Montshire-Rivendell-Dartmouth HHMI Science Camp

Evaluation Report Addendum

Based on Interviews with Rivendell Host Teachers

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This report, based on interviews with the eight Rivendell teachers who hosted HHMI-sponsored Science Camp in their classrooms in January and February 2007, accompanies and extends the evaluation report of May 2, 2007, that documents the Dartmouth mentors’ Science Camp experience. Interviews with the second, third, fifth and sixth grade teachers were held at Westshire School, Samuel Morey School and Rivendell Academy on May 22, 23 and 24. Teachers responded quickly to the interview request, an indicator of their interest in the program and their desire to participate in making it more effective. The interview protocol is included as an appendix to this report.

The goals of the six-week Science Camp, a collaboration among Dartmouth College, Montshire Museum and the Rivendell (NH/VT) School District, are phrased entirely in terms of changing the elementary school students’ attitudes toward science. Neither the evaluation based on the Dartmouth mentors’ experience nor this one, drawing upon the host teachers’ observations and pedagogical expertise, addresses those goals directly. Rather, these reports view the efficacy of the program in terms of student learning from the perspectives of the two groups of adult participants in the program. As the preceding report described the Dartmouth mentors’ experience, this addendum explores the experience of the Rivendell host teachers, likewise asking whether Science Camp was a worthwhile experience for them, what factors contributed to its value and which, if any, diminished it. If sustainability is the goal, then all key personnel must find satisfaction and value in participating in Science Camp.

Rivendell host teachers judged Science Camp to be a worthwhile experience for their students, but they were more guarded in their appraisal than were the Dartmouth mentors. Evaluation is always a “compared to what” question, whether evaluators make the comparison consciously or not. For the Dartmouth mentors Science Camp was a rare opportunity for hands-on teaching experience whose value in learning and enjoyment far outweighed the modest cost in time and effort. For the teachers, however, hosting Science Camp meant sacrificing 90 minutes of limited instructional time for six weeks and placing their students in the hands of enthusiastic but inexperienced instructors, without having any clear authority to intervene to maintain standards of pedagogy and behavior they work hard to establish and sustain. The cost to teachers who care deeply about their work, as these teachers do, and who are judged in part by
their students’ performance on standardized tests, is thus much higher than to the Dartmouth students; it is not surprising that they are more exacting in their assessment of the benefits.

**Value of Science Camp to Rivendell Students**

Host teachers, on average, gave Science Camp an overall grade of “B+.” Fifth and sixth grade teachers were more positive in their assessments than second and third grade teachers; no one offered a grade below “B.” Teachers said Science Camp was worthwhile for their students because it made science special and exciting, exposed students to new ideas and skills, and provided an opportunity to work with young scientists. They noted that their students looked forward to Wednesday afternoons and talked about Science Camp afterward. As one noted, “They were into it. It was fun science time.”

Teachers’ appraisal of elementary students’ learning paralleled that of the Dartmouth mentors. They believe their students learned something (but not a lot) about the science concepts illustrated—reflection, symmetry, density, gears—and took away important understandings about science and how it is done. The insights they attributed to students’ Science Camp experience were:

- Science is fun.
- Science is connected to real life and can be done at home with materials there.
- How to ask questions, observe and experiment.
- There are explanations for things. Things don’t just happen; if you look at them, you can figure out how things work.
- Science takes time and tenacity; problems aren’t solved immediately.
  
  * A new image of the scientist, including women.

Teachers felt that the lessons were, in general, age appropriate and that the materials were well designed. The first two fifth/sixth grade lessons about motion translation and the suspended golf ball experiment in the lower grades drew special praise. The gear lessons fit well with the existing curriculum, were manageable in the time allotted, and illustrated the underlying concept clearly. The golf ball suspended for several weeks in a saline solution held students’ attention for weeks, allowing them to revisit the concept repeatedly, thus extending their understanding. Teachers also had suggestions for improving the lessons.
• **Align the lessons with the curriculum.** While many teachers mentioned the value of exposing students to special topics they would not otherwise encounter, for five teachers that value was less important than the pedagogical and scheduling gains of aligning Science Camp lessons with the existing curriculum. As one teacher said, “This is a coverage issue. It’s just hard to give up that much time.” The loss would become a gain if Science Camp topics reinforced and elaborated the science students were studying (and would be tested on) as part of the regular curriculum.

• **Save time at the end of the lesson for reflection.** Four teachers mentioned this and they were emphatic. One insisted, “They must save time for sharing.” Another who made the same recommendation pointed out that “this is a learning experience, not just an activity.” In addition to verbal sharing at the end of the lesson, three teachers suggested some kind of follow-on activity—perhaps a question to answer or problem to be solved—that would both help students deepen their understanding and also provide documentation of learning.

• **Reduce the lesson length, at least for second and third graders.** Three of the five lower-grade teachers said that 90 minutes was too long for their students to stay focused; several pointed out that no lesson in their classroom runs more than one hour.

• **Simplify lessons.** Using the phrase “less is more,” three lower-grade teachers recommended focusing on just one activity per visit rather than linking two related activities. “Kids need more time to explore and question,” one lower-grade teacher observed. Another lower-grade teacher pointed out that students should be able to do the activities without adult help, mentioning specifically that the mirror lines exercise required assistance for many students, slowing the lesson and reducing students’ sense of accomplishment. One teacher suggested connecting activities more closely to real-world applications as a way of making the concept clearer.

Two of the fifth/sixth grade teachers felt the chemistry lessons were “too complicated” to execute and hard to understand; students “had to take too much on faith.” The other upper grade teacher pointed out that chemistry did not align with the curriculum. Like the Dartmouth mentors, one teacher felt the mechanics lesson using Legos elicited pre-existing feelings about the equipment that interfered with the lesson.

It is an index of teachers’ interest and support for Science Camp that they came to these interviews prepared (sometimes with notes) with constructive suggestions for improvement. All
felt that Science Camp was worthwhile for their students and they valued the excitement about science the program generated. As one teacher reported, “My students did better on later science we studied because of Science Camp. They learned to be more efficient in their inquiry. For science after Science Camp, they were ready to roll.” Their comments make clear that they believe Science Camp is a concept worth making even more effective.

**Value of Science Camp to Rivendell Teachers**

All the Rivendell teachers said they were pleased to see their students engaged and excited about science, but only half—including all the upper-grade teachers and one lower-grade teacher—would volunteer next year for the program in its present form. Those who weren’t sure whether they would want to participate again cited particularly the over-long sessions (for second and third grade) and the lack of alignment with the curriculum. But as we explored Science Camp from the teachers’ perspective, other values and costs came to light that probably also contributed to the bottom-line assessment represented in the decision to volunteer.

When we asked teachers what *they* took away from Science Camp, five of the eight mentioned that they learned new ways to teach science (several said they also learned some science). They said they learned “neat experiments and ideas for future lessons,” “new activities,” “how to question” and “how to approach a topic in a different way from what’s written in the curriculum.” As one put it, “I stole skills and ideas from Greg!” Clearly teachers were attentive to the inquiry methods used in the Montshire activities and benefited from having them modeled in their classrooms.

They were also paying attention to how their students behaved during inquiry science. Four teachers noted that Science Camp gave them the opportunity to step back and observe their class and to reflect on teaching. For one teacher, observation brought the realization “that kids are natural questioners and observers and really enjoy science that is hands-on and fun.”

Two teachers said the benefit of Science Camp was working with the Dartmouth mentors. One described pleasure at “watching them grow” in the classroom; another was “energized by the mentors’ enthusiasm.” A third appreciated having competent “scientist people” working with the students.

Teachers uniformly said they liked the Dartmouth mentors personally and enjoyed working with them. They described mentors as knowledgeable, enthusiastic, positive, flexible,
reliable and good with kids. “Liking kids,” one teacher added, “is half the battle.” However, all but one teacher identified shortcomings in mentors’ pedagogical skills which, combined with teachers’ uncertainty about their respective roles, compromised the classroom experience for most teachers.

Half of the Rivendell teachers (including all the Westshire teachers) had very little idea before Science Camp began how duties and responsibilities were to be shared between them and the Dartmouth mentors. As one said, “That’s my big question. What is my role, especially regarding supervision of the Dartmouth students?” Another concurred, saying, “At times I felt things were going too slow, but I didn’t know what I was supposed to do. I need to understand my role better. This is the biggest issue for me.”

Those who said they did understand their role saw it, in the words of one teacher, as “they [the Dartmouth students] would present and I would pull strings in the back.” The teacher went on to say, “I’m OK with this, but it’s hard to sit back when I know how to fix a situation.” In the end, the division of labor into “teaching” for the Dartmouth mentors and “managing behavior” for the Rivendell teachers proved not only unsatisfying but unworkable. All teachers eventually intervened in the lessons more than they believed they were intended to do. One teacher, who saw teaching and managing behavior as inseparable aspects of a single endeavor, described the situation this way:

I thought that I would just help with behavior, but that is tough. Managing behavior is part of teaching. Ultimately I engaged the kids more, asked them probing questions and got them to think more deeply. This felt OK to me. I could sometimes tell when they [the Dartmouth mentors] needed help. It would be good to work this relationship out early.

Another teacher, who also understood the teacher’s role to be “managing behavior, handling discipline, providing extra eyes, ears and hands,” said:

I wanted to jump in more so that I could add an extra brain as well. I knew what to expect, I could see ahead where problems would arise. Actually, I jumped in quite early.

The combination of unclear, unrealistic roles and inexperienced Dartmouth mentors created a situation that was sometimes uncomfortable for Rivendell teachers. As skilled and experienced teachers who knew their students well, it was hard to watch opportunities missed or lessons go off track through lack of classroom management skills. They could see when pacing
was off or when it was time to refocus or transition, for example, but when they intervened to assist (as they often did) they were never sure that they were acting appropriately for Science Camp. Teachers understood the Dartmouth students’ need and desire for full teaching responsibility; at the same time, they felt a responsibility to their classes. Thus while their students were having fun learning new science and the Dartmouth mentors were having fun teaching it, the Rivendell teachers were often struggling with cognitive dissonance.

Teachers recommended a clearer definition of respective roles and better training for the mentors to resolve this dilemma. Most teachers appear ultimately to have achieved a level of classroom intervention that was satisfying to them; Dartmouth mentors also seemed pleased with the nature of support provided by the teachers (only one mentor felt his/her experience constrained by a teacher’s activity in the classroom). Thus one outcome of this pilot year was to find a balance of classroom activity that benefited both parties. That arrangement needs to be described, discussed and acknowledged beforehand. Teachers and mentors need to talk directly about when, how and why teachers will assist with behavioral and instructional matters, so that they can proceed from the beginning with a mutually agreed-upon protocol.

Teachers also felt that the Dartmouth mentors needed more training in classroom management techniques. While they recognized that classroom management is perhaps “best learned by doing,” they also felt that they had insights to offer, both in general and regarding their own students. Most suggested that Dartmouth mentors visit their assigned classrooms before Science Camp begins to observe the class in action and meet the students. At the same visit, they should talk with the teacher about their classroom expectations and management techniques and about the students’ abilities and backgrounds. This information would not only prepare Dartmouth mentors to teach better, it should also give them greater autonomy in the classroom. As one teacher who recommended a pre-visit explained, “I don’t want to control the class. I want them to have the full experience.” Several others suggested short de-briefing sessions after Science Camp lessons where Rivendell teachers could serve as teaching coaches, sharing their observations and recommending strategies. Some teachers noted that offers to contribute more time to Science Camp from their already-complete days should be underwritten by an incentive to do so, perhaps a release from in-service time or a donation of materials to their classrooms.
Teachers also felt that Montshire educators could expand their pedagogical training for mentors; several singled out the asking of productive questions as an area where Dartmouth students would benefit from further instruction. One suggested that this activity might be modeled by Rivendell teachers acting as teachers and Dartmouth mentors as students, who would then analyze the teachers’ roles. A second area where teachers thought Dartmouth students might be better prepared concerned pacing, things like how to get started (introduce themselves, set expectations, do “ice breakers”), how to know when students are paying attention—and how to get them back when they aren’t, when to slow down to allow for exploration, and how to refocus and transition to a new activity. Several suggested that rehearsing the lesson before presenting it, rather than just experiencing it as a student, might help Dartmouth mentors identify places in the lesson where these skills might be needed. Several others recommended that Dartmouth mentors spend more time sharing their classroom experiences with one another, especially at similar grade levels.

At every turn, Rivendell teachers told us that they should be “in the loop” when programs are planned for their classrooms. One reported that “there was a lot of grumbling in the halls” about lack of communication in the early weeks before Science Camp lesson plans were shared with host teachers, and interviews revealed that many were discomfited by the failure adequately to define and communicate the roles of host teacher and Dartmouth mentor. But better communication with Montshire is just a start. Teachers have experience and expertise to offer that can improve the program. A pre-visit would improve the efficiency of Science Camp by helping classroom teams establish a solid working relationship early on, rather than waiting for this to evolve as the program progresses. In the pre-visit to the class and through regular debriefings, Rivendell teachers can help Dartmouth mentors develop their classroom management skills, improving the experience for everyone involved. Teachers also felt that more instruction in classroom management and more practicing of the lesson, beyond simply learning it, would yield a more productive lesson.

Conclusions

It is important that Rivendell teachers and Dartmouth mentors, from their different perspectives and with their different investments in the program, both felt that Science Camp was worthwhile for Rivendell students but also identified the same shortcomings in Science
Camp and proposed the same solutions (see especially pages 9 and 13 of the May 2 evaluation report). Both called for a closer relationship between teachers and mentors that included a pre-visit to become acquainted with classroom methods and personalities and for some sort of feedback and coaching along the way. Both also recommended that mentors receive more instruction in pedagogy before Science Camp begins. Mentors perceived in themselves the same inadequacies in classroom management skills that the teachers attributed to them. Both teachers and mentors also recommended tighter integration of Science Camp lessons with the existing curriculum so that Science Camp activities would reinforce and extend students’ other science learning.

Like the teachers, mentors in the fifth and sixth grades described their experience as more satisfying than did teachers and mentors in the lower grades. Mentors in the second and third grades worried about whether younger students were grasping concepts; teachers in those grades recommended simpler, shorter lessons with more time for exploration. Both mentors and teachers in the fifth and sixth grades agreed that the mechanics lessons, with the exception of the Legos lesson, were very effective, while the chemistry was complicated and sometimes hard to understand.

One teacher pointed out that even if nothing were to change, new lessons will need to be developed for the third and sixth grades for Winter 2008. Since one set of lessons served the lower (second and third) grades in 2007 and a second set the upper (fifth and sixth) grades, next year’s sixth and third graders will already have encountered the existing activities.

Several teachers raised the issue of scheduling. Two lower-grade teachers felt that spacing lessons closer together, perhaps three times a week for two weeks, would increase the impact of the lessons, but an upper-grade teacher recommended a longer time between lessons to allow for more regular work. One upper-grade teacher simply felt that Science Camp was too short. “We just got established and they were gone.” Given the challenges of matching the Dartmouth quarter system with the public school calendar, the likelihood of finding a different workable schedule is small. Rather, these comments serve respectively to underscore the need for continuity between lessons, the need to align Science Camp topics with the regular curriculum and the need to get mentors comfortable in their roles as quickly as possible.

*A note about sustainability.* Pilot programs are established as trials in the hope that, if successful, they will be sustained after the funding period. As a first step, teachers’ concerns
must be addressed if Science Camp or any of the pedagogical elements it includes are to be adopted by them as permanent parts of the Rivendell science curriculum. Fortunately, teachers’ recommendations—especially connecting lessons to the existing science curriculum—improve the prospects for sustaining the program. If the interactive, hands-on activities of Science Camp build upon and enhance the existing curriculum, the incentive for teachers to continue to use them is vastly increased. Several teachers also mentioned that however much they may endorse Science Camp lessons, they lack the material resources to carry on with them. Leaving the district with some reusable materials for interactive science would also increase the likelihood that the innovative pedagogy of Science Camp becomes part of the regular Rivendell offering.
Appendix

Teacher Interview Protocol
Dartmouth-Montshire Science Camp at Rivendell
Winter 2007

Introduction. Thanks. Confidential/anonymous.

I. When you first learned that your classroom would be participating in Science Camp, how did you understand the goals of the program?
   • Before it started, what were your expectations for how the program would work?
     [Prompts: What would actually happen in the classroom? Did you think this was a good idea? Why or why not?]
   • In a sentence or two, which we’ll unpack as we go along, what is your overall assessment of Science Camp now?

II. For the next part of the interview I’d like to talk about the science lessons themselves.

1. In your view, were the lessons age-appropriate?

2. Were these projects that your students could reasonably accomplish in the time and with the materials they had?

3. What do you think your students learned from the lessons?

4. Do you have any suggestions for ways the science lessons could be made more effective for your students? [Prompt: Different topics? Different kinds of activities? Others?]

5. Thinking about the overall experience for your students, what do you think they took away from Science Camp?

6. Do you think this was a worthwhile experience for your students? Why or why not?

7. What could we change about the program to make it a more worthwhile for your students?

III. Now I’d like to talk about your experience in the Science Camp classroom.

1. First of all, how did you initially understand your role in the program?
   • Did you feel prepared to fulfill that role?
   • Was the role pleasing to you?
   • Did your understanding of your role or your comfort with it change over time?

2. Please describe your relationship with the Dartmouth mentors.
   • Was that relationship comfortable?
• What do you think the Dartmouth mentors got out of the experience in your classroom?

3. What were the mentors strengths as science teachers? Were there aspects of their teaching that could (or should) have been better?
   • Are there skills and understandings they could realistically acquire—in their training or in some other way—that would make them more effective science communicators in the classroom?

4. What could we change about the program to make it more worthwhile for the mentors?

5. Please tell me something you took away from this experience.
   • Why did you pick that to tell me?

6. Now I’d like to ask you the same thing I asked about your students: taking into account the time and effort involved, was this a worthwhile experience for you? Why or why not?
   • If this were a volunteer activity next year, would you do this again? Why or why not?

7. What could we change about the program to make it more worthwhile for you?

8. Would you like to comment on the organization of the program—scheduling, materials, information sharing, organization of personnel, etc.

IV. Is there anything else you’d like to add about the Science Mentor program that we haven’t talked about already?

Thanks so much for your time.