

FINDINGS FROM AN INDEPENDENT EVALUATION OF THE AMNH'S ONLINE SEMINARS ON SCIENCE COURSE: *THE LINK BETWEEN DINOSAURS AND BIRDS*

Inverness Research studied the AMNH Seminars on Science program for eight years, from its inception in 1998 to 2006. Below we present teacher survey ratings for *The Link between Dinosaurs and Birds*, along with profiles of three teachers who took the course.

SURVEY RATINGS FOR *THE LINK BETWEEN DINOSAURS AND BIRDS*

Course takers report on our annual follow-up surveys that *The Link Between Dinosaurs and Birds* has benefited them personally and professionally, and they rate the course highly. However, compared to educators who have taken other AMNH online courses, a smaller percentage of teachers who have taken this course report that their students have also profited or that they have recommended the course to colleagues.

We present below key findings based on the responses of the 39 learners from 11 states who have completed follow-up surveys about the quality and value of the course. The majority of survey takers (74%) are K-12 teachers, but informal science educators and preservice teachers have also provided feedback about how the courses have benefited them personally and as educators.

What do teachers gain for their own learning from *The Link between Dinosaurs and Birds*?¹

- "additional background knowledge of science" (85%)
- "motivation to continue learning about the course topics on my own" (79%)
- "a bank of resources for my own learning" (74%)
- "a rekindling of my passion for science and the work of scientists" (74%)
- "a deeper insight into the work of scientists" (68%)

How do teachers apply the course directly to their classrooms? ²

- "I used what I learned to create a unit for my students" (44%)
- "I made some course resources available to my students" (44%)

How does the course help strengthen teaching?

- "It introduced me to new kinds of materials and media such as simulations and websites that I can use in science" (69%)

¹ Unless noted otherwise, percentages represent teachers who marked 4 or 5 on a 5-point scale where 1 = Not at all, 3 = Somewhat, and 5 = A very great deal.

² For questions regarding student impacts, percentages represent teachers who checked "yes."

The Link between Dinosaurs and Birds

- *"It provided me with hands-on, inquiry learning that can serve as a good model for the kind of work I can have students do"* (67%)
- *"It helped me to learn a new content area that I may teach in the future"* (65%)
- *"I am better able to assist students in meeting our state or district standards"* (42%)

How do teachers say that this course helps their students?

- *"It has made the work of scientists more understandable to students"* (25%)
- *"Students better connect science in school with the real world"* (23%)
- *"Students gain a better understanding of scientific inquiry"* (19%)
- *"Students have better access to and knowledge of latest research"* (17%)

How does the course compare with other professional learning opportunities?

- *"The course was more valuable than other professional development available to me locally"* (79%)
- *"The course is more valuable than other distance learning courses I have taken"* (70%)

Do teachers recommend the course?³

- *"I have recommended the course to colleagues"* (31%)

TEACHER PROFILES FOR THE LINK BETWEEN DINOSAURS AND BIRDS

On the pages below, we have profiles for the following three teachers:

A high school science teacher uses the up-to-date and provocative materials from *The Link between Dinosaurs and Birds* to engage at-risk students with scientific thought

A private school biology and physics teacher, inspired by *The Link between Dinosaurs and Birds*, brings evolution and classification alive for his students

The Link between Dinosaurs and Birds contributes to a teacher's Master's degree and enriches his classroom teaching

³ Percentages represent teachers who checked "yes."

A high school science teacher uses the up-to-date and provocative materials from *The Link between Dinosaurs and Birds* course to engage at-risk students with scientific thought

Mr. Karavais teaches biology, marine biology, and environmental science to 10th, 11th and 12th grade students at a large comprehensive high school in a suburb of New York City. The student population is racially, economically and academically diverse. In the evenings he teaches all the sciences at an alternative high school for at-risk students who need graduation credits.

Using evolution as a tool for engaging students with science. Many of the students in Mr. Karavais' alternative school classes have not been successful in previous science classes and are not engaged by traditionally taught classes. He uses the materials from the SoS *The Link Between Dinosaurs and Birds* course to spark their interest and to introduce them to scientific thought:

Students in the alternative school love controversial topics like those related to evolution – separation of church and state, did we come from monkeys, how did primates evolve, etc. We talk about how fish got out of water, why did certain life forms go back into the water, how did land animals learn to fly, where did feathers come from. I show them bone structure and challenge them to tell me if it is an alligator or human, and they can't tell the difference. We look at embryos and their common features and try to decide what each embryo would have become. How the embryos of different organisms are alike... I can teach evolution as long as I want because I have access to all this material from the SoS course. And it engages the students.

Gaining access to the most recent content knowledge. Mr. Karavais found the SoS course intensely interesting and useful for expanding his own knowledge base.

Before this course, I had paid attention to the kind of basic information about fossils that you get from media blurbs. Now I have a greater understanding of the link between reptiles and avian species, and the evidence for evolution. What made it challenging was that it was so new. I remember leaving the class thinking about the search for a link between the 3-chambered reptilian heart and the 4-chambered heart of birds. Previously I thought most of the evolution evidence was theoretical, but it is actually a work in progress and we are just waiting for more facts and answers.

A challenging but supportive learning environment. The instructors in the online course established and maintained a close relationship with the learners and had high expectations for performance.

I was under a lot of personal stress when I took the summer course. At one point I did not do as well as I could on one of the assignments. The instructor confronted me directly and wanted to know if things were okay. When I explained my situation, he talked with me about ways I could manage the workload. He had a genuine interest in me as a learner.

A private school biology and physics teacher, inspired by *The Link between Dinosaurs and Birds*, brings evolution and classification alive for his students

Mr. R. teaches regular and AP biology, and AP physics in a small, private 6-12 college prep school in Texas. Enrollment in the school is selective and by application, and the school is committed to high academic achievement.

A new approach to teaching standard biology topics. Prior to taking the SoS *The Link Between Dinosaurs and Birds* online class, Mr. R. taught taxonomy in the traditional way. After his encounter with dinosaur evolution, his approach to the topic of classification changed from grouping organisms by category to relating organism around common descent, anatomical features and protein studies.

The dinosaur materials are the particular evidence for evolution. We can look at and compare the anatomical features of birds and dinosaurs. Rather than having my students listen to a lecture, they work through the materials and we discuss the adaptation of each feature—for example the hollow bones of birds, the evolution of forelimbs, and fusion of pelvic bones—and how these features were advantageous for swift moving and flight. It is a process of discovery that brings evolution and classification alive for my students. My students were always disinterested when I taught my unit on taxonomy. But teaching about dinosaur evolution—for instance, the adaptations that became a basis for flight—changed their interest and deepened their understanding.

Gaining and applying content knowledge. The course provided Mr. R.'s first formal introduction to the scientific evidence for the evolution of birds. He used his expanded content knowledge from the SoS course to change the teaching of evolution in his AP biology class into an inquiry experience for the students. This also served as a springboard into the topics of genetics and population biology. In addition, the SoS course also provided the background he needed to develop a new course. He said, "If I had not taken this course, I would not have known enough to teach comparative anatomy, so it enabled me to press on to develop a comparative anatomy course for our school."

Access to expert knowledge, stimulating conversation and engaging content.

Although high quality professional development is readily available in his area and supported by his school, Mr. R. was pleased with the unique opportunities that the SoS course offered. The online readings and weekly essays provided access to the thinking of the current experts in the field and the posted discussions allowed him to interact with a diverse group of course takers. He was motivated to pursue the topic on his own:

In a classroom, only a limited number of people can participate in the discussion. In an online course, everyone can post and read—it is better than a class discussion. I enjoyed the diversity of the people taking the course, some with little background and others with a lot. The course is a lot of work, as much as any graduate course. But it was exciting, engaging, and intensely valuable. I even took myself on a personal field study to see dinosaur tracks and to make my own measurements and collect my own evidence.

***The Link between Dinosaurs and Birds* contributes to a rural teacher's Master's degree and enriches his classroom teaching**

Mr. K. teaches science in a combination middle-high school in rural Florida. His school is in an agricultural region of small towns many miles from a university center. Mr. K. brings a varied background of previous science-related work, including field biology and zoo herpetology, to his 13-year teaching career. His teaching assignments have included marine biology, earth science, ecology, environmental science, chemistry, and anatomy-physiology.

Accessible and useful professional growth. For Mr. K., the SoS online course, *The Link between Dinosaurs and Birds*, supported his personal professional growth trajectory. When he enrolled in the course, he was in the middle of a university course of study leading to a Master of Science degree.

This summer online course was a perfect fit between the courses required for my degree program. When I met the additional requirement for a peer reviewed and accepted research project related to the course, I was able to attain graduate level credit that was transferable to my degree program.

Engaging content and instantly usable teaching tools for classroom. The content of the SoS course provided high interest material for his classes.

No single lineage could account for the vast numbers of birds today. There must have been at least 4 lineages. We looked at the homology of bones of the forearms of the human, the whale, and the bird wing, and all have the same bones. We begin to have an appreciation for the plasticity of the genes that are responsible for the changes in different species. I give my students little bits of evidence and let them think about it— how it came about. All of this I learned in the SoS class.

The course content also supported Mr. K.'s commitment to integrating the various science disciplines.

I always try to tie things together in my teaching. Dinosaurs are of high interest to kids—even high school kids who try not to get excited about anything. And dinosaurs cross the lines between biology and earth science and help kids see how the sciences are related.