BioInteractive's Online Professional Learning Course on Evolution: Overview and Evaluation

BACKGROUND

Howard Hughes Medical Institute's BioInteractive Professional Development Evolution course, published in 2018, was developed to provide educators with in-depth, multimedia resources that highlight important scientific concepts and studies in evolution and engage participants through interactive activities that link to student resources.

OBJECTIVES

1. Deepen content knowledge of evolutionary concepts that are essential to NGSS and AP Biology courses.
2. Increase confidence and comfort in teaching evolution content to general biology and AP Biology students.
3. Identify major evolutionary concepts in scientific studies, authentic data, or educational media used to teach evolution.
4. Identify and incorporate relevant BioInteractive resources to illustrate evolutionary content and science practices in teachers' own course(s).

COURSE FEATURES

Interactive, Engaging Media
Award-winning, high-quality short films, virtual labs, and online interactives

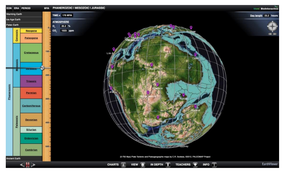
Comprehensive Notebook
Answer reflection and extension questions on course and teaching methods

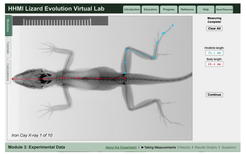
Direct Links to Related Resources
Help link learning with resources and activities to use with students

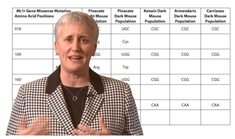
End of Lesson Review Quizzes & Tests
Assessments improve learning and retention of content

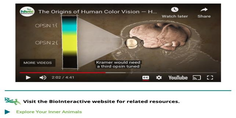
Deeper Content Dives
Investigate and strengthen knowledge in the subject matter explored within the lesson

Educator Tips
Additional resources to provide teachers with implementation tips for BioInteractive activities









RESULTS

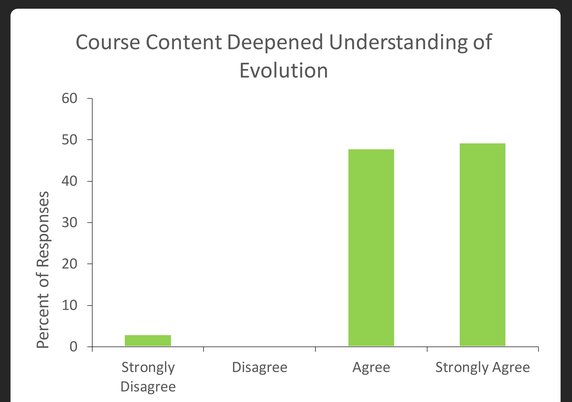
Objective Related Questions	Unit	SD	D	A	SA	Mean	Cohen's D
The course content deepened my understanding of evolution.	*Unit 1*	2.2	5.4	44.6	47.8	3.39	0.6
	Unit 2&3	2.9	0	47.8	49.3	3.43	0.69
I plan to use as least some of the resources in this course next time I teach evolution.	*Unit 1*	2.2	1.1	35.9	60.9	3.55	1.18
	Unit 2&3	2.9	1.4	30.4	65.2	3.58	1.31

SD = Strongly Disagree, D = Disagree, A = Agree, SA = Strongly Agree

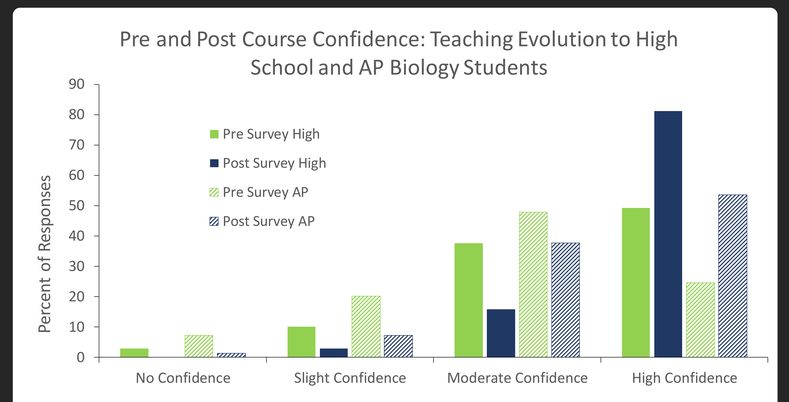
Pre/Post Objective Related Questions	Unit	Pre/Post	NC	S	M	H	Mean	Std. Dev	Cohen's D
Teaching evolution to regular high school biology students.	*Unit 1*	*Pre*	3.3	12.0	37.0	47.8	3.29	0.81	0.60
		Post	1.1	4.3	16.3	78.3	3.72	0.60	
	Unit 2&3	*Pre*	2.9	10.1	37.7	49.3	3.33	0.78	0.69
		Post	0.0	2.9	15.9	81.2	3.78	0.48	
Teaching evolution at an advanced level (for instance, AP Biology).	*Unit 1*	*Pre*	9.8	26.1	43.5	20.7	2.75	0.90	0.72
		Post	5.4	3.3	41.3	50.0	3.36	0.78	
	Unit 2&3	*Pre*	7.2	20.3	47.8	24.6	2.90	0.86	0.68
		Post	1.4	7.2	37.7	53.6	3.43	0.70	
Assigning authentic scientific data to students to support learning objectives in evolution.	*Unit 1*	*Pre*	7.6	47.8	35.9	8.7	2.46	0.76	1.32
		Post	1.1	7.6	40.2	51.1	3.41	0.68	
	Unit 2&3	*Pre*	5.8	31.9	44.9	17.4	2.74	0.82	1.04
		Post	0.0	4.3	43.5	52.2	3.48	0.58	

NC = No Confidence, S = Slight Confidence, M = Moderate Confidence, H = High Confidence

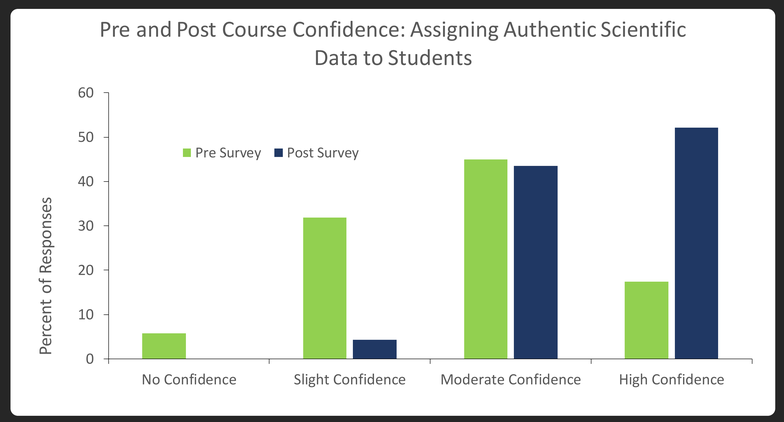
Our online professional development course aids educators in **increasing their knowledge** and **comfort** in **teaching evolution.**



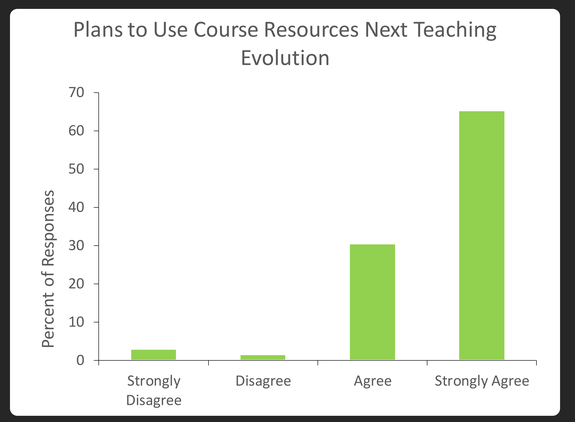
"This was an unbelievable experience! I loved every bit of it. It makes the study of evolution so clear… If teachers today taught evolution the way you did in this course… everyone would totally understand it."



"This is not my field of expertise, so I am very appreciative that this course gave me a lot more confidence than I had before I took it. I also took it to find more resources for my students which I got and am looking forward to using."



"For me, this course was… about getting new ideas regarding resources, how to better sequence materials, how to ask more engaging/clear questions, and how to better collect and use data in my classroom. This course was super helpful in all of these ways, and I really appreciate having free and excellent PD in this area."



"This was totally amazing. This helped me see how I can get my students involved in acting like a scientist by using real world applications without having to go to the Galapagos island, etc. I can't wait to show my students these great activities."

Unit 1 — Pre-Post Learning Objectives		N	S	M	H	Mean	St. Dev.	Cohen's D
Using the theory of natural selection to explain a real-world phenomenon.	*Pre*	3.3	10.9	40.2	45.7	3.28	0.79	0.69
	Post	0.0	3.3	19.6	77.2	3.74	0.51	
Using evidence to build an argument that evolution occurs through the process of natural selection.	*Pre*	2.2	20.7	46.7	30.4	3.05	0.78	0.91
	Post	0.0	3.3	27.2	69.6	3.66	0.54	
Using evidence to support claims about the degree to which traits are passed from parents to offspring.	*Pre*	5.4	18.5	47.8	28.3	2.99	0.83	0.83
	Post	1.1	4.3	27.2	67.4	3.60	0.63	
Using evidence to relate the strength of selection to the rate of change in phenotypes in a population over time.	*Pre*	6.5	23.9	48.9	20.7	2.84	0.82	1.13
	Post	1.1	3.3	25.0	70.7	3.65	0.60	
Describing the similarities and differences among four mechanisms of evolution.	*Pre*	5.4	28.3	45.7	20.7	2.82	0.82	1.13
	Post	0.0	5.4	26.1	68.5	3.63	0.59	
Naming several causes of genetic variation.	*Pre*	4.3	17.4	43.5	34.8	3.09	0.83	0.84
	Post	0.0	4.3	22.8	3.68	0.55		
Calculating statistics that explain variation in populations.	*Pre*	21.7	44.6	18.5	15.2	2.27	0.97	1.10
	Post	1.1	17.4	39.1	42.4	3.23	0.77	

Unit 2&3 — Pre-Post Learning Objectives		N	S	M	H	Mean	St. Dev.	Cohen's D
Describing evidence that supports the idea that species change over time.	*Pre*	1.4	14.5	46.4	37.7	3.20	0.74	1.05
	Post	0.0	1.4	14.5	84.1	3.83	0.42	
Describing evidence that supports common ancestry for all living organisms.	*Pre*	1.4	13.0	46.4	39.1	3.23	0.73	0.97
	Post	0.0	1.4	15.9	82.6	3.81	0.43	
Using evidence to reconstruct phylogenetic relationships.	*Pre*	4.3	20.3	50.7	24.6	2.96	0.79	0.99
	Post	0.0	4.3	27.5	68.1	3.64	0.57	
Interpreting phylogenetic trees.	*Pre*	1.4	14.5	50.7	33.3	3.16	0.72	0.77
	Post	0.0	2.9	29.0	68.1	3.65	0.54	
Identifying examples of evidence for evolution.	*Pre*	1.4	18.8	36.2	43.5	3.22	0.80	0.90
	Post	0.0	1.4	17.4	81.2	3.80	0.44	
Explaining how different definitions of species affect how biologists study speciation.	*Pre*	5.8	21.7	44.9	27.5	2.94	0.86	1.12
	Post	0.0	1.4	24.6	73.9	3.72	0.48	

SUMMARY

- The majority responded positively to the course.
- This course consists of three units and the total time required for the entire course is estimated to be 15 hours.
- 95% of educators strongly agreed or agreed the course deepened their understanding of evolution.
- Educator's confidence in teaching evolution (high school and AP) increased by 30% after finishing the course.
- Confidence in utilizing authentic scientific data was 90% after Unit 1 (^ of 46%) and 96% after Units 2 & 3 (^ of 33%).
- Using HHMI BioInteractive resources to teach evolution content reporting Moderate to High confidence increased from 59% to 94% for Unit 1 and 64% to 97% for Units 2 & 3.

Dr. Paul Beardsley, Melissa Csikari, Ashley Ertzman, Meghan Jeffus

hhmi Howard Hughes Medical Institute

CalPoly Pomona