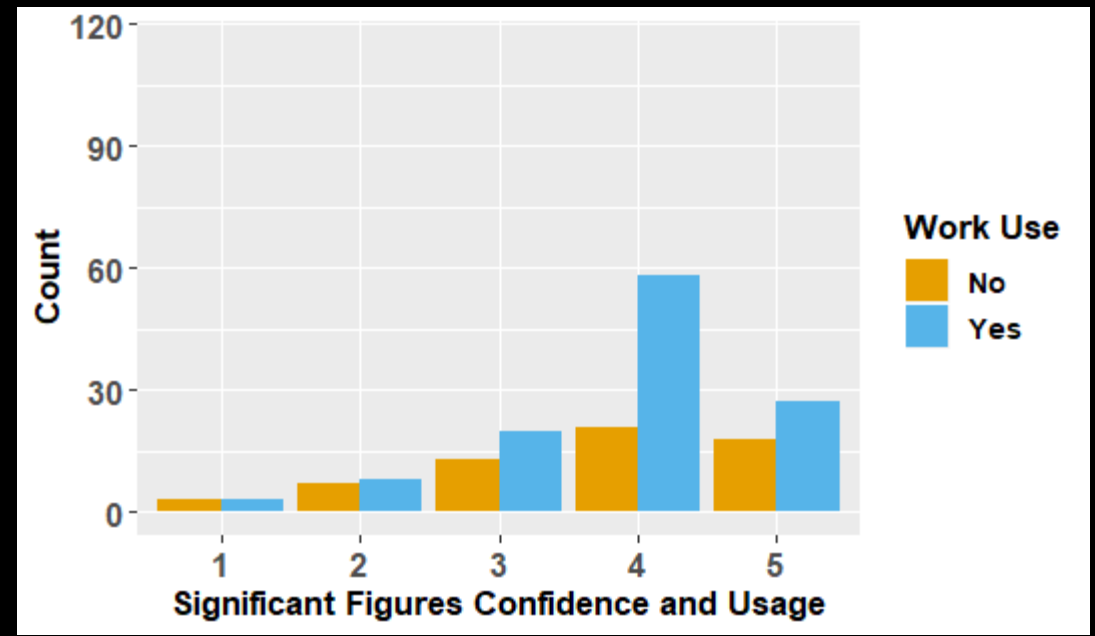
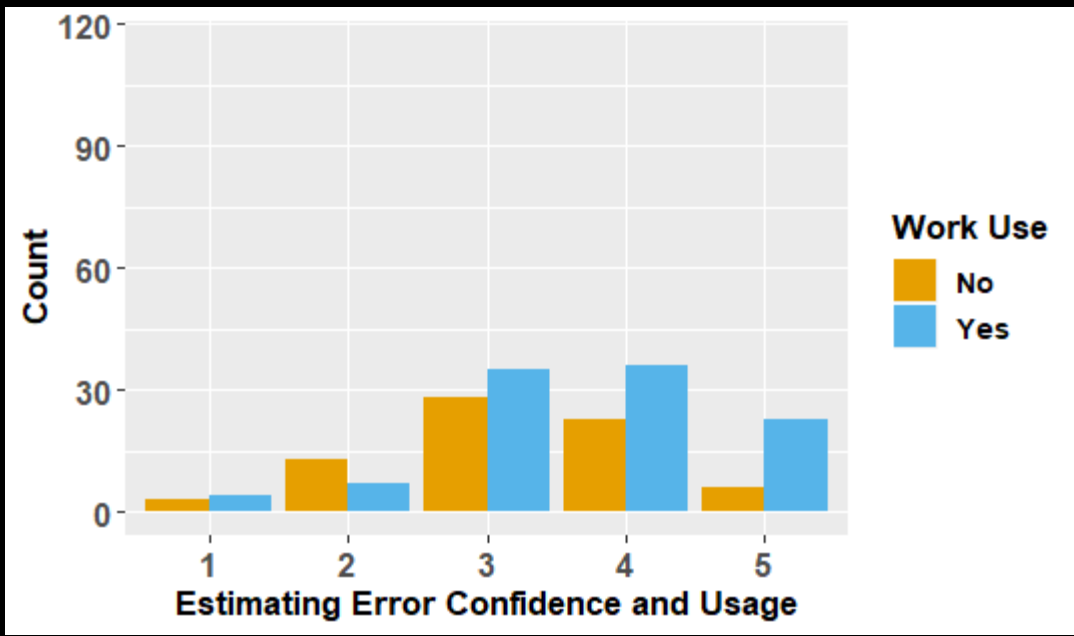
Reading the graphs

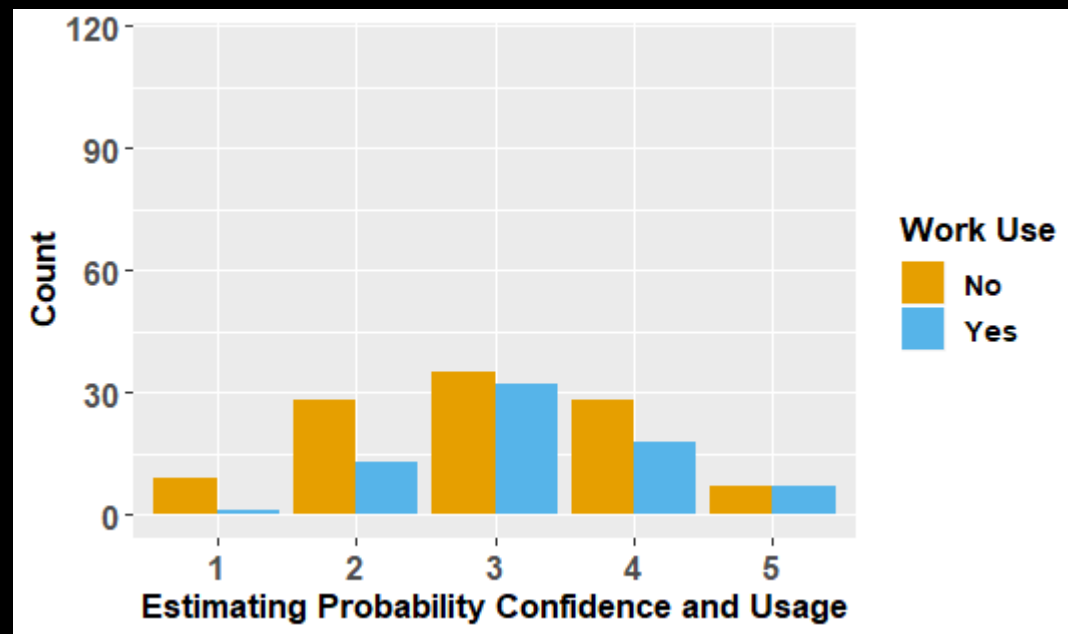
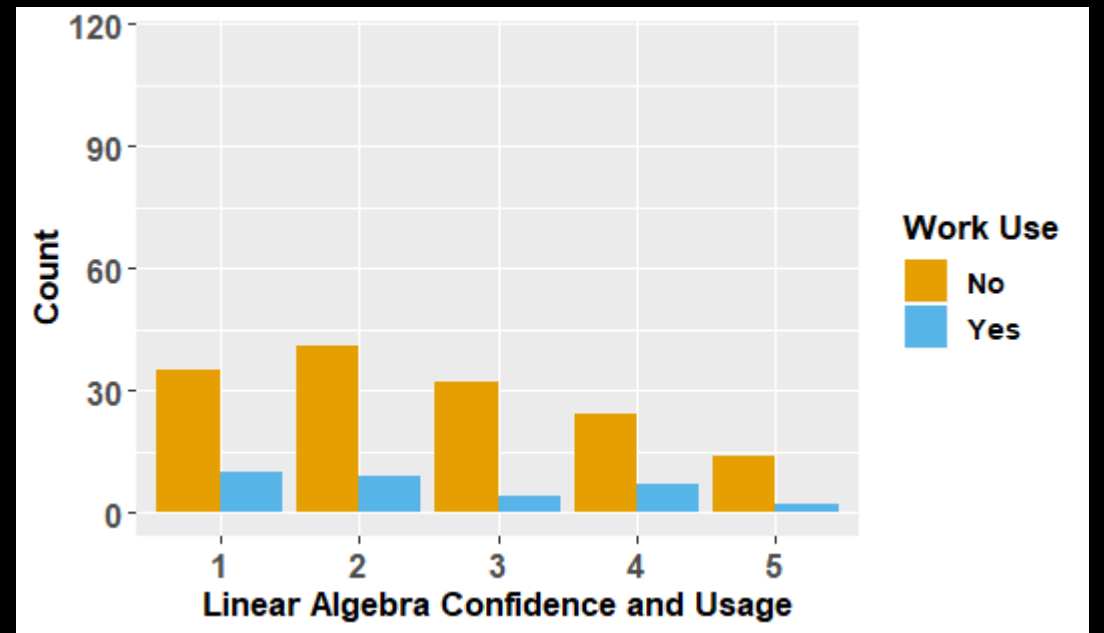
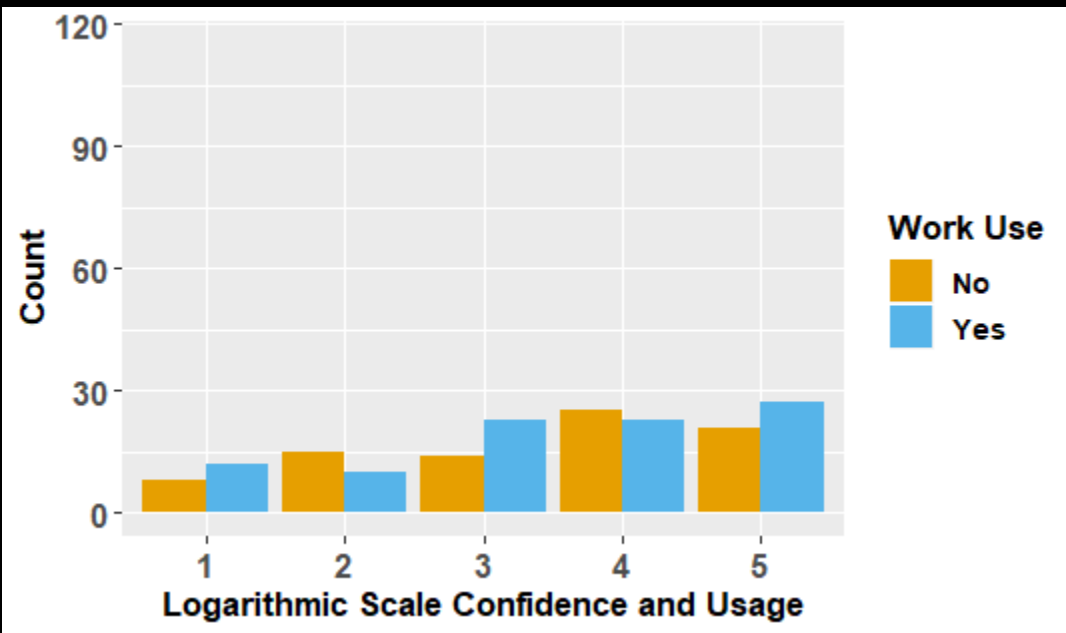
- Ordinal response choices:
 - Not at all confident (1)
 - Slightly confident (2)
 - Moderately confident (3)
 - Very confident (4)
 - Extremely confident (5)







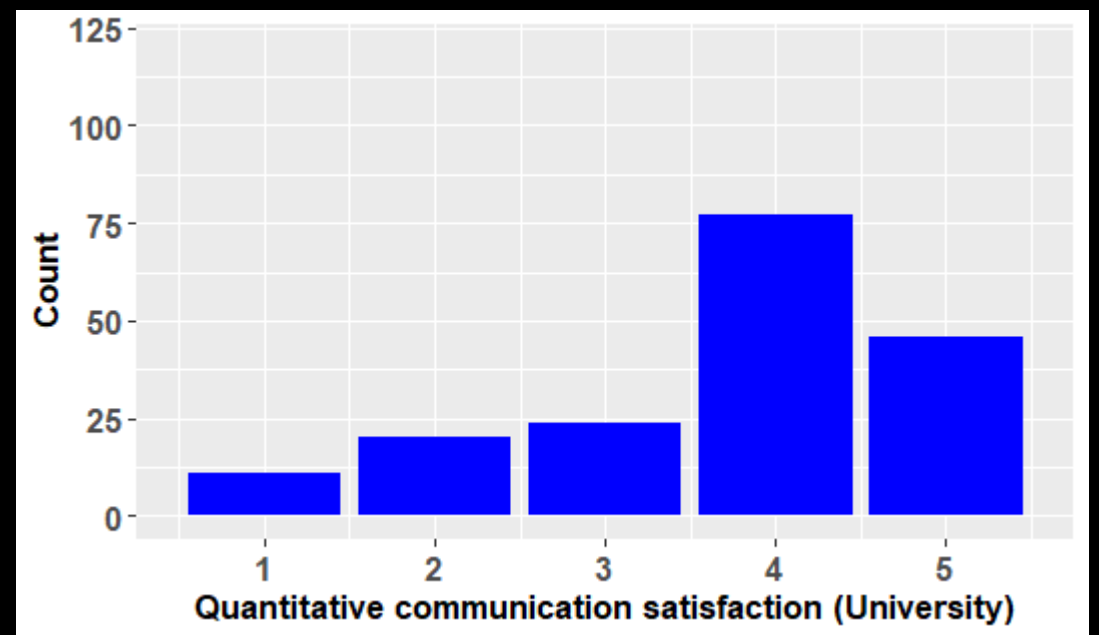
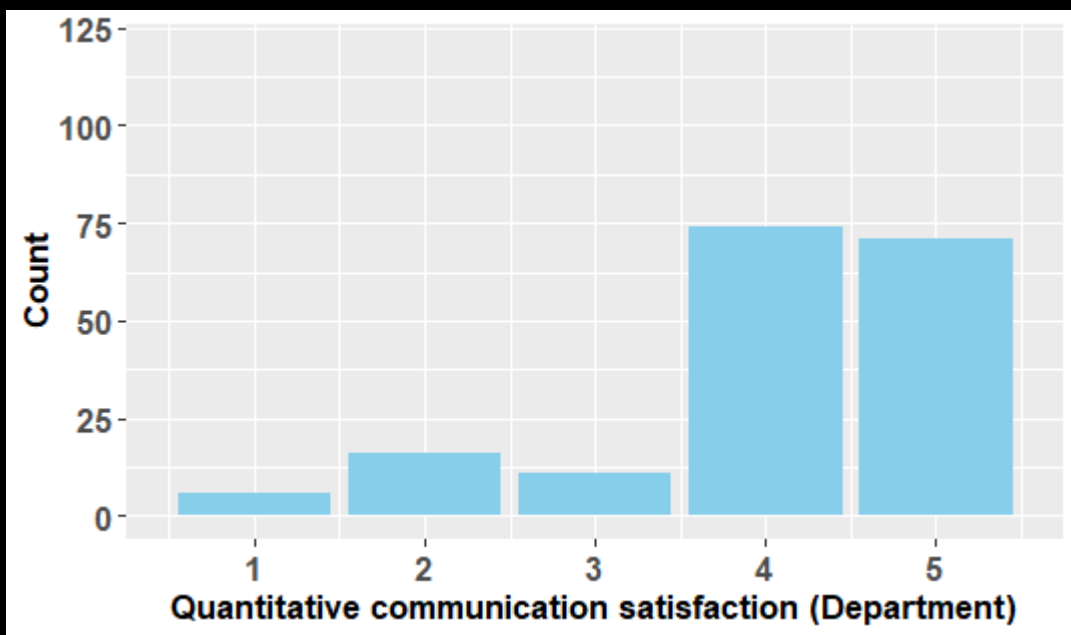
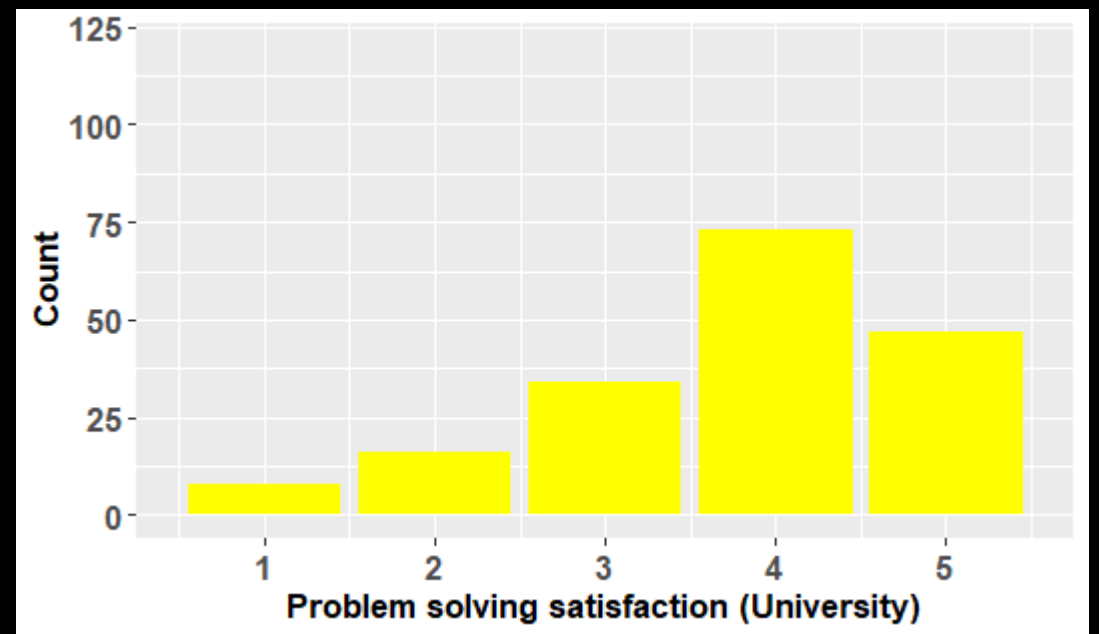
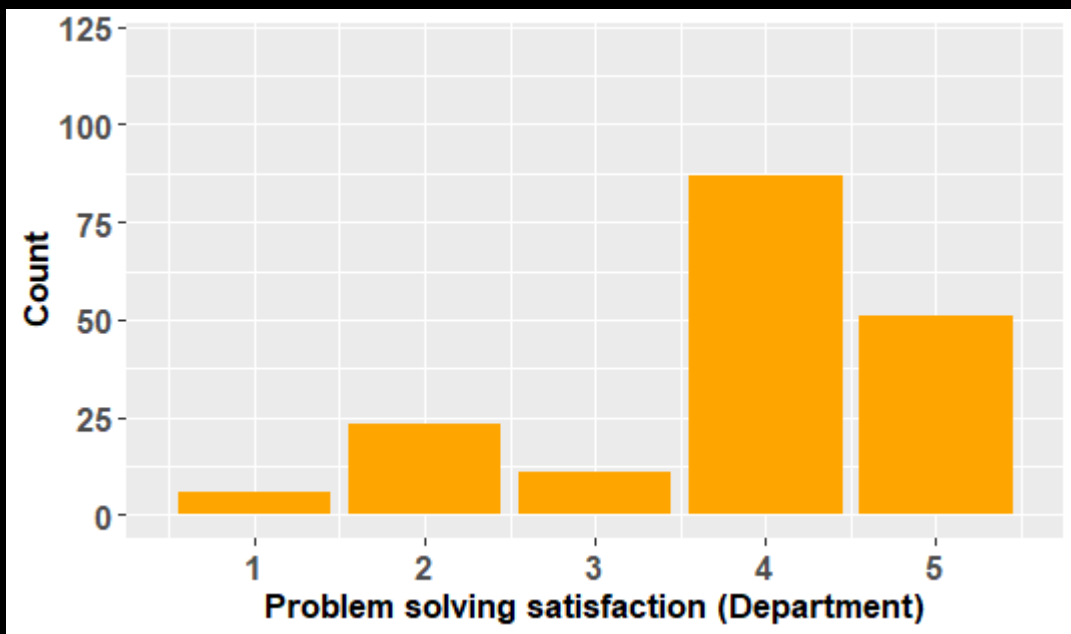




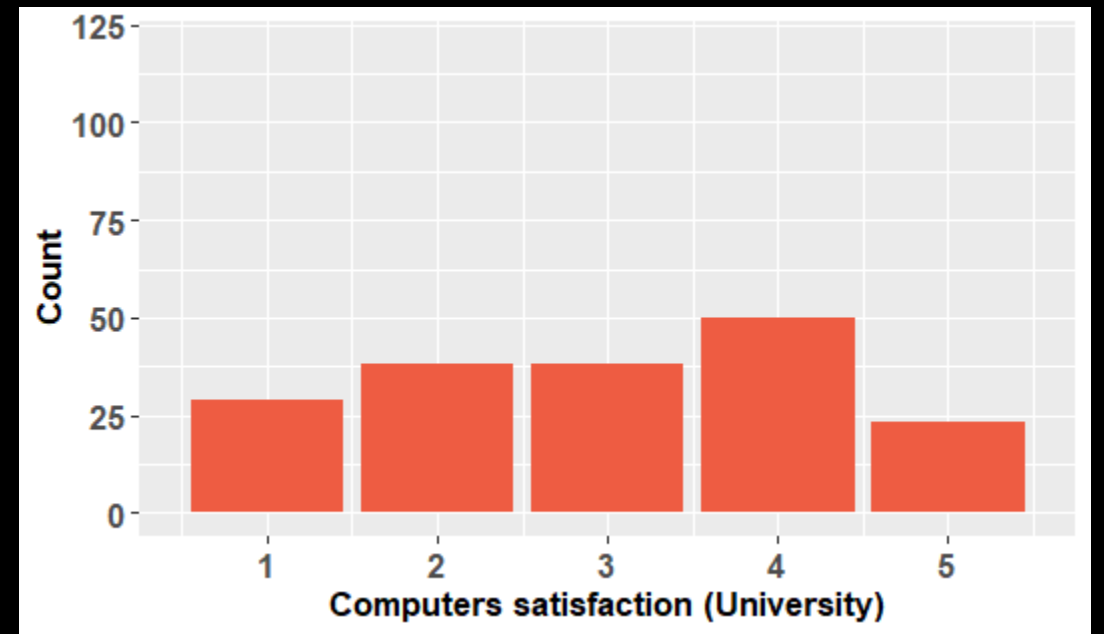
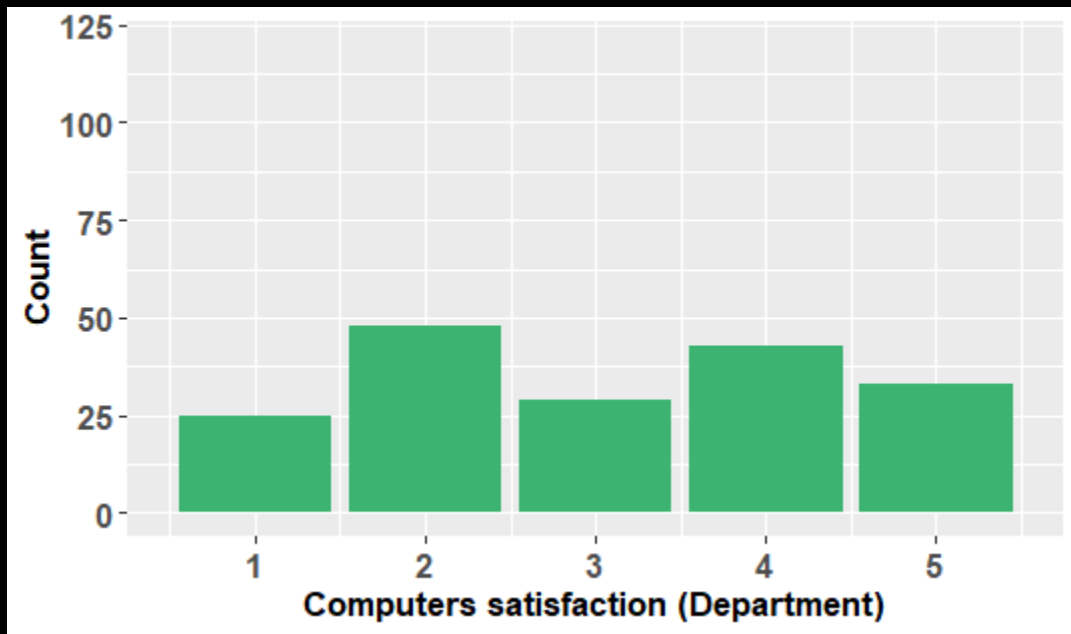
GQPS Research Questions

To what extent do early career geologists self-identify as quantitatively literate relative to the demands of their careers?

To what extent are early career geologists satisfied with the quantitative preparation they received as undergraduates relative to the demands of their careers?



Computer (not-so-) satisfaction



Item	1	2	3	4	5	>3	Topic
3.1	0%	5%	25%	31%	38%	70%	Mental math
3.2	0%	2%	23%	44%	30%	75%	Pencil-paper math
3.3	0%	0%	10%	31%	59%	90%	Calculator math
3.4	2%	3%	15%	28%	51%	79%	Spreadsheet math
3.5	39%	30%	11%	15%	6%	20%	Programming math
4.1	0%	1%	6%	39%	54%	93%	Unit conversions
4.2	0%	2%	9%	24%	65%	89%	Percentages
4.3	0%	3%	14%	37%	47%	83%	Proportions
4.4	0%	6%	16%	35%	43%	78%	Ratios
5.1	4%	11%	35%	33%	16%	49%	Estimating error
5.2	3%	8%	19%	44%	25%	70%	Significant digits
5.3	4%	7%	24%	27%	38%	65%	Trigonometry
6.1	13%	22%	35%	21%	9%	30%	Logarithms
6.2	11%	14%	21%	27%	27%	54%	Logarithmic scales/axes
6.3	25%	28%	20%	17%	9%	26%	Matrix algebra
6.4	6%	23%	38%	26%	8%	34%	Estimating probability
9.1	3%	13%	6%	49%	29%	78%	Department – quantitative problem solving
9.2	3%	9%	6%	42%	40%	81%	Department – quantitative communication
9.3	14%	27%	16%	24%	19%	43%	Department – computers
10.1	4%	9%	19%	41%	26%	67%	University – quantitative problem solving
10.2	6%	11%	13%	43%	26%	69%	University – quantitative communication
10.3	16%	21%	21%	28%	13%	41%	University – computers

Grey – more than 50% of responses 4 or 5

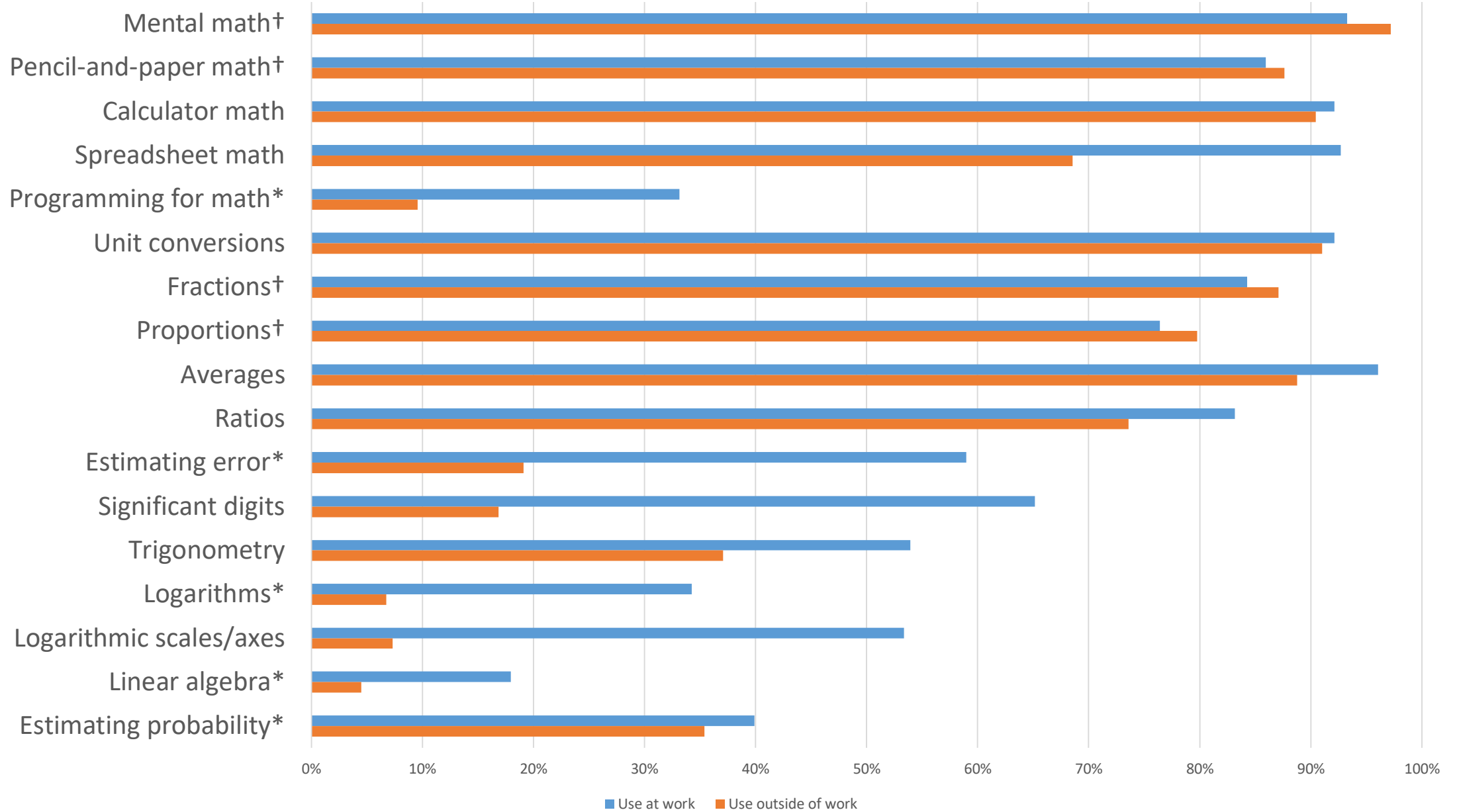
Gold – median response

Red – no responses

GQPS Preliminary Outcomes

- Most (surveyed) geoscientists would be considered *quantitatively literate* relative to career demands (geologic numeracy).
- Most surveyed geologists were satisfied with their undergraduate quantitative problem solving and quantitative communication preparation. (Median =4; >50% of responses 4 or 5)
- Programming skills and computer preparation satisfaction were poor.
- More analysis to be done – this is preliminary.

Thank you!



† - fewer responded yes than no.

* - median value 3 or less

Spearman Correlations for Math Supports

			Spearman's Rho				
Q/Topic	Median	Q#	3-1	3-2	3-3	3-4	3-5
Mental Math	2	3-1	X				
Pencil/paper math	2	3-2	0.59	X			
Calculator math	1	3-3	0.47	0.64	X		
Spreadsheet math	1	3-4	0.33	0.45	0.57	X	
Programming math	4	3-5	0.13	0.20	0.25	0.28	X

Spearman Correlations for Math Topics

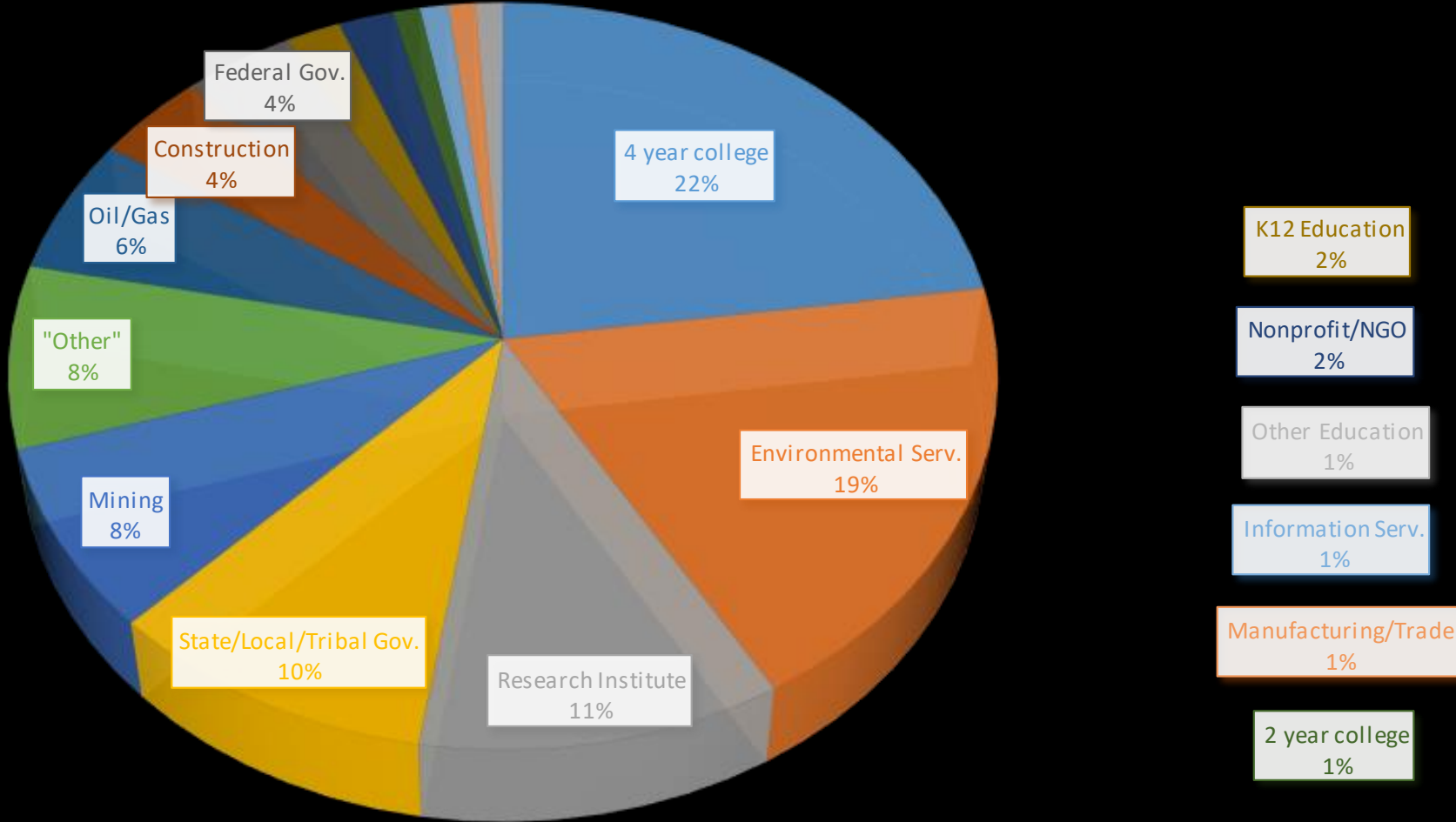
Q/Topic	Median	Q#	Spearman's Rho										
			4-1	4-2	4-3	4-4	5-1	5-2	5-3	6-1	6-2	6-3	6-4
Unit Conversions	1	4-1	X										
Percentages	1	4-2	0.56	X									
Proportions	1	4-3	0.45	0.63	X								
Ratios	2	4-4	0.56	0.58	0.72	X							
Estimating Error	3	5-1	0.26	0.33	0.46	0.42	X						
Sig Figs	2	5-2	0.23	0.28	0.34	0.34	0.45	X					
Basic Trigonometry	2	5-3	0.43	0.39	0.51	0.61	0.37	0.30	X				
Logarithms	3	6-1	0.36	0.43	0.54	0.60	0.46	0.34	0.51	X			
Read/Report using Log Scales	2	6-2	0.31	0.41	0.47	0.52	0.43	0.33	0.44	0.70	X		
Linear/Matrix Algebra	3	6-3	0.20	0.20	0.28	0.34	0.32	0.25	0.23	0.44	0.29	X	
Estimate Probability	3	6-4	0.06	0.19	0.30	0.34	0.46	0.28	0.28	0.49	0.45	0.48	X

Spearman Correlations for Satisfaction

Q/Topic	Median	Q#	Spearman's Rho					
			9-1	9-2	9-3	10-1	10-2	10-3
Quant PS Skills - Dpmt - Satisf.	2	9-1	X					
Quant Com Skills - Dpmt - Satisf.	2	9-2	0.58	X				
Computer Skills - Dpmt - Satisf.	3	9-3	0.46	0.48	X			
Quant PS Skills - Uni - Satisf.	2	10-1	0.36	0.22	0.17	X		
Quant Com Skills - Uni - Satisf.	2	10-2	0.43	0.48	0.24	0.58	X	
Computer Skills - Uni - Satisf.	3	10-3	0.24	0.27	0.50	0.43	0.38	X

University	Count	Percent
Western Washington University	13	7.3%
University of South Florida	11	6.2%
University of Florida	7	3.9%
Whitman College	5	2.8%
University of Wisconsin-River Falls	5	2.8%
Eastern Washington University	5	2.8%
University of West Georgia	4	2.2%
University of Arkansas	4	2.2%
James Madison University	3	1.7%
Allegheny College	3	1.7%
University of Wisconsin-Eau Claire	2	1.1%
University at Buffalo	2	1.1%
University of North Carolina at Chapel Hill	2	1.1%
Concord University	2	1.1%
University of Colorado	2	1.1%
University of British Columbia	2	1.1%
McGill University	2	1.1%
Amherst College	2	1.1%
Colorado School of Mines	2	1.1%
St. Lawrence University	2	1.1%
Brown University	2	1.1%
State University of New York at Oswego	2	1.1%
Washington State University	2	1.1%
Other universities with one alumnus/a	92	51.7%

EMPLOYMENT SECTOR OF GQPS TARGET RESPONDENTS



Details of Preliminary Findings

- More than 50% 4 or 5, median value 4 or 5:
 - Mental, pencil/paper, calculator, and spreadsheet math, unit conversions, percentages, proportions, ratios, significant figures, basic trigonometry, and logarithmic scales
- Less than 50% 4 or 5, median value 3:
 - Estimating error, logarithms, estimating probability
- 26% 4 or 5, median value 2:
 - Linear algebra
- Programming math median value 2; only 20% of responses 4 or 5
- Undergraduate computer preparation satisfaction median values 3; 43%/41% responses 4 or 5