

FINDINGS FROM AN INDEPENDENT EVALUATION OF THE AMNH'S ONLINE SEMINARS ON SCIENCE COURSE: *THE SOLAR SYSTEM*

Inverness Research studied the AMNH Seminars on Science program for eight years, from its inception in 1998 to 2006. In 2009, Inverness Research conducted additional studies of the AMNH's new online course, ***The Solar System***. Below we present teacher survey ratings for *The Solar System*, along with profiles of three teachers who took the course.

SURVEY RATINGS FOR *THE SOLAR SYSTEM*

Course takers report on our follow-up survey that ***The Solar System*** has benefited them personally and professionally, and that their students also profit. We present below a small sample of our findings based on the responses of 50 learners from 16 states who completed follow-up surveys about the quality and value of the course. The majority of survey takers (82%) 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 Solar System*?¹

- *"additional background knowledge of science"* (90%)
- *"a bank of resources for my own learning"* (84%)
- *"motivation to continue learning about the course topics on my own"* (70%)
- *"a deeper insight into the work of scientists"* (64%)

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

- *"I used what I learned to create a unit for my students"* (70%)
- *"I made some course resources available to my students"* (55%)

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"* (67%)
- *"It helped me to learn a new content area that I may teach in the future"* (58%)

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."

- *"I am better able to assist students in meeting our state or district standards"* (56%)

How do teachers say that this course helps their students?

- *"Students have better access to and knowledge of latest research"* (57%)
- *"The work of scientists is more understandable to students"* (55%)
- *"Students now better appreciate the natural world"* (55%)
- *"Students better connect science in school with the real world"* (52%)

How does the course compare with other professional learning opportunities?

- *"The course was more valuable than other professional development available to me locally"* (82%)
- *"The course is more valuable than other distance learning courses I have taken"* (55%)

Do teachers recommend the course?³

- *"I have recommended the course to colleagues"* (52%)

TEACHER PROFILES FOR THE SOLAR SYSTEM

A rural teacher earns credit she needs for high school certification quickly, conveniently and enjoyably

An experienced teacher enriches his strong middle school curriculum with projects from *The Solar System*

A high school teacher deepens her understanding of the learning process as well as of the solar system

³ Percentages represent teachers who checked "yes."

A rural teacher earns credit she needs for high school certification quickly, conveniently and enjoyably

Earning credit critical for continuing to teach high school science

Jennifer teaches Earth, Environmental and ACE (Accelerated College Experience) Environmental Science to 9th-12th graders in rural New York State. She has been teaching for 4 years. Although she has an undergraduate degree in Environmental Science Policy and Management, and a Masters in teaching with certification for grades 1-6, Jennifer still needed to complete 12 credit hours in order to become certified to teach high school science and remain in her current teaching position. Jennifer took two other Seminars on Science courses prior to enrolling in *The Solar System* in January 2008.

There is no college in my area that has Earth Science as a degree program where I could get graduate credit, which is what I really needed. [Taking the SOS course] allowed me to get my certification, and allowed me to keep teaching the course I am teaching today. Without being able to take the course I potentially could have lost my job. There is no place around here that has those course offerings at that level. It was a huge, huge thing because my job relied on me getting that course work done.

Finding content-based professional development more valuable than other professional development

Jennifer enjoyed learning about a subject area that she teaches on a regular basis, and especially the focus on content.

Other professional development deals with how to teach and this dealt with what I was teaching, and so it helped to broaden my perspective and information on the topic, as opposed to telling me how to teach the topic.

I thoroughly enjoyed the course because I have never taken an astronomy course before... it really helped me see the information differently and add onto the information I already knew.

Appreciating the flexibility of taking the 6-week course on-line

The flexibility of the online course was a big plus for Jennifer, who needed to be teaching full-time while taking it.

The two big things for me were the way the course is set up so that it doesn't interfere with what I'm doing in the classroom, and not having to worry about rushing home and trying to get to class. I get all of my assignments up front and I submit them online. The other thing was the blog type atmosphere and having people write back and forth [during the course], so you still get the interaction that you get in a classroom but you don't have to worry about rushing there and having 2 or 3 hours of your time taken up a week.

Another advantage was the concentrated time frame for the course.

Getting 3 credits in 6 weeks was wonderful. Not having to go into the classroom, being able to get my assignments done throughout the week, but still gaining the same amount of information that I would have if I had taken a semester course was absolutely wonderful because I was able to keep all of my other obligations at the same time.

Gaining knowledge and activities that strengthen teaching

The Solar System Course has impacted Jennifer's teaching. She is now better prepared to answer student questions, and she has an enjoyable and effective new activity that she has been able to adapt from the course to use with her own students.

When the kids ask questions, some of their more in-depth questions or the ones that surprise me, which they have seen on TV, I have better answers for them. We also did an activity where we looked at size and scale of objects within the universe and I have used that with my earth science class. I use it with my kids to do the moon and earth to give them a perspective on the size of objects out in space.

Jennifer highly recommends this course to other teachers.

I would say if you are an earth science teacher and you are looking to expand your knowledge of astronomy, [The Solar System] is a worthwhile course. If you are interested in astronomy it is a worthwhile course because I believe it hits a college level, but it also allows for anybody who has not dealt with astronomy an awful lot to pick up the information. And just seeing a different way to approach and use materials in the classroom is useful.

An experienced teacher enriches his strong middle school curriculum with projects from *The Solar System*

Finding *The Solar System* to be “top of the line” professional development

Ari teaches in a Junior/Senior High School just outside of Philadelphia. He teaches math to high school students, and a NASA Challenge class for 7th and 8th graders. Ari was involved with the NASA Explorer school program for a number of years, which provided him with considerable professional development. Ari, who enrolled in this *Seminars on Science* course primarily for his “own fun,” found the quality of *The Solar System* to be “top of the line.”

I loved it! I thought it was great! I even recommended that my dad try to take a course. I thought it was a blast. I thought it was perfect!

Integrating content and activities from the course into his robotics class

Ari also enrolled because he teaches the NASA Challenge class. That class has evolved into robotics as well, and he says that “any kind of space stuff I can mix in is good with the kids.” As he hoped, *The Solar System* course helped him develop new and interesting curriculum for the class.

I have to develop robot challenges for the robotics class where they have to program their robot to do something... I was able to develop an entire solar system unit where the robots journey through the solar system taking on different challenges. The robots have a setting where they can follow light or they can drive until they sense a certain light setting so we were able to do that that with the sun. We were able to break down the sun into its different layers and see which layers were hotter and where it was cooler, and then I was able to translate that into different reflective light settings on the robots. I was able to tie in the things we learned about the sun and tailor it for the kids so they got to learn about the different temperature readings of the corona versus the surface, versus the core.

Bringing the scale of the solar system home for his students

Ari was able to adapt another project from the course for his students as well.

We had to map out the solar system in our neighborhood to get an idea of the vast size of the solar system. I was able to give it to the kids and have them try to figure out how far everything would be. They looked online at the distances and then decided to make them around town. I was able to show the kids that from the school steps Saturn would be way down at the Hollywood Diner. The sun would be a beach ball and Saturn would be like a marble. They were able to get a real world sense of scale.

Ari's students have thoroughly enjoyed the new projects.

They love doing something different. If they have to sit there and read a book they are bored. But if they are able to get up out of their seats and find a way to do it, they love it.

Enjoying the give and take of this on-line course

In addition to the projects, Ari really enjoyed the message board and the interaction back and forth with the other participants and the professors.

Every week there would be an assignment and an essential question for the week that everybody had to answer online. I enjoyed seeing if anybody replied or if the professor replied and how I could rebut quickly, argue my point or agree.

A high school teacher deepens her understanding of the learning process as well as of the solar system

Learning more content for teaching a new Astronomy class

Kristin teaches Earth Science to 9th graders, and has recently begun teaching a new Astronomy course for juniors and seniors. She lives and works in Boise, where she teaches in the biggest high school in the state. Kristin has been teaching for 7 years and describes the professional development options available to her locally and statewide as "pretty limited." *The Solar System* course was highly relevant to Kristin because she wanted to deepen her own content knowledge and find ways to make the Astronomy class more relevant and meaningful for her students.

*I got my masters in Earth Science, which has a very small astronomy component, but not as much as I would like to have since I am teaching this class. The Astronomy class is a brand new class and I am still developing the curriculum, so I took *The Solar System* to get more background knowledge for myself and more current up-to-date information.*

Meeting the challenges of the course yields new insights about how the teacher—and her students—learn

Kristin appreciated *The Solar System* for being challenging and for providing insights into her own learning process which she thinks apply to her students as well.

I definitely would say that it made me think about how I learn. For example, I'm thinking of this one project where we had to use online maps to create a scale model—it was really challenging and it was something that I had never done before. Just thinking about how much I learned when I was so challenged, it was good for me to apply that to my

The Solar System

students. Sometimes when they complain and they are saying things like, 'This is so hard,' that might be the moment when they are actually going to learn the most.

Increased content knowledge was another goal for Kristin. She said she learned "so many different things about the characteristics of the planets, from their atmospheres to the history of how they were formed and came to have the landforms that they do."

She also enjoyed and learned from the interaction with the other people in class.

It was really beneficial to get everyone else's viewpoints and to see what their questions were about the content. It brought up other things that I hadn't thought about before. There were ample opportunities for each learner to follow things that really interested him or her, specifically on the discussion board.

Accessing up-to-date content and resources for her classroom

Kristin has been able to enhance her Astronomy class by accessing up-to-date content and adapting some activities directly from *The Solar System*. For example, she learned about exoplanets and planets that are newly being discovered beyond our solar system.

Although it was something that I didn't know much about before I took the course, as a result I designed a project for my students researching different planetary systems and creating models of different solar systems beyond ours, so they had to branch out beyond our own solar system.

Kristin also used the NASA website in her classroom to add knowledge that was more advanced than her textbook.

We were studying the Milky Way Galaxy and there was a report that came out on one of NASA's websites about them finding some major new research. It just happened to come out on the day we were reading about it in the book, and clearly what the book said was different than what was now being found out, and so it provided some really great examples of how science is always changing.

Overall, Kristin felt that the SOS course exemplified her own approach to teaching and learning: "try to keep it up-to-date and relevant, and to encourage kids to follow their own interests within the space of the curriculum... just how they model it in the course".