

# Supplemental Material

*CBE—Life Sciences Education*

Feldon *et al.*

---

Table S1.  
*Number of Students by Program Type*

---

Program	# of Students	% of Students
Molecular and Cellular Biology	96	28.6%
Microbiology and Immunology	33	9.8%
Biochemistry	30	8.9%
Genetics	24	7.1%
Ecology and Evolutionary Biology	22	6.5%
General Biomedical Sciences	21	6.3%
Neuroscience	19	5.7%
Pathology	16	4.8%
Pharmacology	9	2.7%
Physiology	5	1.5%
Other	20	6.0%
Not Reported	41	12.2%
Total	336	100%

---

Note: In a multivariate analysis of variance (MANOVA), gender x program interactions for reported hours of research were nonsignificant ( $p > 0.7$ ). Thus, program was not considered a relevant variable for the reported analyses.

---

Table S2.

*Mean Hours Spent Teaching per Week*

---

Teaching Hours/Week	Count	Percentage
< 2 Hours/Week	245	73%
Between 2 and 5 Hours/Week	31	9%
> 5 Hours/Week	60	18%

---

---

Table S3.  
*Carnegie Classification of Universities in the Sample*

---

Carnegie Classification	Count	Percentage
R1	42	79%
R2	7	13%
Other	4	8%

---

## Final Linear Model for Males and Females Corresponding to Figure 1.

Level 1: Repeated Response Variable Model

$$Y_{ti} = \beta_{0i} + \beta_{1i}(TIME_{ti}) + \beta_{2i}(TIME_{ti}^2) + \beta_{3i}(TIME_{ti}^3) + \beta_{4i}(TIME_{ti}^4) + \varepsilon_{ti}$$

Level 2: Intercept Variance Model

$$\begin{aligned}\beta_{0i} = & \gamma_{00} + \gamma_{01}(Asian_i) + \gamma_{02}(Black_i) + \gamma_{03}(Latino_i) \\ & + \gamma_{04}(ResearchExperience\_Undergrad_i) \\ & + \gamma_{05}(ResearchExperience\_Graduate_i) \\ & + \gamma_{06}(ResearchExperience\_Industry_i) \\ & + \gamma_{07}(Self - Efficacy\_DesignExperiments_i) \\ & + \gamma_{08}(Self - Efficacy\_FormHypotheses_i) \\ & + u_{0i}\end{aligned}$$

Level 2: Linear Slope Variance Model

$$\begin{aligned}\beta_{1i} = & \gamma_{10} + \gamma_{11}(Asian_i) + \gamma_{12}(Black_i) + \gamma_{13}(Latino_i) \\ & + \gamma_{14}(ResearchExperience\_Undergrad_i) \\ & + \gamma_{15}(ResearchExperience\_Graduate_i) \\ & + \gamma_{16}(ResearchExperience\_Industry_i) \\ & + \gamma_{17}(Self - Efficacy\_DesignExperiments_i) \\ & + \gamma_{18}(Self - Efficacy\_FormHypotheses_i) \\ & + u_{1i}\end{aligned}$$

Level 2: Quadratic Change Variance Model

$$\begin{aligned}
\beta_{2i} = & \gamma_{20} + \gamma_{21}(Asian_i) + \gamma_{22}(Black_i) + \gamma_{23}(Latino_i) \\
& + \gamma_{24}(ResearchExperience\_Undergrad_i) \\
& + \gamma_{25}(ResearchExperience\_Graduate_i) \\
& + \gamma_{26}(ResearchExperience\_Industry_i) \\
& + \gamma_{27}(Self - Efficacy\_DesignExperiments_i) \\
& + \gamma_{28}(Self - Efficacy\_FormHypotheses_i) \\
& + u_{2i}
\end{aligned}$$

Level 2: Cubic Change Variance Model

$$\begin{aligned}
\beta_{3i} = & \gamma_{30} + \gamma_{31}(Asian_i) + \gamma_{32}(Black_i) + \gamma_{33}(Latino_i) \\
& + \gamma_{34}(ResearchExperience\_Undergrad_i) \\
& + \gamma_{35}(ResearchExperience\_Graduate_i) \\
& + \gamma_{36}(ResearchExperience\_Industry_i) \\
& + \gamma_{37}(Self - Efficacy\_DesignExperiments_i) \\
& + \gamma_{38}(Self - Efficacy\_FormHypotheses_i) \\
& + u_{3i}
\end{aligned}$$

Variation around each of the growth trajectory fixed effects, respectively, was also observed as follows:

Where  $VAR(u_{0i})$ ,  $VAR(u_{1i})$ ,  $VAR(u_{2i})$ , &  $VAR(u_{3i}) = \tau_{00}$ ,  $\tau_{11}$ ,  $\tau_{22}$ , &  $\tau_{33}$ , respectively, and

$$\mathbf{T} = \begin{bmatrix} \tau_{00} & \tau_{10} & \tau_{20} & \tau_{30} \\ \tau_{10} & \tau_{11} & \tau_{21} & \tau_{31} \\ \tau_{20} & \tau_{21} & \tau_{22} & \tau_{32} \\ \tau_{30} & \tau_{31} & \tau_{32} & \tau_{33} \end{bmatrix}.$$

Off-diagonal elements represent covariances among growth trajectory variance components (i.e. random effects).

Figure S1. Hierarchical linear models of males and females research time with standard errors around biweekly time points.

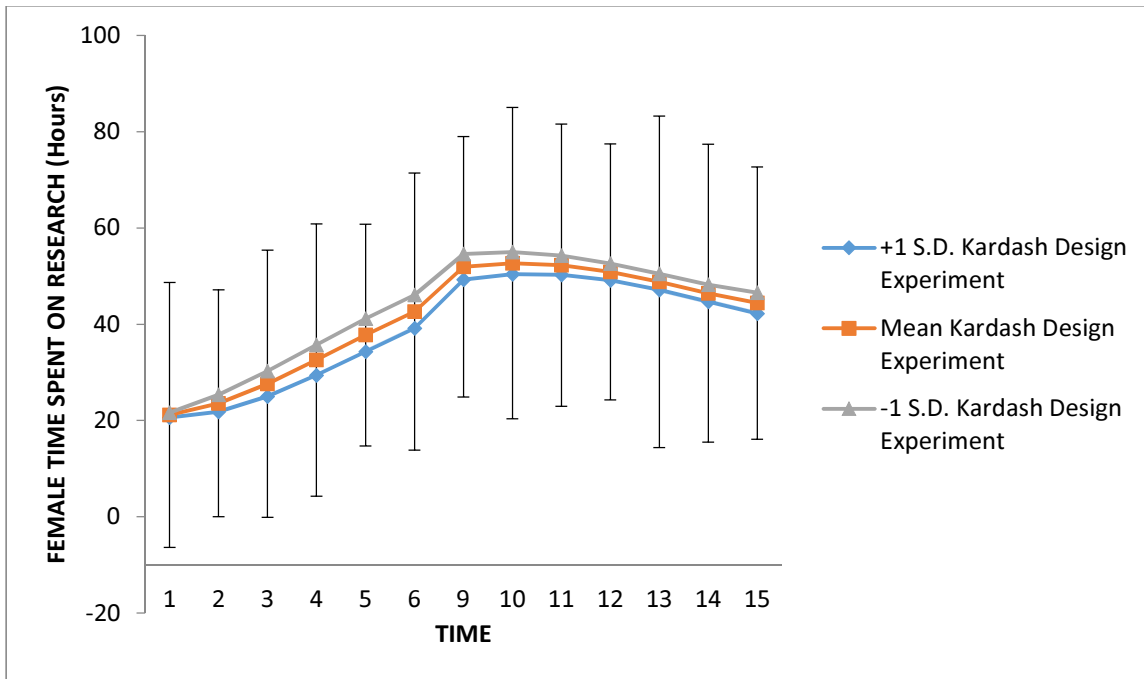
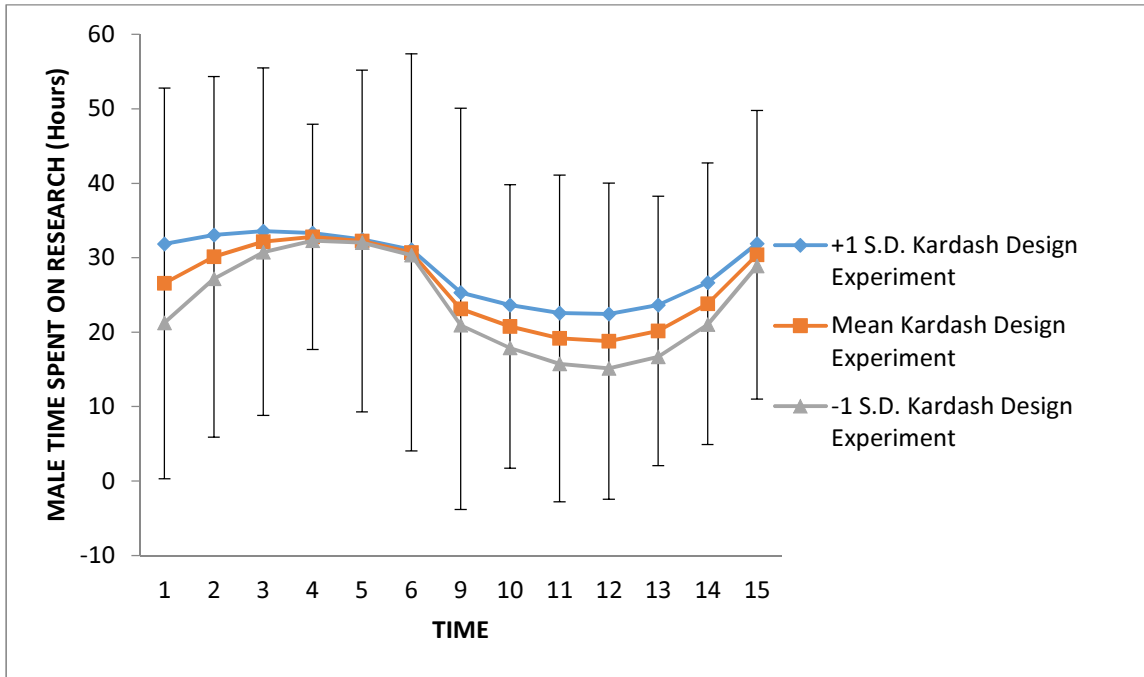




Table S4.

*Longitudinal Analyses Summary, Level-1: Males*

Parameters	Linear: Random	Quadratic: Fixed	Quadratic: Random	Cubic: Fixed	Cubic: Random	Quartic: Fixed
Regression Coefficients (Fixed Effects)						
Intercept ( $\gamma_{00}$ )	36.28**	36.27**	36.26**	37.39**	37.39**	39.40**
Time ( $\gamma_{10}$ )	0.95**	0.96	0.96	0.23	0.22	-1.83
Time2 ( $\gamma_{20}$ )		<.001	-0.001	0.11	0.11	0.67
Time3 ( $\gamma_{30}$ )				-0.05	-0.05	-0.59
Time4 ( $\gamma_{40}$ )						0.17
Variance Components (Random Effects)						
Residual ( $\sigma^2$ )	241.65**	241.65**	218.89**	218.76**	204.66**	204.49**
Intercept ( $\tau_{00}$ )	518.78**	518.19**	732.88**	732.94**	840.98**	840.86**
Slope ( $\tau_{11}$ )	4.02**	4.01**	31.20*	31.24*	79.20	79.22
Covariance ( $\tau_{01}$ )			-98.12	-98.16*	-168.39	-168.38
Quadratic ( $\tau_{22}$ )			0.07*	0.08*	0.11	1.44**
Covariance ( $\tau_{02}$ )			4.04	4.04	15.77	15.77

Covariance ( $\tau_{12}$ )			-1.45*	-1.45*	-9.55*	-9.56*
Cubic ( $\tau_{33}$ )					0.25**	0.25*
Covariance ( $\tau_{03}$ )					-4.98	-4.98
Covariance ( $\tau_{13}$ )					3.47**	3.45**
Covariance ( $\tau_{23}$ )					-0.58**	-0.58**

---

Model Summary

Deviance Statistic	-6984.58	-6984.58	-6957.48	-6957.15	-6947.23	-6946.71
No. of Estimated Parameters	6	7	10	11	15	16

---

Note: \* =  $p < .05$ ; \*\* =  $p < .01$

Table S5.

*Longitudinal Analyses Summary, Level-2: Males*

Predictors	Parameter Estimates	Predictors	Parameter Estimates
Intercept		Quadratic	
Asian	18.60*	Asian	0.88*
Black	11.16	Black	-0.90
Latino	23.29*	Latino	0.02
Undergraduate RE	-0.95	Undergraduate RE	0.16
Graduate RE	-4.96	Graduate RE	0.07
Industry RE	12.97*	Industry RE	0.30
Form Research Hypothesis	-6.09	Form Research Hypothesis	-0.21
Design Experiments	9.63	Design Experiments	0.58*
Slope		Cubic	
Asian	-6.97*	Asian	-0.33*
Black	0.80	Black	0.52
Latino	-2.00	Latino	0.02
Undergraduate RE	0.89	Undergraduate RE	-0.09
Graduate RE	-1.25	Graduate RE	-0.01
Industry RE	-2.66	Industry RE	-0.12
Form Research Hypothesis	2.20	Form Research Hypothesis	0.06
Design Experiments	-4.24	Design Experiments	-0.22*

Note: \* =  $p < .05$ ; \*\* =  $p < .01$

Table S6.

*Longitudinal Analyses Summary, Level-1: Females*

Parameters	Linear: Random	Quadratic: Fixed	Quadratic: Random	Cubic: Fixed	Cubic: Random	Quartic: Fixed
Regression Coefficients (Fixed Effects)						
Intercept ( $\gamma_{00}$ )	35.07**	31.52**	31.69**	32.99**	33.15**	39.16**
Time ( $\gamma_{10}$ )	0.73**	2.09	2.03	1.18	1.07	-5.02*
Time2 ( $\gamma_{20}$ )		-0.09	-0.08	0.05	0.06	1.72**
Time3 ( $\gamma_{30}$ )				-0.05	-0.06	-1.66*
Time4 ( $\gamma_{40}$ )						
Variance Components (Random Effects)						
Residual ( $\sigma^2$ )	292.91**	290.69**	242.29**	242.12**	210.90**	209.18**
Intercept ( $\tau_{00}$ )	487.88**	487.76**	827.82**	828.67**	1353.00**	1361.11**
Slope ( $\tau_{11}$ )	3.06**	3.06**	49.70*	49.74*	218.41**	219.59*
Covariance ( $\tau_{01}$ )	-13.95**	-13.91**	-137.75	-137.93	-434.84*	-437.76*
Quadratic ( $\tau_{22}$ )			0.16*	0.16*	3.60**	3.62**
Covariance ( $\tau_{02}$ )			7.10	7.11	49.35*	49.66*

Covariance ( $\tau_{12}$ )			-2.70*	-2.70*	-26.72**	-26.88**
Cubic ( $\tau_{33}$ )					0.55**	0.56**
Covariance ( $\tau_{03}$ )					-16.88*	-16.98*
Covariance ( $\tau_{13}$ )					9.61**	9.66**
Covariance ( $\tau_{23}$ )					-1.38**	-1.39**

---

Model Summary

Deviance Statistic	-10990.54	-10982.49	-10898.44	-10897.83	-10853.58	-10846.75
No. of Estimated Parameters	6	7	10	11	15	16

---

*Note:* \* =  $p < .05$ ; \*\* =  $p < .01$

Table S7.

*Longitudinal Analyses Summary, Level-2: Females*

Predictors	Parameter Estimates	Predictors	Parameter Estimates
Intercept		Quadratic	
Asian	6.86	Asian	0.28
Black	12.06	Black	0.42
Latino	-0.86	Latino	-0.53
Undergraduate RE	0.52	Undergraduate RE	0.18
Graduate RE	-10.82*	Graduate RE	-0.39
Industry RE	2.33	Industry RE	0.01
Form Research Hypothesis Design Experiments	4.20	Form Research Hypothesis Design Experiments	-0.33
	1.41		0.29
Slope		Cubic	
Asian	-2.38	Asian	-0.12
Black	-4.30	Black	-0.12
Latino	1.11	Latino	0.32
Undergraduate RE	-1.44	Undergraduate RE	-0.07
Graduate RE	2.16	Graduate RE	0.18
Industry RE	-0.11	Industry RE	-0.01
Form Research Hypothesis Design Experiments	1.60	Form Research Hypothesis Design Experiments	0.15
	-2.27		-0.10

Note: \* =  $p < .05$ ; \*\* =  $p < .01$

**Instruments displayed on following pages**

"To what extent do you feel you can?"

	Not at all	Less capable	Capable	More capable	A great deal
Understand contemporary concepts in your field	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make use of the primary scientific research literature in your field (e.g., journal articles)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identify a specific question for investigation based on the research in your field	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Formulate a research hypothesis based on a specific question	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Design an experiment or theoretical test of the hypothesis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understand the importance of "controls" in research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Observe and collect data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Statistically analyze data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interpret data by relating results to the original hypothesis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reformulate your original research hypothesis (as appropriate)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

>>

Powered by Qualtrics



### Default Question Block

Have you had any journal articles published over the last year?

- Yes  
 No

Please give citation information.

Have you had an conference papers accepted over the last year?

- Yes  
 No

Please give citation information

Have you had any abstracts accepted over the last year?

- Yes  
 No

Please give citation information.

Which of the following options describe the support you received for tuition and/or stipend during the past academic year?

	Source of Support		Description of Support	
	University or Department	Sponsor (e.g. NSF, NIH, private foundation)	Percent of Support (e.g. 50%, 100%)	Explanation (if necessary)
Teaching Assistantship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
Research Assistantship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
Fellowship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
Loans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>

What kinds of things affect your time spent on research on a weekly basis?  
Please categorize by percentage.

Required hours	<input type="text" value="0"/> %
Changes in workload based on project demands	<input type="text" value="0"/> %
Comfort in lab	<input type="text" value="0"/> %
Personal judgement/discretion	<input type="text" value="0"/> %
Opportunity to contribute more to the research effort	<input type="text" value="0"/> %
I'm not a good fit	<input type="text" value="0"/> %
I'm not taken seriously	<input type="text" value="0"/> %
Course work	<input type="text" value="0"/> %
Familial responsibilities	<input type="text" value="0"/> %
Non research work obligations	<input type="text" value="0"/> %

Total

0 %

Powered by Qualtrics

### Default Question Block

Over the last two weeks, approximately how many hours have you spent engaged in teaching activities (e.g., lecturing, tutoring, grading, preparing instructional materials)?

On a scale of 1 to 7, how much do you value this activity? (1=not at all, 7=very highly)

1

2

3

4

5

6

7

On a scale of 1 to 7 how confident do you feel in your ability to perform these activities? (1=not at all, 7=very highly)

1

2

3

4

5

6

7

### Block 1

Over the last two weeks, approximately how many hours have you spent engaged in supervised research activities (e.g., working in a lab)?

On a scale of 1 to 7, how much do you value this activity? (1=not at all, 7=very highly)

1

2

3

4

5

6

7

On a scale of 1 to 7 how confident do you feel in your ability to perform this activity? (1=not at all, 7=very highly)

1

2

3

4

5

6

7

## Block 2

Over the last two weeks, approximately how many hours have you spent writing for publication in collaboration with a faculty member or other senior researcher (e.g., journal article, conference paper, grant proposal, report to funding agency)?

On a scale of 1 to 7, how much do you value this activity? (1=not at all, 7=very highly)

1

2

3

4

5

6

7

On a scale of 1 to 7 how confident do you feel in your ability to perform this activity? (1=not at all, 7=very highly)

1

2

3

4

5

6

7

Powered by Qualtrics