Alumni Narratives on Computational Geology (Spring 1997 – Fall 2013)

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Introduction

The 2014 and 2016 Summits on the Future of Undergraduate Geoscience Education[1] (and associated survey)[2] identified several key skills and habits of mind as being necessary for geologists to learn as undergraduates, and overwhelmingly rated the learning as more important than specific coursework common to the major. Among the key skills and habits of mind were quantitative and computational skills, communication, problem solving, critical thinking, and integrating large data sets into problem solving and computation.

The course **Computational Geology** (Vacher 2000) has been taught annually by the secondary author (LV) at USF for 20 years. It infuses Quantitative Literacy (QL) into a geologic context and addresses many of the quantitative skills discussed by the summits and the survey noted above. The course attempts to help produce quantitatively literate geologists from the USF geology program.

The duration of the course offering and its relative scarcity versus other standard geology courses offered a unique opportunity to sit with alumni to discuss the course, its impacts, and the needs of the workforce.

Methods

Twenty alumni meeting basic criteria for the study were contacted via an email script for scheduling, from which ten alumni were interviewed using a semi-structured protocol with three set questions, and follow-up questioning permitted.

Qualified candidates were USF geology alumni, took and passed computational geology (97-13), were deemed professionally successful by LV, and collectively included a sample of regulators, consultants, and academics.

Informed consent was obtained, per USF IRB #e22615, and signed consent forms are under lock and key. All reported names used in the project are pseudonyms chosen by the interviewees. Interviews were audio recorded until transcribed and checked for accuracy, and then audio recordings were erased. Interviewees were not informed of the questions before interviews began.

Questions: 1. What do you remember from the course?

2. What have you used from the course?

3. What should students learn in the course?

Results

Table 1: Summary of Common Course Topics

Interviewee	Topic: Computer Lab	Excel	Modules	Lecture	Group Problems	Quizzes
Medusa	■	■		■	■	
Jam	■	■			■	■
Sunshine	■	■	■		■	
Gilda	■	■	■	■		■
Luke	■	■	■	■		
Arya	■	■	■	■		
John Smith	■	■	■	■	■	
Sam	■	■	■	■		
John Doe	■	■	■			■
Lee	■	■	■	■		

Key: ■ Item Present; ■ Item Not Present

Table 2: Summary of Common Course Memories

Interviewee	Topic: Excel	Modules	Napkin/BoE	Polya/Problem solving	Unit Conversions	Difficult
Medusa	■		■	■		■
Jam	■		■	■		■
Sunshine	■	■	■			■
Gilda	■	■			■	
Luke	■	■			■	
Arya	■	■	■			
John Smith	■	■		■	■	■
Sam	■	■			■	
John Doe	■	■		■		
Lee	■	■	■	■		

Table 3: Summary of Common Course Uses

Interviewee	Topic: Excel	Notes	Polya	Modules	Weighted Averages	Unit Conversions
Medusa	■					
Jam	■		■	■		
Sunshine	■			■		■
Gilda	■		■			■
Luke	■					■
Arya		■		■	■	
John Smith	■				■	
Sam	■					■
John Doe	■		■			■
Lee	■	■	■			

Table 4: Summary of Common Course Suggestions

Interviewee	Topic: Status quo plus	Excel	Unit Conversions	Large Data Packages	Communication	Other programs
Medusa						
Jam		■	■			
Sunshine					■	
Gilda	■	■	■			■
Luke	■	■	■			
Arya		■				
John Smith	■	■	■		■	
Sam					■	
John Doe		■	■	■		
Lee		■		■		■

Discussion

Interviewee memories showed that the course has evolved significant over the 20 years it has been offered in both methods and scope.

Significant differences were noted in the time ranges and content topics for each career group.

- Regulators had the shortest interviews (19:53-31:06, avg. 23.7 min.) and coded responses were almost all short phrases repeated by other interviewees. They had trouble remembering details of the course beyond certain basics.
- Academics had the longest interviews (43:40-56:51, avg. 48.6 min.) and coded responses were mostly large blocks of unique story quotes.
- Consultants had mix of both – time range was midway (25:17-39:40, avg. 33.9 min.) and included both large blocks of unique story quotes and short phrases repeated by others.

This divergence speaks to the possibility that different career paths for geologists call for different types and levels of QL.

Specific quotes from each interviewee indicate that the learning outcomes of the course are being met for at least some of the people who take the course. Studying how the course worked for them may help us determine whether the course helped everyone else, and if not, see how that can change.

Reflexivity/Limitations

The work contains bias, including selection bias in the professionally successful sample population. Convenience sampling was employed due to lack of outside funding, and confirmation bias was noted in follow-up questions. All interviewees and the primary author owe some gratitude to the instructor of the course. Surveys to a representative population are recommended to confirm the conclusions.

Conclusions

Interviewees had an overwhelmingly positive response to the course. However, given the selection/sampling bias, this result is rendered questionable as applied to any but the sampled population. Further study is highly recommended across a sample population more representative of the general alumni of course. Based on the results of this project and existing studies on the needs of the geoscience education field, an online survey can be constructed.

Professionally successful alumni reported using course knowledge, skills, and traits extensively in their professional and personal lives and gave helpful and practical suggestions for course improvement.

Outcome tables indicated that successful course alumni were quantitatively literate, showing multiple examples of specific facts, concepts, skills/competencies, and traits endemic to QL despite the time since they took the course.

Future steps include additional connected studies along the same line of research, Exploring the Future of Quantitative Geology. Studies and/or dissertation chapters may include:

- A locally administered survey to USF geology alumni over a series of questions that will be generated based on the results of this thesis and outside studies on the needs of the field. These studies will attempt to quantify the effects of the computational geology course on the training of USF geology graduates without the biases of this qualitative study.
- A nationally administered survey to geologists over a similar series of questions regarding how their undergraduate program prepared them for the needs of the geologic industry they entered, especially with regards to quantitative skills and habits of mind. These two surveys will be compared to determine the efficacy of USF's computational geology program versus other universities who do not have such courses.

Selected References

Vacher, HL. 2000. "A course in geological-mathematical problem solving." *Journal of Geoscience Education* 48 (4):478-481.

1 http://www.jsg.utexas.edu/events/future-of-geoscience-undergraduate-education/

2 http://www.jsg.utexas.edu/events/files/Survey_NSF_report.pdf

Further information

This work, ©2016 Victor J. Ricchezza, was the primary author's MS thesis, successfully defended June 8, 2016.

For more information on this project, or the author's other work, visit http://vicricchezza.weebly.com/thesis.html or scan the QR code.