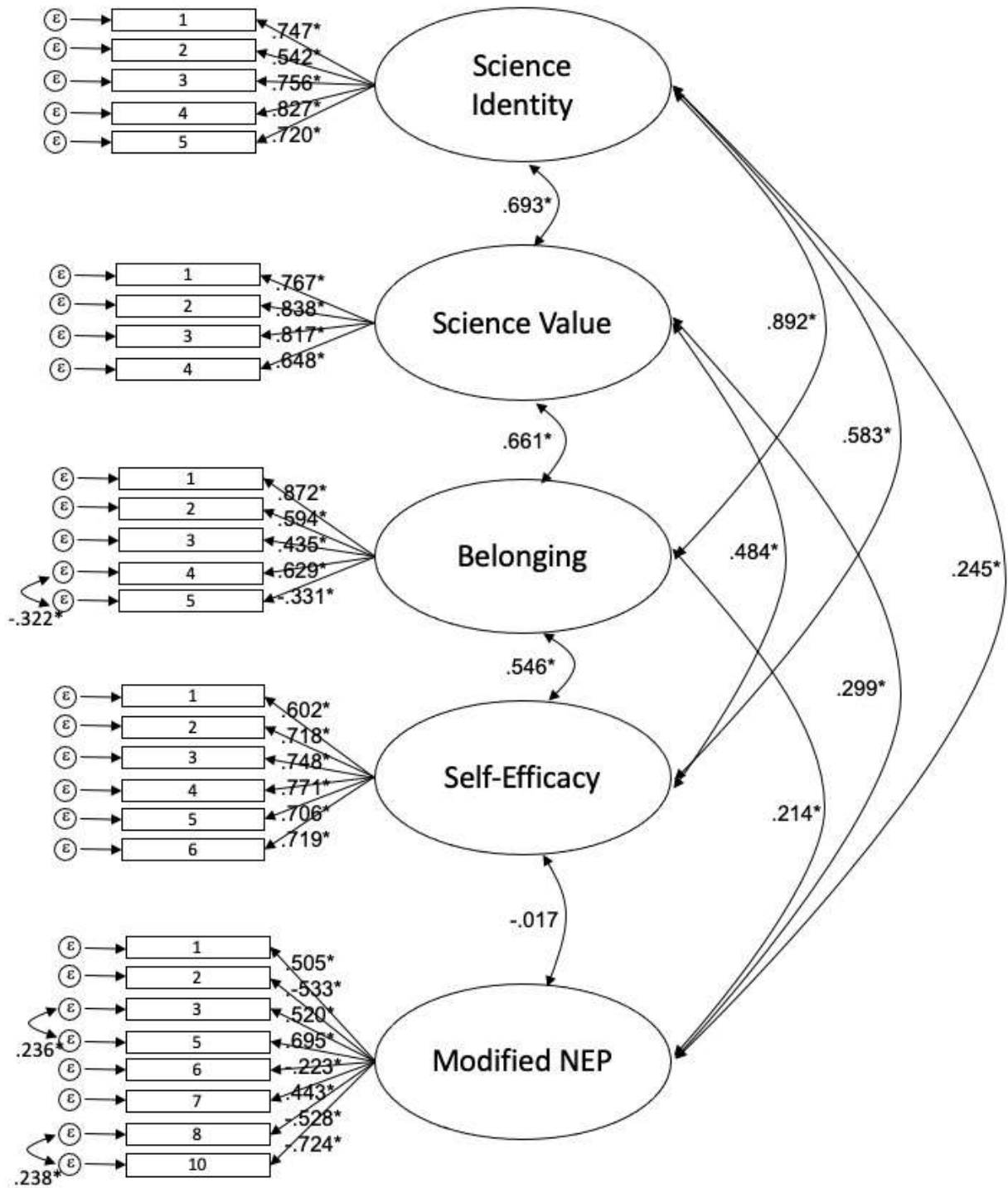


Supplemental Material

CBE—Life Sciences Education

Greenall *et al.*

Supplementary Figure 1. CFA Results



Supplementary Survey 1: Pre-Survey

Demographics

Q1.1 What is your gender?

- Female
- Male
- Non-binary/ third gender
- Prefer to self-describe _____
- Prefer not to say

Q1.2 How many semesters of college have you completed?

- 0 (this is my first semester)
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

Q1.3 What year were you born?*

Q1.4 What is your declared major?*

Q1.5 What is your current GPA?(If you are a 1st-semester freshman, provide your high school GPA) _____

Q1.6 How many Science classes have you taken in college?

- 0
- 1-2
- 3-5
- 6-8
- 9-10
- 10 or more

Q1.7 How many Science classes did you take in high school?

- 0
- 1-2
- 3-5
- 6-8
- 9-10
- 10 or more

Q1.8 What country were you born in?*

Q1.9 What is your ethnicity? (choose all that apply)

- White
- Hispanic or Latino
- Black or African American
- Native American, American Indian, or Alaska Native
- Asian
- Native Hawaiian or Pacific Islander
- Other (please specify) _____

Questions with an asterisk () were accompanied with a drop-down menu for students to choose an option. These were for birth year, declared major, and country of birth.

MEIM-R Scale

For the following questions: 1 = strongly disagree, 5 = strongly agree

Q2 Regarding your _____** identity, please indicate how much you agree with the following statements.

I have spent time trying to find out more about my ethnic group, such as its history, traditions, and customs.

1 2 3 4 5

I have a strong sense of belonging to my own ethnic group.

1 2 3 4 5

I understand pretty well what my ethnic group membership means to me.

1 2 3 4 5

I have often done things that will help me understand my ethnic background better.

1 2 3 4 5

I have often talked to other people in order to learn more about my ethnic group.

1 2 3 4 5

I feel a strong attachment towards my own ethnic group.

1 2 3 4 5

**The blank was filled in with the ethnicity the student indicated in the previous question. A MEIM-R set of questions appeared for each ethnicity a student indicated, so if a student indicated Hispanic and Asian as their ethnicities, then they would have two sets of MEIM-R questions, one for their Hispanic identity and one for their Asian identity.

Science Identity

For the following questions: 1 = strongly disagree, 5 = strongly agree

Q3 Please indicate how much you agree with the following statements.

I have a strong sense of belonging to the community of scientists.

1 2 3 4 5

I derive great personal satisfaction from working on a team that is doing important research.

1 2 3 4 5

I have come to think of myself as a “scientist”.

1 2 3 4 5

I feel like I belong in the field of science.

1 2 3 4 5

The daily work of a scientist is appealing to me.

1 2 3 4 5

Identities

Q4.1 How does your ethnic identity influence your science identity?

- Conflicts a lot
- Conflicts a little
- Has no relationship
- Strengthens a little
- Strengthens a lot

Q4.2 Please explain your answer.

Science Values

Q5 Please rate how much the person in the description is like you. 0 = not like me at all, 1 = not like me, 2 = a little like me, 3 = somewhat like me, 4 = like me, and 5 = very much like me

A person who thinks it is valuable to conduct research that builds the world's scientific knowledge.

0 1 2 3 4 5

A person who feels discovering something new in science is thrilling.

0 1 2 3 4 5

A person who thinks discussing new theories and ideas between scientists is important.

0 1 2 3 4 5

A person who thinks that scientific research can solve many of today's world challenges.

0 1 2 3 4 5

Intention to pursue science

Q6 To what extent do you intend to pursue a science related research career?

Definitely will

Probably will

Might or might not

Probably will not

Definitely will not

Belongingness

For the following questions, 1 = strongly disagree and 7 = strongly agree

Q7 Please indicate how much you agree with the following statements

When I am in a science setting, I feel a connection with the science community.

1 2 3 4 5 6 7

When I am in a science setting, I feel respected.

1 2 3 4 5 6 7

When I am in a science setting, I trust my instructors to be committed to helping me learn.

1 2 3 4 5 6 7

When I am in a science setting, I enjoy being an active participant.

1 2 3 4 5 6 7

When I am in a science setting, I try to say as little as possible. (reverse scored)

1 2 3 4 5 6 7

Self-Efficacy

For the following questions: 1 = not at all confident, 5 = absolutely confident

Q8 Please indicate your confidence level in performing the following tasks.

Use technical science skills (use of tools, instruments, and/or techniques).

1 2 3 4 5

Generate a research question to answer.

1 2 3 4 5

Figure out what data/observations to collect and how to collect them.

1 2 3 4 5

Create explanations for the results of a study.

1 2 3 4 5

Use scientific literature and/or reports to guide research.

1 2 3 4 5

Develop theories (integrate and coordinate results from multiple studies).

1 2 3 4 5

Environmental attitudes

For the following questions: 1 = strongly disagree, 5 = strongly agree

Q9 Please indicate how much you agree with the following statements.

We are approaching the limit of the number of people the earth can support.

1 2 3 4 5

Humans have the right to modify the natural environment to suit their needs

1 2 3 4 5

When humans interfere with nature it often produces disastrous consequences

1 2 3 4 5

†Human ingenuity will ensure that we do NOT make the earth unlivable.

1 2 3 4 5

Humans are severely abusing the environment.

1 2 3 4 5

The earth has plenty of natural resources if we just learn how to develop them.

1 2 3 4 5

Plants and animals have as much right as humans to exist

1 2 3 4 5

The balance of nature is strong enough to cope with the impacts of modern industrial nations

1 2 3 4 5

†Despite our special abilities humans are still subject to the laws of nature

1 2 3 4 5

The so-called “ecological crisis” facing humankind has been greatly exaggerated.

1 2 3 4 5

†Questions indicated were removed from NEP analysis due to CFA results.

Supplementary Survey 2: Post-Survey

Q1. Did anything specific increase or decrease your science identity during the semester? Please explain.

Identities

Q2.1 How does your ethnic identity influence your science identity?

- Conflicts a lot
- conflicts a little
- has no relationship
- strengthens a little
- strengthens a lot

Q2.2 Please explain your answer.

Q3.1 How does your ethnic identity influence your attitude towards conservation/the environment

- Conflicts a lot
- Conflicts a little
- Has no relationship
- Strengthens a little
- Strengthens a lot

Q3.2 Please explain your answer.

Q3.3 Would your answer to the previous question have been the same before this class? Please explain.

Q3.4 What other identities do you consider an important part of who you are? (Possible examples: cultural, political, religious, LGBTQ, familial, etc.)

Q3.5 Answer this question for each of your identities and please explain your answer. How does this influence your science identity?

- Conflicts a lot
- Conflicts a little
- Has no relationship
- Strengthens a little
- Strengthens a lot

Q3.6 Would your answer to the previous question have been the same before this class? Please explain.

Science Identity

For the following questions: 1 = strongly disagree, 5 = strongly agree

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A person who thinks it is valuable to conduct research that builds the world's scientific knowledge.

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A person who thinks that scientific research can solve many of today's world challenges.

0 1 2 3 4 5

Intention to pursue science

Q6 To what extent do you intend to pursue a science related research career?

- Definitely will
- Probably will
- Might or might not
- Probably will not
- Definitely will not

Belongingness

For the following questions, 1 = strongly disagree and 7 = strongly agree

Q7 Please indicate how much you agree with the following statements

When I am in a science setting, I feel a connection with the science community.

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1 2 3 4 5

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Supplementary Table 1

Codebook Used for Qualitative Analysis

Category	Code	Subcode	Example Response
Community	desire to help		I want to come and study science so I could go back and help my people.
	lack of support from		I wish there was more acceptance or even understanding for me wanting to become a marine biologist.
	pressure from		There is always a lot of pressure for the eldest to be very successful...
	privileged because of		I am privileged to be able to say I have never had to think about my ethnicity in regards to my science identity.
	representation of community		There are not many Polynesians in the field of science
	support from		My community really wants to see science majors who are Hawaiian succeed in this field so I do feel a firm sense of support in that regard
Country	developed	opportunities	I have access to lots of tools to help me succeed scientifically.
	underdeveloped	dependence on natural resources	...the land provides for us, and in return, we must take care of the land
		lack of scientific development	Tonga is a very much [a] developing country and the thought of science is not needed for their development at the moment.
		push back against science	...many native Hawaiians don't agree with this and see it as desecration of values, beliefs, and an invasion of our homeland.
Identity	cultural		I don't any conflict between my culture and science
	ethnic		My ethnic background turns my priority to studying and better understanding the

		environmental needs of the moana cultures.
	gender	Being the eldest Tongan daughter means a lot just attending university.
	political	I still feel American politics are drifting too far into areas they should not (like the scientific community).
	religious	everything has connection and explanation at a spiritual and scientific level
Important of Science Identity	important	I want to come and study science
	lack of ID, no ID, ID not important	I don't really have a "science identity" because I am not heavily involved in science.
Interactions	kept separate intentionally	My two identities exist on [their] own.
	negative or conflicting	My native Hawaiian background is rich with beliefs that contradict the facts that modern science has proven.
	neutral or no relationship	My ethnicity has no relation to my science identity
	positive or strengthening	Because my Polynesian culture connects my people a lot with the earth, I think biology in particular has a close tie with my ethnicity. Respecting the earth makes me want to learn more about it
	unsure	I haven't really thought about that.
Motivations and Limitations	limitations	As a Hawaiian, I am very attached to my home in the islands, and I am unwilling to let work move me abroad.
	motivations	It's survival that motivates me to pursue a meaning career and purpose.
Relationships	between environment and student	The Polynesian culture is very strengthening seeing as our people care to protect our Oceans and our way of life.
	between human and student	Science helps me see how people are scattered plus the way we live.

	ancestors	Science is applied to star navigation, although my ancestors used non instrumental navigation and way-finding.
	family	My family has a history of being biologists
	members of other races	I have a lot of respect for non-Caucasian scientists and recognize every scientist's contribution.
	oneself	I am many things and to me it means I can do anything and be anything.
	other communities	... more familiar with certain actions and behavior that we only Tahitians have comparing to other Polynesians.
	between science and student culture	Success in the Tongan culture is rarely seen as a scientist.
	stereotypes	I personally don't believe that as a Samoan student, science was one of those subjects that we were encouraged to major in...
	teaching, traditions, TEK	My ethnic background turns my priority to studying and better understanding the environmental needs of the moana cultures.
Time	future	My future goal is to somehow use the knowledge that I have gained over the years to somehow help my people choose better, healthier lifestyles.
	past	the circumstances in which I was brought up and started to pursue science.

Supplementary Table 2

Results of Multiple Linear Regression with Pre-Science Identity, Pre-Science Values, Pre-Self-Efficacy, Pre-Belonging, and Pre-NEP as Targets

Outcome Variable	R ²	Adjusted R ²	Predictor	B (coefficient)	SE _B	β (standardized coefficient)	p value
Pre-science identity	0.261	0.255	(Intercept)	13.334	0.421		<0.001
			NHPI	-0.031	0.431	-0.002	0.942
			International	0.058	0.352	0.006	0.870
			Female	-0.284	0.251	-0.037	0.259
			# of High School Science Classes	0.336	0.106	0.107	0.002
			STEM major	4.046	0.278	0.478	<0.001
			Female * NHPI	-1.014	0.877	-0.038	0.248
Pre-science self-efficacy	0.110	0.103	(Intercept)	17.958	0.497		<0.001
			NHPI	-0.695	0.512	-0.050	0.175
			International	-0.596	0.421	-0.053	0.157
			Female	-01.356	0.298	-0.163	<0.001
			# of High School Science Classes	0.342	0.125	0.103	0.006
			STEM major	2.174	0.330	0.240	<0.001
			Female * NHPI	-0.382	1.042	-0.013	0.714
Pre-science	0.159	0.152	(Intercept)	13.833	0.400		<0.001

values

			NHPI	-0.732	0.412	-0.064	0.076
			International	-0.184	0.337	-0.020	0.585
			Female	-0.219	0.240	-0.032	0.360
			# of High School Science Classes	0.148	0.100	0.054	0.141
			STEM major	2.824	0.266	0.367	<0.001
			Female * NHPI	0.383	0.838	0.016	0.648
Pre-belonging	0.166	0.158	(Intercept)	23.436	0.497		<0.001
			NHPI	-0.597	0.512	-0.042	0.244
			International	-0.521	0.419	-0.045	0.214
			Female	-0.460	0.298	-0.054	0.122
			# of High School Science Classes	0.120	0.125	0.035	0.337
			STEM major	3.622	0.330	0.387	<0.001
			Female * NHPI	1.167	1.042	0.039	0.263
Pre-environmental concern (NEP)	0.103	0.095	(Intercept)	23.763	0.593		<0.001
			NHPI	0.385	0.611	0.023	0.529
			International	-0.228	0.501	-0.017	0.649
			Female	2.787	0.355	0.283	<0.001
			# of High School Science	0.118	0.149	0.030	0.427

Classes

STEM major	1.583	0.394	0.147	<0.001
Female * NHPI	0.697	1.242	0.021	0.575

Supplementary Table 3

Results of Multiple Linear Regression with Science Identity Change, Science Values Change, Self-efficacy Change, Belonging Change, and NEP Change as Targets

Outcome Variable	R ²	Adjusted R ²	Predictor	B (coefficient)	SE _B	β (standardized coefficient)	p value
Science identity change	0.146	0.136	(Intercept)	6.098	1.034		<0.001
			NHPI	1.216	0.970	0.054	0.211
			International	0.253	0.779	0.014	0.745
			Female	0.227	0.510	0.019	0.656
			# of High School Science Classes	-0.848	0.293	-0.126	0.004
			STEM major	-4.394	0.562	-0.334	<0.001
			Female * NHPI	2.454	1.952	0.054	0.209
Science self-efficacy change	0.050	0.038	(Intercept)	2.779	1.085		0.011
			NHPI	-0.036	1.033	-0.002	0.973
			International	-0.115	0.831	-0.006	0.890
			Female	1.378	0.539	0.115	0.011
			# of High School Science Classes	-0.432	0.307	-0.065	0.160
			STEM major	-2.132	0.594	-0.163	<0.001
			Female * NHPI	1.627	2.087	0.036	0.436
Science values change	0.138	0.128	(Intercept)	5.026	0.807		<0.001
			NHPI	1.149	0.769	0.065	0.136

			International	-0.030	0.618	-0.002	0.962
			Female	-0.243	0.400	-0.026	0.544
			# of High School Science Classes	-0.563	0.228	-0.109	0.014
			STEM major	-3.388	0.441	-0.331	<0.001
			Female * NHPI	-0.648	1.553	-0.018	0.676
Belonging change	0.095	0.084	(Intercept)	4.818	1.111		<0.001
			NHPI	0.511	1.059	0.021	0.630
			International	0.457	0.852	0.024	0.592
			Female	0.385	0.551	0.031	0.486
			# of High School Science Classes	-0.640	0.314	-0.092	0.042
			STEM major	-3.786	0.608	-0.276	<0.001
			Female * NHPI	0.555	2.138	0.012	0.795
NEP change	0.051	0.039	(Intercept)	3.742	1.363		0.006
			NHPI	-0.725	1.298	-0.025	0.576
			International	0.440	1.044	0.020	0.674
			Female	-2.992	0.676	-0.199	<0.001
			# of High School Science Classes	0.029	0.385	0.003	0.941
			STEM major	-1.794	0.746	-0.109	0.017
			Female * NHPI	-2.265	2.621	-0.039	0.388