Science Camp: A Three-Year Summary

Now in its third iteration, the Montshire-Rivendell-Dartmouth Science Camp, supported by a four-year grant from the Howard Hughes Medical Institute, is a smoothly functioning collaboration that achieves far more than the stated goal of bringing excitement, expertise and relevance to elementary school science classes. Drawing on the science education resources of Montshire Museum of Science, and with the support and assistance of teachers in the Rivendell School District, the program trains Dartmouth College students to bring hands-on science to over 150 third through seventh graders in this small, rural school system. In the process, undergraduate and graduate student mentors also improve their science communication skills and Rivendell teachers receive new science materials and ideas. As one mentor remarked, “They get an amazing amount of good out of such a short program.”

The high yield Science Camp derives from its modest six-week investment results from conjoining an ingenious idea with thoughtful feedback. The idea—to place talented young scientists in elementary school classrooms to present weekly science lessons designed by experienced science educators—defines the solid core of the program. The personal connection between motivated Dartmouth mentors and receptive youngsters demystifies and personalizes science, transforming it from an arcane topic reserved for grizzled men to an accessible and relevant activity pursued by people with whom Rivendell children can identify. The power of this concept carried Science Camp through its first year, bringing rewards to mentors and children while at the same time revealing ways to improve its implementation.

Each year Montshire and Dartmouth planners have acted on feedback from teachers and mentors, collected in culminating evaluation interviews, to refine and strengthen the program. In Year 1 (2007) mentors and teachers pronounced Science Camp a success, saying that elementary school students learned interesting science and, in the words of one mentor, “that science can be fun and that they can do it too.” For their part, mentors uniformly enjoyed the experience and reported that they acquired valuable, transferable pedagogical skills. But both mentors and teachers recommended two major changes that they felt would increase the program’s impact on student learning and on mentors’ ability to communicate science effectively. First, although the 2007 science lessons were well-designed and carefully vetted, teachers and mentors recommended that lessons should be developed that were keyed to the district’s grade
curriculum, so that Science Camp activities built upon and reinforced what students were learning in the regular classroom at that time. Second, both mentors and teachers asked for closer communication among all parties, so that they could work together efficiently to make the science lessons smooth, engaging and productive.

Thus in Year 2 (2008) Montshire planners developed new weekly science lessons aligned with the curricular expectations for each grade, an effort that required doubling (from two to four) MMS education staff assigned to the project. This change alleviated faculty concerns about losing instructional time to science topics unrelated to the grade learning goals and about losing the opportunity to reinforce regular science learning. At the same time Montshire planners augmented communication with teachers, initiating a pre-Science Camp introductory meeting among teachers, mentors and science educators where participants reviewed the fundamentals of inquiry science and met together as classroom teams, exchanging information, laying out expectations and establishing rapport. Program syllabi were distributed to teachers and mentors so that everyone understood the trajectory of the experience for the students.

In the 2008 post-interviews teachers and mentors uniformly endorsed these changes. Teachers who had been uncertain about the net value of Science Camp after 2007 were now firmly on board, reporting that the 2008 experience simultaneously made science special and strengthened the regular curriculum. Mentors described a classroom experience that was even more satisfying than the previous year. Teams communicated more frequently and comfortably, facilitating the flow and integration of lessons.

To further improve what they now viewed as a very solid program, mentors and teachers who had held voluntary classroom pre-visits suggested those visits be mandatory, so that mentors could meet their students informally and get a sense of classroom dynamic before actually teaching a lesson. Mentors also asked that the Monday night training sessions be more focused, with more substantive instruction in teaching and learning. Teachers and mentors alike suggested evaluating what students actually learned in Science Camp and recommended better publicity for the culminating Family Night at MMS, a free evening event that showcased Science Camp activities and gave students an opportunity to share their excitement about science with parents and siblings (attendance had suffered due to weather-related schedule changes in 2008).

Again, program planners listened carefully and responded resourcefully. They extended the 2009 Science Camp schedule by one week, to include a classroom pre-visit. They revamped
the Monday night training session to include more rigorous instruction in teaching and learning. To deepen the connection between Science Camp lessons and grade expectations, MMS educators met with Rivendell third and fourth grade teachers and selected the respected Insights curriculum to guide teachers and mentors through Science Camp units on astronomy and electricity. Teachers made time for students to complete a pre-post exercise about science attitudes and mentors designed constructed response questions to measure content learning about their lessons. The MMS Family Night was well publicized—and well attended.

The cumulative result of tightening the curricular connection, improving mentor preparation and filling in communication gaps is a program that this year draws superlatives from virtually all participants. While teachers and mentors offered a few suggestions for further improving the program (e.g., provide the complete lesson plans in the beginning, make sure lessons include a good introduction and summary), they felt the program was, in the words of one mentor, “an extraordinary experience, wholly rewarding.” What makes Science Camp so rewarding is the wide range of benefits to teachers, students, and mentors.

**Benefits to teachers.** Teachers were pleased to have well-designed lessons and materials to support their regular science sequence and the collaboration of energetic and creative young scientists in the classroom. They were delighted to see their students expanding their understanding of science and having fun at the same time. Science Camp also gave them a valued opportunity to reflect on their own students and teaching practice.

**Benefits to students.** Teachers and mentors both felt that students understood the concepts they were presented in Science Camp—none of them trivial, especially for young students. As one mentor said, “Our class was so diverse academically, but in the end, they all got it. It was an amazing feeling—they really got it!” Perhaps more important, the presence of personable young scientists changed students’ perception of science as an enterprise and as a profession. As one teacher explained:

The mentors made being a scientist seem less abstract. They were young and seemed more “real,” so becoming a scientist seemed more attainable. And they learned about the possibilities of science—“Wow, you mean that’s science?” They saw that there was so much to it.

A pre-post exercise asking students to write five things that come to mind when they think about a “scientist” showed that, overall, students had a more positive and personal view of scientists (and
by implication, science) after Science Camp. “Constructed response” answers to novel content questions developed by mentors confirmed that most students had mastered the material.

**Benefits to mentors.** All Dartmouth mentors said the program was worthwhile and that they would do it again—or recommend it to friends (in fact, most already had). They cited two main reasons why: the opportunity to give back to the community and the opportunity to become better science communicators. The combination of MMS pedagogical training and on-the-ground classroom experience gave mentors insights into teaching they will take with them into any teaching situation, from the classroom to the boardroom. They learned that the audience for science is diverse and that each must be addressed on its own terms, a job that requires a lot of thought and planning. They learned that leading listeners to understanding is more effective than telling them facts. And as they stepped back and thought deeply about science concepts and processes, many found their own interest in science reinvigorated. In their own words:

> Teaching is not easy. It takes a lot to put together an effective lesson, to actually address an audience, figure out whether they’re getting it or not. It’s very different from doing a lecture. It was fun and exciting to figure out how to explain things so that kids would understand them.

I learned how to refine my communicating science to non-scientists. Not everybody has a science PhD. You have to think about how to explain things, relate science to things that are relevant to the listener. You have to work with them at their level of understanding.

This provides inspiration to keep going through grad school. It reminds me of why I like science.

This influenced my life. As a last year grad student, this was an uplifting experience. I realized that science is not just lab work. I taught this to the kids and to * myself.*

The structure and supporting elements of Science Camp enhanced the core learning and teaching activities, adding social opportunities, altruism, new vistas and even tasty meals to the experience. As one mentor summarized, “It was perfect. It was great to be in class, it was great to be away from school, the students were inspiring and MMS was great.”