



Infusing the Majors Science curriculum with primary literature

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Why?

Positively impact students in the following ways:

- Increase content knowledge
- Increase ability and level of comfort with reading scientific articles
- Understand the process of science and the lives of the people who do science.



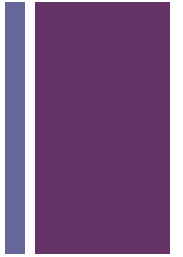
+ What?

- Inspired by The CREATE method (Sally Hoskins, SUNY) www.teachcreate.org

“... a teaching approach that uses intensive analysis of primary literature to demystify and humanize science for undergraduates. Journal articles – the real currency of science — are used as an inroad to understanding “who does science, how, and why?”

“In summary, students read and analyze sets of carefully chosen papers using various approaches (concept mapping, cartooning, visualization and transformation of data) to gain a progressively deeper understanding of the science behind each paper, and, as the sequence of papers progresses, the process of scientific discovery.”

- Modifications were necessary....





How?

Experimental Design

- I used a pre/post survey instrument that focused on four areas that were relevant to my goals for this project:
 - Understanding
 - Skills
 - Attitudes
 - Integration of Learning
- This survey instrument is available on SALGSITE (www.salgsite.org) and was developed to assess CREATE-type courses nationwide.

Understanding

1. Presently, I understand...

1.1 The following activities that will be explored in this class not applicable not at all just a little somewhat a lot a great deal

1.1.1 How to "concept map"

1.1.2 How to use sketching/cartooning to clarify how experiments or studies were done

1.1.3 How to "annotate figures"

1.1.4 How to work effectively in small groups

1.2 What motivates people to choose biology, psychology or chemistry research careers

1.3 How to critically evaluate experiments or studies proposed by others

1.4 How to look at data and figure out what question the study that generated the data was addressing

1.5 What researchers and scientists are like as people

1.6 I understand "the nature of science"

1.7 What words come to mind when you think about "scientists"?



Attitudes

3. Presently, I am...	not applicable	not at all	just a little	somewhat	a lot	a great deal
3.1 Enthusiastic about careers in biology and/or chemistry research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.2 Interested in taking or planning to take additional classes in this subject	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.3 Confident that I can "decode" data presented in graphs, tables or charts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.4 Confident that I can read and analyze primary literature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.5 Confident that I can intelligently criticize others' ideas or proposals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.6 Confident I can design a good experiment or study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.7 What words come to mind when you think about "research careers?"	<input type="text"/>					
3.8 Are you currently interested in a research career? (yes, no, maybe). Why or why not?	<input type="text"/>					

+ Implementation

- I ran the experiment twice, once in Fall 2015 with one section of BIO182 (24 students) and once in Spring 2016 with one section of BIO182 students (23 students)



Pre Test

Regular BIO182 Curriculum PLUS...

...Two papers (Fall 2015)

...Four papers (Spring 2016)



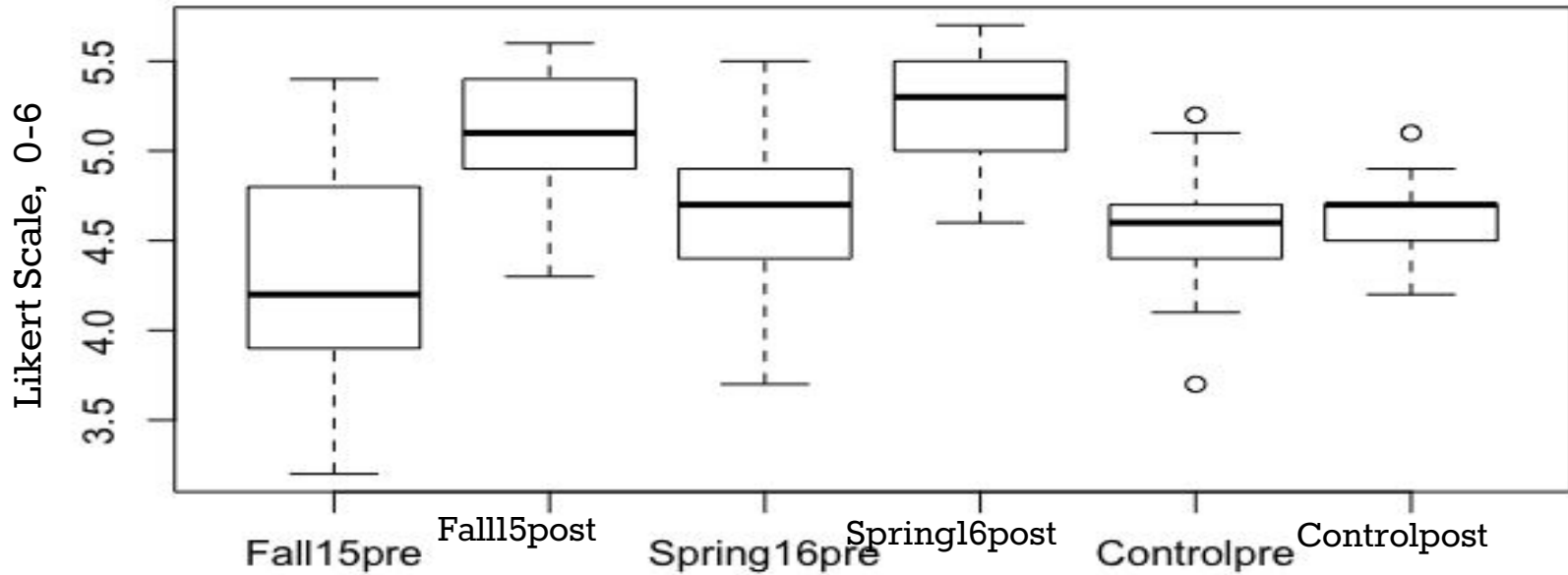
Post Test

- My control group was another BIO182 class, taught by an adjunct, using my same Canvas course shell, without the added papers.



Results

Box Plot summary of Likert scale responses



+ Data Analysis

- My data were not normally distributed, so I used the Wilcoxon Rank Sum test to compare pre- and post- average responses for each question on the survey.
- Highly significant p values for both the experimental cohorts
- No significant variation in survey responses in the control group





Improvements in Likert scores by question group



- Fall '15: Likert responses increased by an average of 0.82 points per question.
- Spring '16: Likert responses increased by an average of 0.57 points per question

	Fall '15 pre vs post	Spring '16 pre vs post	Control pre vs post
Overall	+0.82 (p<0.05)	+0.57 (p<0.05)	+0.08
Section 1 (Understanding)	+0.73 (p<0.05)	+0.7 (p<0.05)	+0.1
Section 2 (Skills)	+1.1 (p<0.05)	+0.71 (p<0.05)	+0.27 (p<0.05)
Section 3 (Attitudes)	+0.78 (p=0.06)	+0.43 (p<0.05)	+0.13
Section 4 (Integration of Learning)	+0.6 (p<0.05)	+0.3 (p=0.06)	-0.38 (p<0.05)

+ Other Data not yet quantified

- Exam question about author attributions
- Comments on Exam
- Long answer questions on Survey



+ Unexpected bonuses

- As it turned out, their content was surprising, revealing the importance of evolution to Biology). I really liked this unifying thread through

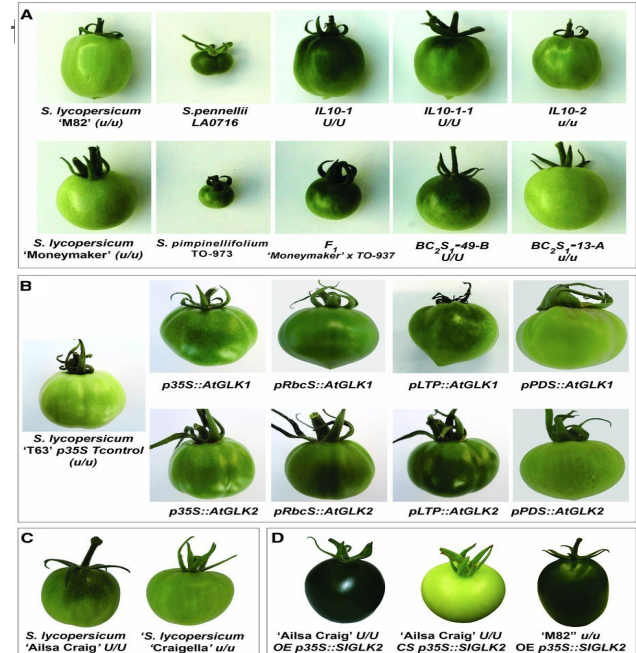


- Unit 1 Evolution

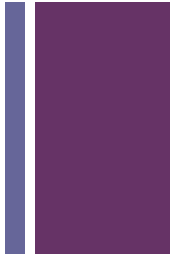
- Unit 2 Adaptation and Speciation

- Unit 3 Population

- Unit 4 Evolution



+ Unexpected Challenges and Changes



- Initial plans to not directly teach much content were shelved
- Number of papers read was greatly reduced from the original proposal
- I did not measure Biology content knowledge as I had intended to
- This became a supplemental lab activity to augment the existing BIO182 curriculum.
- Late addition of a control group



Thanks to.....



- MCLI
- My fellow MILRF fellows:
 - Nicola Plowes (MCC), Niccole Cerveney (MCC), Jennifer Lane (GCC),
Holly Harper (RSC), Danielle Carlock (SCC)
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