Supplemental Material

CBE—Life Sciences Education

Schinske *et al.*

Supplemental Materials

Schinske *et al.*, 2016. Scientist Spotlight Homework Assignments Shift Students' Stereotypes of Scientists and Enhance Science Identity in a Diverse Introductory Science Class

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List of Individuals Featured In Scientist Spotlight Assignments

Week 2
Charles Limb – Neuroscientist

Week 3
Ben Barres – Neuroscientist
Dorit Ron – Neuroscientist

Week 4
Erwin Chargaff – Biochemist
Francis Crick – Molecular Biologist
Rosalind Franklin – Chemist
James Watson – Molecular Biologist
Maurice Wilkins – Physicist and Molecular Biologist

Week 5
Agnes Day – Microbiologist and Cancer Researcher

Week 6
Raymond Dubois – Cancer Researcher

Week 7
Lawrence David – Microbiologist

Week 8
Thumbi Ndung'u – HIV/AIDS Researcher

Week 9
Flossie Wong-Staal – Virologist and Molecular Biologist
Juan Perilla – Biophysicist

Week 10
Min Chueh Chang – Reproductive Biologist
Carl Djerassi – Chemist
Luis Miramontes – Chemist
Gregory Pincus – Reproductive Biologist
Edris Rice-Wray – Reproductive Health Researcher

Week 11
Darlene Cavalier – Citizen Scientist

Reading Reflection Assignment #3

Read the article, titled *Cancer's Random Assault*, by Denise Grady (New York Times, January 5, 2015) found on pages 1-3 of your course reader. As you read, annotate (i.e., underline, note in margins) to identify:

Evidence

Information you think might be important to understand or consider more closely later

Interpretations & Difficulties

Your opinions or curiosities
Roadblocks or difficulties you had while reading

Once you finish, write 350 words or more summarizing your Evidence and Interpretations & Difficulties surrounding this article.

Supplemental Table 1

Racial (a) and Gender (b) Identities of Students in Scientist Spotlight Homework and Course Reader Homework Classes

a)

Racial/Ethnic Identities	Scientist Spotlight Homework Classes	Course Reader Homework Classes
Latina/o	22%	27%
White	21%	16%
Vietnamese	9%	10%
Filipina/o or Pacific Islander	9%	4%
Chinese	8%	8%
Asian	5%	6%
Korean	3%	4%
Black	3%	3%
Indian (Asia)	3%	2%
Persian	2%	2%
Indonesian	0.6%	3%
Japanese	0.3%	2%
Others	2%	4%
Multiple Races	11%	10%
Decline to State	2%	0%
Proportion of students from underserved racial/ethnic groups	55%	51%

b)

Gender Identities	Scientist Spotlight Homework Classes	Course Reader Homework Classes
Female	58%	56%
Male	40%	44%
Transgender	1%	1%
Other	1 student declined to state and 1 student identified as “agender”	1 student declined to state and 1 student identified as “gender neutral”

Attitudes

Please share your opinions of the statements below. There are absolutely no right or wrong answers, and nothing would be better than to see a wide variety of ideas from different students in class. You will not be graded based on the way you answer any of these questions.

Presently, I am...

	Not at all	Just a little	Somewhat	A lot	A great deal
* Enthusiastic about this subject	○	○	○	○	○
* Interested in discussing this subject area with friends or family	○	○	○	○	○
* Interested in taking or planning to take additional classes in this subject	○	○	○	○	○
* Interested in pursuing a science career	○	○	○	○	○
Confident that I understand this subject	○	○	○	○	○
Confident that I can do this subject	○	○	○	○	○
Comfortable working with complex ideas	○	○	○	○	○
Willing to seek help from others (teacher, peers, TA) when working on academic problems	○	○	○	○	○

*Items included in the "Science Interest" scale (see also Supp Mat Parts G-H)

Background information...

I have the profoundest appreciation and respect for your background, identity, and aspirations. Though the information below only gives a small glimpse into these aspects of your life, it is a helpful start to understanding who I will be serving this quarter and will help me ensure I serve all my students in an equitable manner.

What best characterizes your major, past coursework, and career interests?

	Strongly Disagree	Disagree	Mildly Disagree	Mildly Agree	Agree	Strongly Agree
I am majoring or plan on majoring in Biology	○	○	○	○	○	○
I am majoring or plan on majoring in another Science or Math field	○	○	○	○	○	○
I am majoring or plan on majoring in a different subject	○	○	○	○	○	○
My major is undecided at this time	○	○	○	○	○	○
I am considering a career in a human health related field	○	○	○	○	○	○

Regarding your past science classes...

	Yes	No
Is Bio 11 the first COLLEGE science class you've taken?	○	○
Is Bio 11 the first science class you've EVER taken at any level?	○	○

I identify as (choose all that apply)

- ☐ Female
- ☐ Male
- ☐ Transgender
- ☐ Decline to State
- ☐ Other (please specify)

I most closely identify as (choose all that apply)

- [ ] Black/African American
- [ ] Cambodian
- [ ] Chinese
- [ ] Filipino or Pacific Islander
- [ ] Hmong
- [ ] Indian (Asia)
- [ ] Japanese
- [ ] Korean
- [ ] Other (please specify)
- [ ] Laotian
- [ ] Latino/Chicano/Hispanic
- [ ] Native American/American Indian
- [ ] Persian
- [ ] Vietnamese
- [ ] White
- [ ] Asian
- [ ] Decline to state

The first language I learned to speak was...

- [ ] Arabic
- [ ] Cantonese
- [ ] English
- [ ] Farsi/Persian
- [ ] Hindi
- [ ] Korean
- [ ] Mandarin
- [ ] Punjabi
- [ ] Spanish
- [ ] Tagalog
- [ ] Vietnamese

Other (please specify)

Descriptive Statistics Listed by Hypothesis Number & Figure Number

Hypothesis 1 (Descriptions of Scientists):

Treatment Effects On Use of Stereotypical Descriptions of Scientists

Group	Time	Raw Mean Percent Stereotypes Used	Raw Std. Error	Weighted Mean Percent Stereotypes Used	Weighted Std. Error
Course Reader Homework	Beginning of Course	67.173	3.972	67.384	4.079
	End of Course	63.191	3.585	18.312	2.973
Scientist Spotlight Homework	Beginning of Course	61.917	2.369	51.131	1.959
	End of Course	41.888	2.004	31.077	1.428

Treatment Effects On Use of Nonstereotypical Descriptions of Scientists (Fig. 1)

Group	Time	Raw Mean Percent Nonstereotypes Used	Raw Std. Error	Weighted Mean Percent Nonstreeotypes Used	Weighted Std. Error
Course Reader Homework	Beginning of Course	13.496	2.186	43.771	2.836
	End of Course	9.346	2.924	41.925	1.471
Scientist Spotlight Homework	Beginning of Course	18.527	1.115	34.427	1.362
	End of Course	54.421	2.018	47.781	.706

Hypothesis 2 (Relating to Scientists):

Treatment Effects On Ratings of Relatability to Scientists (Fig. 2)

Group	Time	Weighted Mean Level of Agreement w/Relatability Prompt	Std. Error
Course Reader Homework	Beginning of Course	1.926	.186
	End of Course	2.006	.100
Scientist Spotlight Homework	Beginning of Course	2.113	.168
	End of Course	2.987	.090

Longitudinal Trends Regarding Hypotheses 1 and 2:

Longitudinal Trends in Stereotypical Descriptions of Scientists Following Scientist Spotlights (Fig. 4a)

Time	Mean Percent Stereotypes Used	Std. Error
Beginning of Course	71.025	4.558
End of Course-test	46.920	4.548
6 Mos After Course	45.889	5.342

Longitudinal Trends in Nonstereotypical Descriptions of Scientists Following Scientist Spotlights (Fig. 4b)

Time	Mean Percent Nonstereotypes Used	Std. Error
Beginning of Course	11.452	2.755
End of Course-test	50.989	4.528
6 Mos After Course	51.627	5.190

Longitudinal Trends in Ratings of Scientist Relatability Following Scientist Spotlights (Fig. 4c)

Time	Mean Level of Agreement w/Relatability Prompt	Std. Error
Beginning of Course	1.846	.192
End of Course-test	3.000	.200
6 Mos After Course	3.000	.231

Hypothesis 3 (Science Interest):

Changes in Stereotypical Descriptions of Scientists & Changes in Science Interest (Fig. 5a)

Group	Time	Mean Science Interest	Std. Error
Students that Shifted to Use Fewer Stereotypes	Beginning of Course	3.312	.114
	End of Course	3.574	.092
Students that Did Not Shift to Use Fewer Stereotypes	Beginning of Course	3.591	.153
	End of Course	3.479	.123

Changes in Nonstereotypical Descriptions of Scientists & Changes in Science Interest (Fig. 5b)

Group	Time	Mean Science Interest	Std. Error
Students that Shifted to Use More Nonstereotypes	Beginning of Course	3.374	.068
	End of Course	3.607	.055
Students that Did Not Shift to Use More Nonstereotypes	Beginning of Course	3.528	.176
	End of Course	3.446	.141

Changes in Ratings of Relating to Scientists & Changes in Science Interest

Group	Time	Mean Science Interest	Std. Error
Students that Did Not Shift to Rate Scientists as More Relatable	Beginning of Course	3.485	.109
	End of Course	3.586	.087
Students that Shifted to Rate Scientists as More Relatable	Beginning of Course	3.287	.076
	End of Course	3.568	.061

Hypothesis 4 (Course Grades):

Treatment & Course Grades (Fig. 6a)

Group	Mean Course Grade	Std. Error
Course Reader Homework	2.236	.225
Scientist Spotlight Homework	2.863	.080

Use of Nonstereotypes & Course Grades (Fig. 6b)

Group	Mean Course Grade	Std. Error
Students that Did Not Shift to Use More Nonstereotypes	2.562	.172
Students that Shifted to Use More Nonstereotypes	3.052	.073

ANCOVA Tables Following Quantitative Analyses

Hypotheses 1 & 2

Changes in Perception of Scientists from Pre-Test to Post-Test

	df	*F*	*η*	*p*
Stereotypes	(1,311)	27.76	.08	< .001
Stereotypes x Condition	(1,311)	13.39	.04	< .001
Nonstereotypes	(1,311)	.69	< .01	.405
Nonstereotypes x Condition	(1,311)	16.51	.05	< .001
Relatability	(1,276)	.80	< .01	.373
Relatability x Condition	(1,276)	8.49	.03	.004

Note: All analyses conducted with gender, race (traditionally well- vs. under-served), and course section controlled as covariates.

Hypothesis 1 & 2 (Longitudinal Trends)

Longitudinal Changes in Perception of Scientists at 6mos

	df	*F*	*η*	*p*
Stereotypes	(2,78)	4.36	.10	.016
Nonstereotypes	(2,80)	5.97	.13	.004
Relatability	(2,46)	2.63	.10	.083

Note: All analyses conducted with gender and race (traditionally well- vs. under-served) controlled as covariates.

Hypothesis 3

Shifts in Scientist Stereotypes, Interest in Science, and Interest in STEM Major

	df	*F*	*η*	*p*
Science Interest x STEM Major	(1,216)	10.39	.05	.001
Science Interest x Stereotypes	(1,182)	4.46	.03	.036
Science Interest x Nonstereotypes	(1,182)	3.32	.02	.070
Science Interest x Relatability	(1,184)	2.10	.01	.149

Note: All analyses conducted with gender, race (traditionally well- vs. under-served), previous science experience, and course section controlled as covariates.

Hypothesis 4

Shifts in Scientist Stereotypes, Relatability, and Grade

	df	*F*	*η*	*p*
Treatment x Grade	(1,279)	6.682	.02	.018
Stereotypes x Grade	(1,211)	3.00	.01	.085
Nonstereotypes x Grade	(1,211)	6.68	.03	.010
Relatability x Grade	(1,171)	1.65	.02	.195

Note: All analyses conducted with gender, race (traditionally well- vs. under-served), course section, and previous college science experience controlled as covariates.

Factor Analysis & Creation of the Science Interest Scale

The eight items adapted from the SALG (Seymour et al., 2000; Supp Materials Part D) were highly correlated, with nearly all *r*-values above .30 and *p*-values less than .001 (see table below for a complete list of item correlations). Despite the strong positive relationship between the majority of the items, a review of the questions suggested that there were two distinct constructs assessed by the scale, and that separating these out could provide additional insight into participants' experiences with the Scientist Spotlights. In order to clarify these relationships, reduce noise, and maximize the variance explained, we conducted a principal components factor analysis using a promax rotation. Seven of the eight items loaded on two factors, together explaining 55% of the variance and all with loadings over .6. Ultimately, this resulted in the subscale we titled "Science Interest" ($\alpha = .831$, see Supp Materials Part H for items and factor loadings). This subscale was used to calculate both beginning- and end-of-course Science Interest scores for each student.

Correlations Between Eight Modified SALG Items

	1	2	3	4	5	6	7	8
1. Enthusiastic about this subject	—							
2. Interested in discussing this subject area with friends or family	.653*	—						
3. Interested in taking or planning to take additional classes in this subject	.639*	.568*	—					
4. Interested in pursuing a science career	.479*	.408*	.692*	—				
5. Confident that I understand this subject	.439*	.396*	.443*	.365*	—			
6. Confident that I can do this subject	.359*	.314*	.309*	.203*	.671*	—		
7. Comfortable working with complex ideas	.360*	.385*	.324*	.234*	.562*	.678*	—	
8. Willing to seek help from others (teacher, peers, TA) when working on academic problems	.151	.237*	.115	.082	.100	.268*	.238*	—

Note: items marked * are significant at $p < .001$

Quantitative Survey Items Constituting the "Science Interest" Scale

Factor Loadings for From Principal Component Factor Analysis with Promax Rotation for the Adapted Student Assessment of their Learning Gains Questionnaire

Item	Factor loading
Factor 1: Science Interest (α = .83)	
3. Interested in taking or planning to take additional classes in this subject	.89
1. Enthusiastic about this subject	.77
4. Interested in pursuing a science career	.70
2. Interested in discussing this subject area with friends or family	.69
Factor 2: Science Confidence (α = .84)	
6. Confident that I can do this subject	.92
7. Comfortable working with complex ideas	.76
5. Confident that I understand this subject	.72
Cross-Loaded Items (Dropped)	
8. Willing to seek help from others (teacher, peers, TA) when working on academic problems	.17/.27

Note. N = 267 and α = .83 for entire measure.

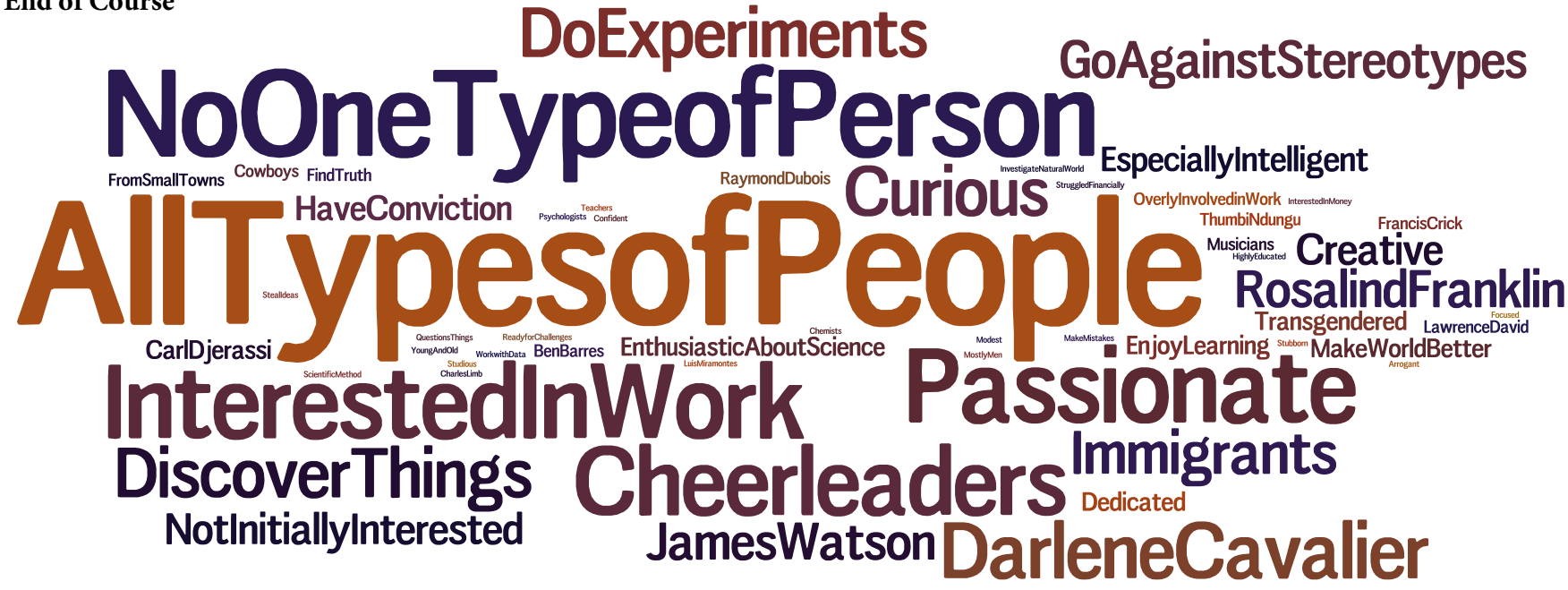
Word Clouds Depicting Students' Descriptions of Scientists at Three Time Points

We created word clouds to visually represent students' descriptions of scientists using the tools at http://www.wordle.net/. Word clouds represent an increasingly popular tool for visualizing qualitative data (Henderson and Segal, 2013). They graphically represent word counts by showing more prevalent words in larger font sizes and less prevalent words in smaller font sizes. Though word clouds remove words from their contexts and can sometimes appear to overemphasize long words, they have the potential to serve as powerful tools in qualitative studies when the words are linked back to their original contexts through full quotations (Henderson and Segal, 2013). The following pages depict students' descriptions in essays from the beginning of the course, the end of the course, and 6 months after the course. These word clouds were generated using the lists of descriptions of scientists produced when quantifying students' responses to the stereotypes prompt.

Henderson, S., & Segal, E. H. (2013). Visualizing qualitative data in evaluation research. *New Directions for Evaluation*, *2013*(139), 53-71.

Beginning of Course

End of Course



6 Mos After Course