

**“A HEAD START ON SCIENCE”**

**FINAL EVALUATION**

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# **“A HEAD START ON SCIENCE”**

## **Final Evaluation Report**

### **EXECUTIVE SUMMARY**

Funded primarily by a grant from the Department of Health and Human Services, “A Head Start on Science” was designed to demonstrate an effective way to improve the Head Start teaching staff’s comfort level with and competency in teaching science, and to increase the quantity and quality of science experiences of Head Start children. The program originated as a collaborative effort between the Department of Science Education at California State University, Long Beach and the Long Beach Unified School District. Dr. William Ritz, Project Director, provided the underlying vision for the project, along with Dr. Ann Wilmshurst, currently Long Beach Head Education Manager. The project was expanded during its second year to include 33 agencies under the Los Angeles County Office of Education (LACOE) Head Start Preschool Program, and the Head Start Program in Syracuse, New York (PEACE), in collaboration with Dr. Larry Shafer at Syracuse University.

During the formative evaluation of “A Head Start on Science,” the project evaluator provided frequent feedback to project staff, and offered observations, comments and suggestions for ongoing modification as the project developed. The summative evaluation was designed to determine to what extent participating in the program would encourage teachers to engage in more investigative science activities with their children, and to employ more appropriate questioning strategies. Using data from questionnaires, interviews with teachers, aides, supervisors, administrators and staff, as well as from

observations of Head Start classrooms, the evaluation sought to determine changes in teachers' attitudes towards science, and their confidence level in conducting science activities with their pre-school children. The evaluation also explored how readily and effectively the model program, designed and first tried in Long Beach (LBUSD), could be transported to a larger Head Start Program (LACOE), and to one geographically remote from the original project (Syracuse, NY). This report constitutes the final evaluation report for this project.

All of the data indicate that the several components of "A Head Start on Science," both in their original form and in two subsequent replications, were clearly successful in meeting its two major objectives: (1) increasing Head Start teachers' comfort level with science, and (2) increasing the number and quality of science-related interactions in the Head Start classroom. This occurred both in environments where the teachers were quite "science naïve," and in those where teachers were initially more comfortable with science.

The project's success appears to be attributable to several factors that maintained constant in each of the three different settings:

- Positive expectations that these teachers, many with limited educational backgrounds, CAN learn to be comfortable with science and to facilitate powerful Science interactions with preschool children;
- The "Encouraging a Sense of Wonder" theme, which had a profound impact on curing the "science phobia" unfortunately engendered by our current educational system;
- A strong overall model consisting of a Summer Institute plus ongoing support;
- Strong and effective leadership from the project staff; and
- A practical institute model incorporating knowledgeable and well-prepared

leaders, an informal atmosphere, well-chosen activities, appropriate facilitation, modeling of process, and thoughtful reflection.

Transplanting “A Head Start on Science” to a much larger program locally (LACOE), and simultaneously to one somewhat smaller but geographically remote (Syracuse) provided a good opportunity to examine what it takes to make the model work elsewhere. Clearly, all of the features mentioned above are crucial. But, to wider dissemination, ways must be devised to reduce dependence upon Long Beach project staff. Continuing with the facilitator model, and specifically training those teachers and supervisors who have been through the program to share/conduct further Institutes might be one possible solution. Also, the results point to the need to train a significant percentage of an agency for an extended period time with adequate follow-up support if real reform is to happen. Such commitment of time and resources requires the backing of not only teachers but higher agency administrators as well. Finally, the experience of “A Head Start on Science” indicates that the workshop developed in Long Beach may have to be modified to fit settings where teachers are further along in science, and may be ready for the next level. In such settings, for example, teachers can deal with more science concepts and explore more issues in early childhood education. A needs assessment performed before undertaking an Institute could help planners tailor the program to meet the needs of its audience.

These considerations aside, there is no question in the evaluator’s mind that “A Head Start on Science” was successful, and that the ultimate beneficiaries will be the children whose earliest memories of “school science” will be of fun, excitement and wonder. The challenge, of course, will be to keep that “sense of wonder” as they progress through the many years of formal education that lie ahead.

## **WHAT IS “A HEAD START ON SCIENCE”?**

Although Head Start has had a powerful impact on the nation’s youngsters, most Head Start programs, regardless of their large-scale successes, have lacked an effective science component. Indeed, for too many Head Start teachers, teacher aides, and home visitors, the word “science” conjures up some very uncomfortable feelings and remembrances. Science was the subject most dreaded in school. Science is a subject only for the elite. Science is something that is only done by bearded old men in white coats who smoke pipes and wear horn-rimmed glasses. Many readily admit that science makes them uncomfortable. Some notable exceptions notwithstanding, science engenders little or no enthusiasm among many Head Start teachers, who feel neither comfortable with nor competent in science. Consequently, too few Head Start children become involved in meaningful science experiences.

This realization prompted William Ritz, Chair of the Department of Science Education of the California State University, Long Beach to join with the Head Start Program of Long Beach, California Unified School District to create a project entitled, “A Head Start on Science”. Funded primarily by a grant from the US Department of Health and Human Services, the project was designed to demonstrate effective ways to improve the Head Start teaching staff’s comfort level with and competency in teaching science, and to increase both the quantity and quality of science experiences of Head Start children.

The basic design of the project is seen in Figure 1. During its first year, the entire Head Start staff of teachers and teachers aids of the Long Beach Head Start Program participated in science training. During the following year Head Start participants were trained from both the Los Angeles County Office of Education, and the Syracuse, New

York Head Start Programs. The Southern California programs were conducted through the Department of Science Education at California State University, Long Beach; the Syracuse program was coordinated through Syracuse University.

## **A HEAD START ON SCIENCE**

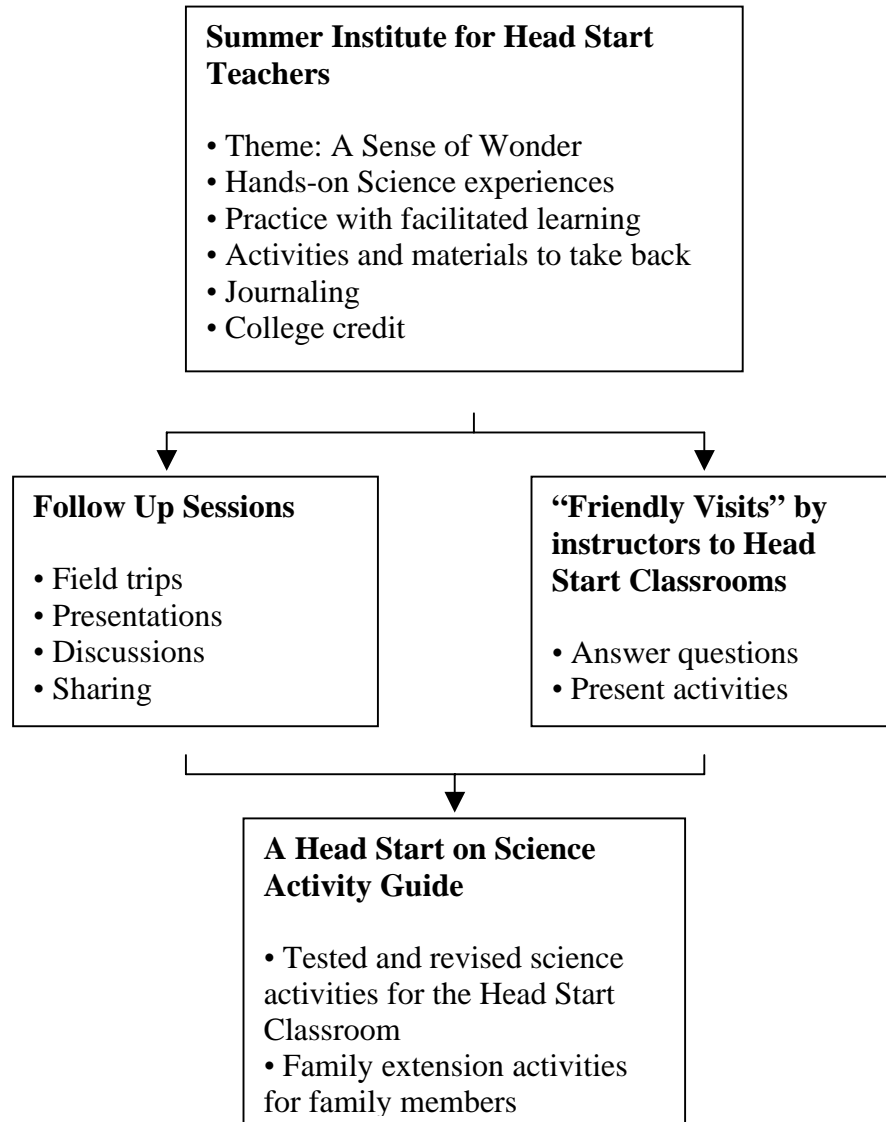


Figure 1 (Essential Components of “A Head Start on Science”)

The evaluation for “A Head Start on Science” consisted of

- visiting classrooms both before and after training;
- attending Head Start planning meetings, summer Summer Institutes and follow up events;
- interviewing Head Start teachers, supervisors, and administrators;
- conducting surveys of Head Start teachers and supervisors;
- reading teachers’ journals.

Project formative provided consisted of frequent feedback to project staff, offering observations, comments and suggestions as the project developed. The summative evaluation was designed to determine to what extent participating in the program encouraged teachers to engage in more frequent investigative science activities with pre-school children, and use more appropriate questioning strategies. It sought to determine changes in teachers’ attitudes towards science, and their confidence level in conducting science activities with their children, as well as to estimate the likelihood of these changes being permanent. The evaluation also explored how easily and effectively the model program, designed and first tried in Long Beach (LBUSD), could be transported to another, larger local Head Start program (LACOE), and to another site (Syracuse, NY) geographically remote from the original project. This report constitutes the final evaluation report for this project. Previous interim reports are included in Appendix IA-ID.

# THE LONG BEACH EXPERIENCE

## Baseline

To provide baseline information on teacher practice in Long Beach Head Start centers, the evaluator visited selected Head Start classrooms at three sites, each with multiple classrooms. She brought to each classroom an “activity box” containing either (1) snails—with water, eye droppers, magnifying glasses, and leaves, or (2) magnets—with a collection of metallic and non-metallic objects, and told the teachers to simply introduce these materials as they would normally do. She videotaped the interactions among the teacher, the children, and the materials. Using an “observation protocol” (See Appendix II) she looked for the following in each classroom:

- Grouping of children: To what extent does the teacher ensure all children get hands’ on experiences?
- Body language of teachers. To what extent do they encourage children to dive in and explore?
- Questioning strategies: How do the teachers pose questions? How do they respond to questions from children?
- Making it relevant: How to teachers relate what children do with the organism/magnets to the children’s own experiences?
- Other pertinent observations: For example, what evidence of child-involved science activity is visible in the classroom? To what extent does the teacher connect the magnet/snail activity with other objects in the room?
- Teacher conversation with researcher. How much understanding of the science concepts behind the activity does the teacher demonstrate? How comfortable does she seem with the snail/magnets?

She analyzed the questioning strategies that the teachers used and to what extent they encouraged children to observe, investigate, and explore. These observations revealed that many Long Beach Head Start teachers appeared to be weak in both their

confidence about science and their ability to engage children in meaningful science experiences.

The questionnaire administered before the first Summer Institute (see Appendix III) appeared to reinforce these observations. While the open-ended responses revealed that most of the teachers claimed to be aware of the importance of a hands-on, inquiry-based approach to teaching science, only 10% of the 59 teachers responding, reported that they were “very comfortable” with science (53% said they were “comfortable”), while 22% reported being very uncomfortable, and “15%” somewhat uncomfortable.” Similarly, 46% of the teachers reported that they did science once a week or less, while only 35% said they did it every day.

## **Summer Institute**

At the urging of the Long Beach Head Start Program, the first “A Head Start on Science” Summer Institute was expanded from the proposed 30 participants to a total of 97 (one from every classroom), and was modified to employ a “trainer of trainers” model. To accommodate these numbers, twenty seven Head Start “lead” teachers received intensive training during the first five days of the Institute (Friday through Thursday, August 16-22, 1998); they then served as “facilitators” for the larger group of teachers and teachers’ aides which met during its final four days (August 26-29, 1996). The training staff consisted of the Project Director, eight leaders (all with extensive experience in either elementary science or early childhood education), one science consultant, and the Project Coordinator.

Daily observations during the Long Beach Summer Institute, in-depth discussions with staff and participants, written comments from leaders and participants, and reflections by leaders on the phone and at the first follow-up meeting, clearly indicated

that participation in the summer Institute had a tremendous impact on these teachers. The tone of ALL of the Participant's responses was overwhelmingly positive. The following comments, taken from the teachers' journals, are typical:

“Definitely the best hands-on workshop that I have attended since I began working with the LBUSD.”

“This has been the most information that was really useful in the classroom.”

“This was the greatest learning experience I ever had. I can take it to the children.”

The Institute was especially effective in involving the participants in doing science through hands-on activities and introducing them to questioning strategies. One of the most obvious results was that the teachers (especially the facilitators) displayed a new confidence in their own ability to involve Head Start children in science. The major Institute theme, “Encouraging a Sense of Wonder,” permeated the activities, and participants reflected their new appreciation for the nature of science and how to teach it, both explicitly in their conversations and writing, and implicitly through their often unbounded new enthusiasm for science:

“I enjoyed having many preconceived notions regarding science dismissed, such as: science is boring, everything about science ends without an answer (everything just up in the air). Every day is filled with wonder, wow! What an appropriate theme for this training.”

Although necessity mandated a two-stage training process, it became one of the strongest features of the Institute. The model appears to have worked so well because:

- the hard work by the project staff prepared the facilitators with the self-confidence they needed to be effective;
- the second week gave the facilitators an immediate opportunity to try out their newly learned questioning and other process-oriented skills;

- there were enough facilitators assigned to each classroom so that they supported each other; and
- the Head Start lead teachers (who became facilitators during the second week) were already familiar with both the culture of Head Start and the teachers with whom they facilitated.

Comments such as the following from the facilitators were typical:

“I feel very comfortable knowing that in these two weeks I learned how to facilitate others by sharing ideas and taking ideas from others.”

“At first I was uncomfortable, shy, hesitant and didn’t have any idea of my job. But through the 5 days training from all the Cal State Facilitators, I felt comfortable and gave me ideas of how to be a good and effective facilitator.”

Most of the activities were very well received. They were hands-on, interesting, and fun, used every-day objects and organisms, and modeled exemplary science teaching strategies. The activities did a good job of getting the participants enthusiastic about science, and giving them confidence in their ability to introduce children to science. Participants and leaders felt the activities that worked especially well fell into three categories:

- adult/child activities, where the same activity was approached both from the perspective of both an adult and child learner;
- family extension activities, which provided techniques for involving parents and other care givers in the science activities; and
- activities that involved making materials, such as planting, collecting insects, water play, etc.

In addition to the “encouraging a sense of wonder” theme and the two-stage training process and specific activities, leaders and participants pointed to other features of the Institute contributing to its success:

- the opening activities that worked well to make everyone relax and feel at ease;
- the knowledge, preparedness and flexibility of the leaders, their respect for their audience, and their sense of humor;

- the socialization and team building with co-workers (the Institute helped establish friendships among teachers from different centers—this can help teachers develop a strong support network);
- the daily feedback provided by participants on what they understood or where they needed assistance;
- the relaxed atmosphere, including such activities as the daily early morning donut and coffee “friendly time,” and the pot luck, which helped create bonds between the leaders and participants;
- the practice of having leaders model processes, such as using questioning strategies or teaching to an adult vs. a child, before participants were asked to engage in the process themselves;
- the idea of teaming a science leader with one from early childhood, which helped balance the Institute instructional staff; and
- the practice of daily journaling, which helped participants to reflect on their day, and to consolidate their understandings.

Overall, the evaluator believes that the most powerful effect of the Institute was changing teachers’ attitudes towards science, which established the foundation for all subsequent change. The teachers were freed from their fears of teaching science (and their own ignorance of science content). The teachers summarized it best in their journals and questionnaire responses:

“I have another, different point of view about science. [She says that she always liked science and included it every day in her class.] But for me sometimes I felt like I needed to know more how to get children excited and interested in science...Now I know that I only need to provide the materials and activities and let children discover by themselves without “teaching.” This will make my work easy and less stressful. Thank you.”

“It has broadened my knowledge of what science is and how to apply it in every area in my classroom. Also that science can be fun.”

“I came here thinking that this was going to be another boring class with nothing but lectures, formats, and a lot of writing. Boy oh boy was I wrong. There was so much hands on. I did everything. It opened my sense of wonder. Thanks. Believe me, when I do back to my classroom my science area is going to be a lot bigger and I will teach it to my children in the same fun way all the facilitator leaders taught me.”

## **Follow Up**

Following the Summer Institute, the evaluator attended all “A Head Start on Science” post-Institute activities, conducted site visits to Head Start centers, interviewed teachers and Head Start staff, and gathered data from teachers via questionnaires and from their journals. Each of these activities yielded data suggesting that the Head Start classrooms in Long Beach have improved both the quality and quantity of science experiences being offered to the children in the program.

Three post Institute follow-up meetings were held, each gathering together the Head Start teachers for a half-day training session. These sessions allowed the teachers to reestablish contacts and friendships initiated during the Institute, learn more about science and how to teach it to very young children, and maintain the spirit and enthusiasm for the project that was so evident during the summer. In addition, follow up “friendly visits” were given by the Institute’s lead teachers, to provide personal help and guidance to the teachers, to show them some new activities, and to answer any questions they might have.

Based on interviews with teachers during the follow-up sessions and on their written comments and subsequent conversations, the follow up meetings were very successful. The first session, at El Dorado Nature Center in Long Beach, was especially well received. Many Head Start teachers have had very little experience with the outdoors. For example, one teacher commented in her journal “...it was the first time I

saw live bunny rabbits running around the park, and a beautiful white bird flying over the pond and turtle[s] swimming in the water.” Although some expressed initial dismay about venturing into nature on a very soggy wet day, none regretted the experience. Teachers also responded well to a talk on science and young children by Dr. Mary Rivkin at the second post-summer workshop, and became very involved in observing and “asking questions” of some garden snails. A third follow-up activity, not attended by the evaluator, was a visit to the Cabrillo Marine Aquarium, a hands-on marine environment. There participants walked through the aquarium, tired out experiments at the water’s edge, hatched grunion, and used microscopes to view sea life.

The evaluator visited a total of 9 Head Start classroom sites (3 in November, 3 in March, and 3 in April, most with multiple classrooms at each site), taking extensive notes and videotaping children and teachers at each site. At the vast majority of the sites observed, science has obviously taken a prominent place in the classroom—science areas were filled with interesting hands-on materials, and displayed children’s work, such as “tornado jars,” “hairy potatoes,” seedlings in pots or in bags in the window. Many rooms had living organisms—fish, animals, and plants—and teachers had developed activities around them, including field trips incorporating observation. Teachers reported that they now include much more science in their lesson plans, and many recognized that activities they have always done with their children (like playing with “play dough” and making bubbles) actually related to science experiences.

Many of the teachers observed did a fine job of carrying out facilitated science teaching, engaging the children by using open-ended questioning strategies and encouraging them to explore on their own. Since teachers entered the program demonstrating a spectrum of different attitudes towards and experiences with science, however, progress was, as expected, not uniform. Some sites showed much more

evidence of science activity than others. The most challenging difficulty faced by the teachers, even as they included much more science in their curriculum, seemed to be relinquishing the role of “information giver,” and letting the children explore and discover for themselves. (This problem is not unique to Head Start teachers, but plagues science education K-16!)

In addition to interviews with teachers made during site visits, the evaluator spoke with the Head Start staff about the project. Dr. Ann Wilmshurst, who as an occasional consultant to the Long Beach Head Start Program, observed Head Start classrooms both before and after the project began, reported that “people are more comfortable with science...and they are aware of what is science and what isn't...They recognize that this is easy and they feel really comfortable.” She reported that one teacher is planning every lesson every day for the whole year around science. Jim Matlock, the LBHS Director, said that he saw more pronounced and “used” science areas in the classrooms. For example, he noted that before he had seen microwaves stored on the science table; now he saw that these areas were in use. He also noted that the teachers now seemed enthusiastic about their science areas. He reported being impressed by the level of enthusiasm, involvement and camaraderie among teachers. “I have never seen this staff so enthusiastic.” He said that it “rejuvenated him to see that the staff could respond so positively and enjoy something so much,” and he agreed to promote activities to increase the staff’s knowledge and use of science.

Two definitive indicators of the project’s success come from an analysis of the teacher’s journals and the results of a mid-year survey, both collected at the end of the second follow-up meeting. Teachers were expected to keep a journal of their Head Start activities, and reading the 37 journals that were submitted provided a rich source of data for the evaluator. Since the project did not give explicit instructions about journal format

or focus, the richness of the teachers' descriptions varied widely. Some gave detailed accounts of the science activities,

“today I took [the] prism outside and made a rainbow on the wall. Children came running to me and asked me how did I do that. I allowed [the] children to take turns to make a rainbow by holding [the] prism in the sun. They loved it so much [that] when they came to [the] classroom they went directly to [the] science area and made rainbows.”

Others simply listed what they had done. Some teachers reflected on the children's reactions to the activities, “I learn that when children discover things on their own instead of telling them, it builds up their character and self-confidence, like ‘look at what I found’ and children feel real good about themselves.” Others used the journals more as personal diaries. Many of the activities reported by teachers were ones they had done before in their classes (like making play dough, or cutting up pumpkins), but it is revealing that they now recognized that these every-day activities could also have a science focus. And, as expected, some teachers did far more than others. (See Appendix IV for a list of the science activities reported by Long Beach teachers.)

The increase in the number of science activities carried out in the Head Start classrooms was strikingly presented in the 87 mid-year surveys collected at the 2/21/97 meeting. Analysis of the data shows that 63% of the teachers now report doing science every day, compared to 35% before the Summer Institute. Equally significant, 52% percent of the teachers now report being very comfortable with science, compared with 10% before the Institute, and only 5% said they were very or somewhat uncomfortable now, compared to 37% before. Indeed, 95% of the teachers now report being either “comfortable,” or “very comfortable” with doing science. (See Figures 2 and 3.)

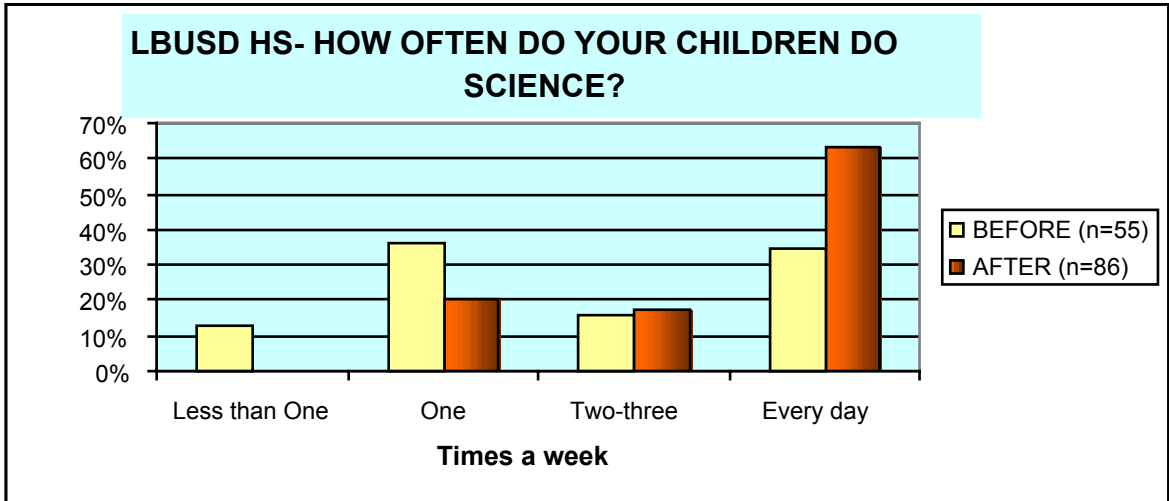


Figure 2

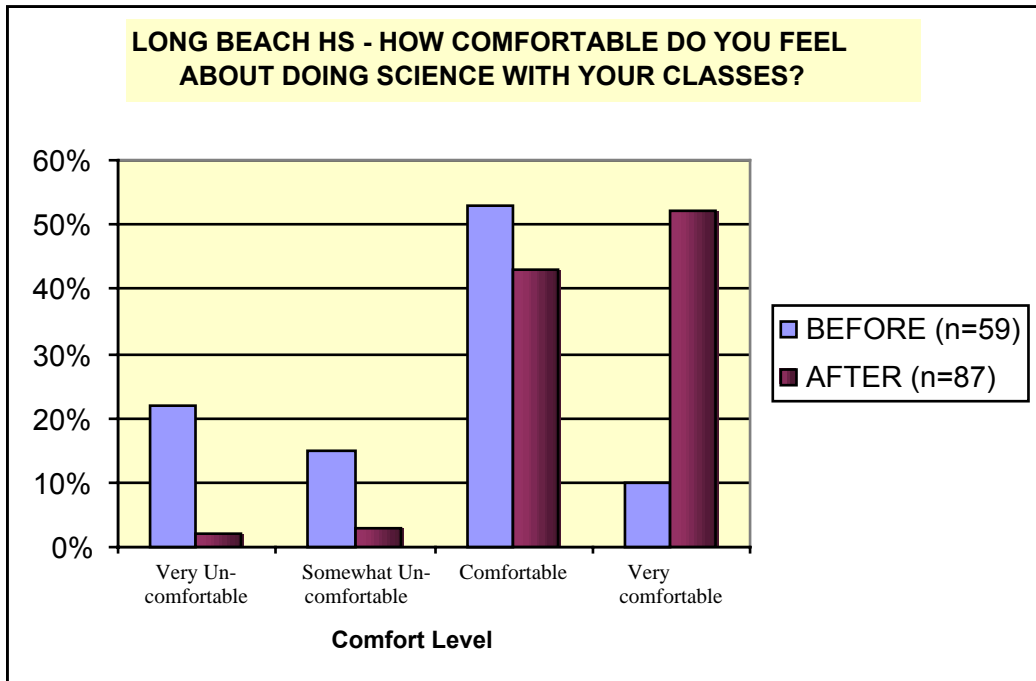


Figure 3

None of the teachers reported major problems with most of the activities in the *A Head Start on Science Activity Guide*, but a few said that they had modified them for their students. The general comments were very positive.

After a successful first year with Long Beach Head Start, “A Head Start on Science” was replicated for teachers from both the Los Angeles County Office of Education (LACOE) Head Start Preschool Program (representing many different agencies), and the Head Start Program in Syracuse, New York. Two, week-long LACOE Summer Institutes were held on August 11-15 and August 18-22, 1997 at California State University, Long Beach. The Syracuse Summer Institute, was held August 18-22, 1997 at Syracuse University.

## **THE LACOE EXPERIENCE**

### **Baseline**

The Los Angeles County Office of Education (LACOE) Head Start Preschool Program is the largest Head Start grantee in nation, including 33 different delegate agencies, some school and some community based, and one operated directly by LACOE. Of these, 10 district and 12 community agencies serving over 18,000 pre-school children, in addition to the direct LACOE program (with 350 children) participated in the 1997-1998 “A Head Start on Science” program.

It was not possible to make baseline observations before the LACOE Institute, because the participants were identified too late. However, the evaluator visited several Head Start classrooms immediately after the Institute, observing and videotaping the

interactions between the teachers and children on the snails and magnet tasks. Since she could only see a few sites at a few agencies, it wasn't possible to get a clear picture of how much science is being emphasized in LACOE in general. Visiting sites where teachers had not attended the training could not really be used for baseline comparison, because there was so much variability from site to site. At one site (which has its own science trainer), science was obviously a high priority, and there were many signs of science activity; at others there was little or no evidence of science being taught.

### **Summer Institute**

With so many teachers to be reached, project and LACOE staff decided to train some of the Head Start supervisory personnel as well as teachers and head teachers during two, one-week Summer Institutes, with both groups expected to share their knowledge with other teachers in their Head Start programs. Summer Institutes were held on August 11-15 and August 18-22, 1997 in two science laboratories at California State University, Long Beach with a total of 62 participants, 30% of whom were supervisory personnel.

The following staff carried out the Training for the LACOE Institute:

- the Principal Investigator;
- four leaders—teachers with extensive backgrounds in science who had been leaders in last year's Summer Institute;
- five Head Start teachers, who had served as facilitators during the Summer 1996 Institute and who were now able to take leadership roles, and;
- the "A Head Start on Science" Project Coordinator.

The Project Evaluator attended several planning meetings, and observed each day of the first week's Institute, videotaping some of the activities and providing on-going feedback to project staff. (During the second week, she was in Syracuse, observing their one-week "A Head Start on Science" Summer Institute.) The LACOE "A Head Start on Science" Summer Institute, like its Long Beach predecessor, involved participants in doing hands-on science activities and emphasized the strategies of "facilitated learning." The general format was the same as for the Long Beach Summer Institute, with some changes in individual activities made as a result of the previous year's experience. Although some participants displayed initial hesitation about interacting with teachers from different agencies, the Instructional staff made a point of recognizing and respecting the differences among participants. Several activities at the beginning of the week helped the groups of around 15-20 in each of the two rooms to "gel." An initial impression, confirmed by the pre-institute survey, was that the participants appeared more comfortable with science and were better prepared than last year's group. This might be expected, since the teachers were more experienced, and 30% of the group were supervisors. Nonetheless, participants were enthusiastic, and several said that, although they had done some of the activities before, the Institute helped them see them in a new light.

The theme, "Encouraging a Sense of Wonder," once again permeated the Institute, and participants responded enthusiastically to most activities. When asked in the exit survey to indicate what that they had learned during the Institute, the most common response reflected a new vision of science. The following examples demonstrate the attitudes of the participants:

“When I think of science I usually think of learning something abstract and complex, after this week, I think of science in the following manner - play, interesting, fun, learning about the world around us, everything.”

“When I first got here, I felt a bit ‘iffy’ about science, but now I am so calm and relaxed about making science part of my everyday curriculum.”

Participants also indicated that they had gained a new appreciation for facilitated learning, again reflected in various comments:

“As a facilitator, I must provide not only the materials but the opportunity for children to explore with all their senses.”

“I will remember to ask more questions and wait for a response. I learned to follow the children’s lead and let them direct the activity as long as they are on task.”

These were the major process objectives of the Institute. Even though the Institute devoted but a limited amount of time dealing with ways to share “sense of wonder” science with other LACOE Head Start teachers, several participants mentioned in the survey that they looked forward to sharing what they had learned with others.

One of the features of the Institute that worked especially well was using a small group of facilitators from last year’s Summer Institute to help plan and conduct the Institute. This helped to ground the planning in the experience of those who had attended the Institute last summer, and who had used the activities in their classrooms. The facilitators worked as partners with the Institute leaders, and served as leaders in presenting several of the activities. As a result, they became strong role models for the participants, modeling how teachers can share what they have learned with others.

As in the previous year, most activities were very well received. They were hands-on, interesting and enjoyable, used every-day objects and organisms, took advantage of the local outdoor environment, and modeled exemplary science teaching

strategies. They were effective in engaging the participants, holding their attention, and giving them confidence in their ability to introduce Head Start children to science. Other features that were successful during the previous summer proved to be equally effective with the LACOE audience. These included the “encouraging a sense of wonder” theme; intriguing opening activities, journal writing, and knowledgeable, well-prepared and enthusiastic leaders who modeled the facilitation process. Teachers also felt that the relaxed atmosphere of the Institute helped create bonds between leaders and participants, and that having the leaders model the kinds of facilitating behaviors that they expected the teachers to use was very useful. As with the Long Beach participants, the opportunity to earn college credit helped motivate the LACOE participants, and encouraged an overall sense of professionalism within the program.

Although the Summer Institute was extremely successful, two issues arose that were unique to LACOE. Because the participant list was submitted so late, the project was not able to conduct an appropriate needs assessment, and, as necessary, modify the Institute to fit the needs of its audience. The assumption was that the participants, like those in Long Beach, would display but a very basic understanding of science and have only minimal experience with facilitated learning. The reality was that more of the participants had stronger science backgrounds than anticipated, and had some experience with facilitated learning. However, even those more experienced individuals acknowledged that the Institute was an extremely worthwhile experience in reinforcing their facilitation skills and in orienting their perspectives about science.

A second issue, directly related to this, was the assumption that both supervisors and teachers would share their new understandings with teachers in their agencies. Except for a short session at the end of the Institute, during which self-selected groups of

teachers and supervisory personnel made specific plans to bring “A Head Start on Science” training back to their agencies, the Summer Institute was not organized to prepare the participants in the leadership skills that they may need to become successful disseminators. Indeed, when discussing this with participants, some seemed unsure if the reason that supervisors were attending was to conduct such trainings, or simply to support teachers who had been through the Summer Institute. The original design of project was for direct training of teachers. If training trainers is to be an essential part of the program, it needs to be understood and planned for in advance.

## **Follow Up**

The evaluator attended the three LACOE follow-up events. The first was a field trip on the Yellow Fin, a research vessel owned by CSULB; the second a trip to Monrovia park nature reserve. As in the Long Beach program, these excursions, although not providing specific activities for the teachers, gave them insight into investigating nature outdoors. Teachers really appreciated the experiences (for many it was the first time in a boat or out in the woods). These outdoor activities, however, could have been improved if the naturalist or scientist leading the group had better understood the background of the teachers, and if special consideration could have been made for teachers with mobility problems. For example, the nature hike was too rugged for some teachers; some of the teachers became seasick on the Yellow Fin. Overall, however, these activities were designed mostly to enrich the teachers’ own science knowledge and appreciation for the nature, and by and large, judging from teachers’ comments, they succeeded admirably on both counts. At the third LACOE follow-up meeting, teachers were introduced to some new activities. One, making and racing paper boats, introduced

teachers to some fundamental ideas of physics, while, the other, with snails, reinforced basic observation and questioning processes. As they had done the previous year, the follow up meetings served to renew friendships and revitalize the group.

Because so many separate agencies were involved in the LACOE Summer Institute, and because one-third of the participants in the Institute were supervisors, the evaluator concentrated on determining how participants were sharing what they had learned in the Summer Institute. She attended one training conducted by a supervisor and one conducted by teachers, and she interviewed other teachers who had conducted workshops, as well as asking about workshops in the mid-year questionnaire. As before, the evaluator provided the Principal Investigator with specific comments and suggestions for improvement.

The Head Start supervisor who had attended the Institute, and who is responsible for three sites, with a total of 20 teachers (10 classrooms), conducted a 2 hour in-service on science as part of an area meeting. Seventeen teachers attended. She did an admirable job of emulating the spirit of the Summer Institute, and tried to go over all of the major ideas of the week-long Institute in 2 hours, including the nature of science, how children learn, and facilitation. The highlight of the workshop, as was true of the Summer Institute, was the hands-on activities she provided. Using teachers who had attended the Summer Institute as facilitators, the supervisor set up four tables with hands-on activities, and the facilitators modeled good science teaching, i.e. getting the participants to make predictions, asking good open-ended questions, letting the teachers explore for themselves. In the evaluation of the workshop, teachers were asked what they learned and how they could use it in their classes. Comments were similar to those from the Summer Institute:

“Science is not a complicated area, it is easy to implement in our program”

“We have a lot of resources to use with children in the classroom and outside. We can use all of these resources during the year program to motivate children to participate and explore their world in a science area.”

“I will introduce the material to the children then, I start with simple materials, just look around, and let the children explore and talk about it.”

Some of the teachers commented, however, that there was simply too much information packed into the short time span, an opinion shared by the evaluator. Still, it was encouraging to see that at least some of the enthusiasm for science and the “sense of wonder” could be transmitted in such a short time.

The evaluator also attended a 3-hour workshop, given by teachers who had attended the Summer Institute. There were 41 teachers from 6 centers in attendance, plus a group of home visitors. The workshop revolved around involving the teachers in a variety of the science activities from the Summer Institute, chosen because the presenters found them the most fun and interesting, and because they could be done at home by the home visitors. Comments from the teachers on the closing questionnaire were once again overwhelmingly positive.

“This presentation was great. Everything was clear, interesting and fun and also we learn. New training that us home visitors can apply into our activities.”

“This was a great training – great hands on activities. We should do this more often.”

“...[S]hould have more of these trainings were participation and sharing are with staff.”

“Presenters were ready with materials and well organized, activities were innovative and interesting.”

Although the leaders did an admirable job of organizing the workshop and getting all of the materials ready, they did not seem really able to place them within the context

of science process or facilitated learning; the hands-on activities alone constituted the workshop. However, given that the workshop participants at least got a glimpse of science as an enjoyable and interesting enterprise, and had some science activities to share with their students, the workshop could be deemed a good start. Perhaps more important, it showed teachers how other teachers can share what they have learned and themselves become facilitators. The experience was certainly worthwhile for the teachers organizing it and offered considerable benefit for the participants.

The mid-year questionnaire also asked participants if they had shared what they learned with others during the year. Six of the 11 supervisors responding (55%) said that they had given workshops, and the same number indicated that they had shared individual activities. All of the supervisors said that they shared with other teachers and aides at their agencies, and six indicated that they had also shared with parents. One supervisor (the one observed by the evaluator) reported giving a total of 25 workshops; others gave either one or two. Workshops were attended by from 25 to 110 teachers, and ranged from 2 to 3 hours.

Of the 22 teachers responding to the survey, 15 (68%) said that they shared what they had learned with other teachers and aides at their centers, and 13 (59%) shared with parents. Six (27%) shared with their supervisors. Most (55%) shared individual activities, but 6 (27%) gave one or two workshops involving between 10 and 50 participants. Two teachers reported that they planned to do workshops later in the year. One teacher commented that "...the children were so excited they shared with other children during recess times and neighborhood times."

Analysis of the mid-year questionnaires also indicated that, while the LACOE Head Start teachers did not show quite as striking a change in the comfort level or in the

frequency of science instruction in their classrooms as had the Long Beach teachers, they nevertheless made substantial gains in both areas. Perhaps the absence of such dramatic change is simply because they demonstrated a greater facility with science coming into the program. The number of teachers reporting doing science “every day” rose from 3% to 28%, with those reporting doing science at least twice a week rising from 50% to 66%. The number reporting doing almost no science dropped from 14% to 0%. Similarly the number of teachers reporting feeling “very comfortable” with science rose from 11% to 30%. By mid-year, 91% of the teachers reported being either “comfortable” or “very comfortable” with science, as opposed to 73% before the program. (See Figures 4 and 5)

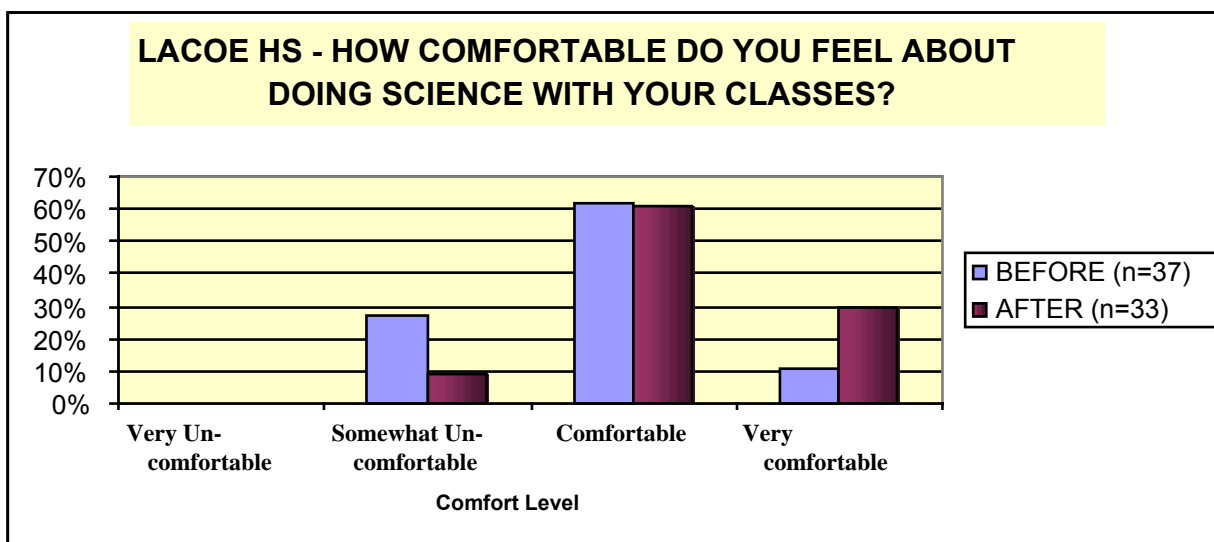


Figure 4

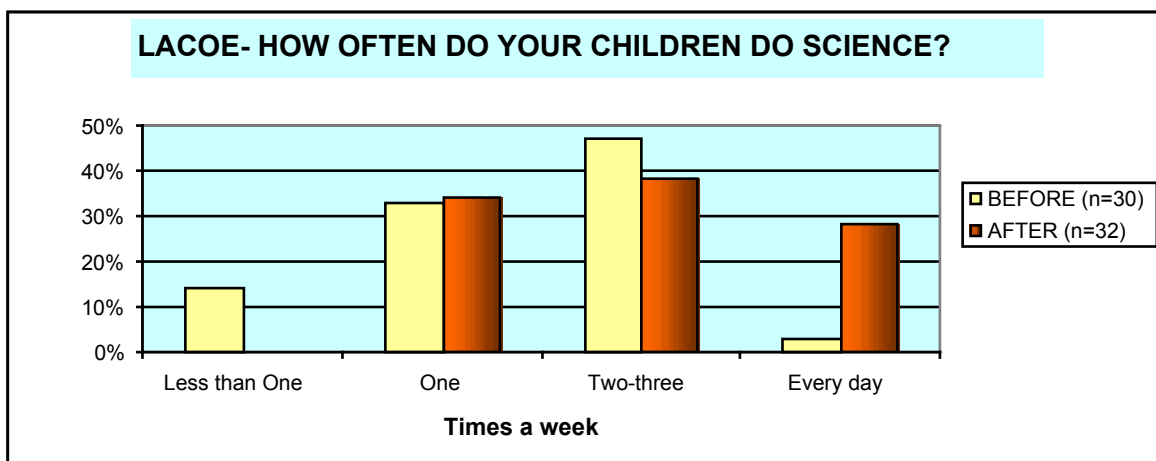


Figure 5

As in the previous year, the reading of the participants' journals provided a rich source of data about the "A Head Start on Science" Program. And, as before, many of the activities (i.e. "the senses," "mixing colors") were ones with which teachers were familiar, but they now saw them as science opportunities. Similarly, some teachers did many more activities than others, and teachers did not report every science activities that they did with their children. The journals also revealed for some teachers an increase in confidence as the year wore on.

"I'm beginning to feel good about the science we do in the class. We do more than I realized...Confidence is growing and the children are beginning to get inquisitive."

"As the year commenced, I had serious doubt about my ability to implement an effective science curriculum...that I would be able to instill a love of science in the children in my class, plus I would overcome some of the fear myself."

This teacher went on to write that, although she still had fears of not knowing all of the answers, she felt she had met her goals. She was able to set up an environment inviting to science in a new facility, and she described how finding a dead fly in a spider web led to two weeks of science occurring in almost all areas of the room, as well as home extension activities.

## **THE SYRACUSE EXPERIENCE**

### **Baseline**

"A Head Start on Science" also operated in Syracuse, New York during the second year of the project, to determine what elements are essential to successfully transplant the

program to new soil. The evaluator gathered baseline data by visiting three Head Start centers, carrying with her a box of large land snails from California (the local Syracuse snails were much less impressive).

It seemed clear in the three sites visited that these teachers appeared comfortable both with science and with good questioning strategies. Although some sites showed more active science involvement than others (live animals in the room, prominent science displays), in none of the sites did the evaluator get the feeling that science was not a part of everyday activities at the center. Moreover, teachers, even those who might have been personally squeamish about handling snails, encouraged the children to dive right in. In no case did a teacher exhibit either fear of the organisms or disgust at their “sliminess.” Quite the contrary. Most of the teachers allowed the snails to crawl on them and encouraged the children to do the same, while promoting close observation. (Note: Since these large snails are not native to NY, this was the first time the children [and teachers] had seen such creatures.) Most teachers had the children use the magnifying glass provided in the box, and one added her own magnifying viewer.

The kinds of questions teachers asked also reflected good inquiry-based teaching. In no case was a teacher’s approach overly pedantic, having the children sit while she talked to them about snails. (The one case where a teacher tried to give the children some “facts” about snails, they turned out to be wrong.) Some of the teachers were great at asking open-ended questions and keeping the students thinking, talking and observing the animals. Others asked fewer questions, but those asked were still open-ended. In these classes, the children spent more time just exploring on their own.

It should be noted, however, that the evaluator only visited three classes, and these were chosen by the Syracuse Head Start staff. Other teachers might not have been as

comfortable with science as these teachers were, and science might not be as prominent in their classrooms. Indeed, although the pre-institute questionnaires revealed that 66% of teachers felt “comfortable” with science, only 10% reported being “very comfortable.” And while only 11% reported doing science less than once a week, 43% reported doing it only once a week, and a mere 11% said they did it every day.

### **Summer Institute**

In preparation for the Syracuse Summer Institute, the two Institute leaders from Syracuse and the Syracuse Project Coordinator attended part of the first LACOE Summer Institute. In addition, one leader and one facilitator from the LACOE Institute briefed the Syracuse staff, and each was paired with a Syracuse leader for the Syracuse Institute proper. Two additional support staff in Syracuse helped with the many logistical complexities of conducting the Summer Institute, and the Syracuse Director (Dr. Larry Shafer from Syracuse University) worked closely with the Syracuse Head Start staff on overall planning and coordination.

The evaluator observed each day of the week-long Summer Institute (talking to participants and leaders and videotaping selected activities), as well as conducting a Pre-Institute Survey and Post-Institute questionnaire. The Syracuse Summer Institute was held August 18-22 in two Laboratories at Syracuse University, where 32 teachers (at least one from every Head Start center in Syracuse) and 4 supervisors attended.

The evaluation revealed that the general approach taken in the “A Head Start on Science” project also transferred well to this new environment. This success can be attributed to a number of factors:

- the very strong model established by the first “A Head Start on Science” Summer Institute in Long Beach, with its emphasis on imparting to the teachers a “sense of wonder,” as well as both the theory and practice of facilitated learning;
- the use of science activities which had been tested and proven during the previous Institutes;
- the presence of a very strong and capable team of leaders at the Syracuse site, supported by a staff that handled the enormous logistical dimensions of the project effectively;
- the visit of the Syracuse teaching staff to the LACOE Summer Institute before the Syracuse Institute;
- the assistance of an experienced leader and a Head Start teacher-facilitator from Long Beach who briefed the Syracuse staff and helped in the training, but who let the Syracuse leaders “run their own show;” and
- the use of detailed scripts describing each day’s activities from which the leaders in the new program could work, and which they could modify as needed.

Participants also credited the opening activities, which started each Institute day in a fun and interesting way, and worked well to make everyone relax and feel at ease. They also appreciated the leaders modeling the processes they were learning, such as using questioning strategies, and they found the journals helpful to reflect on each day’s activities and consolidate their understanding.

Participants’ comments on the exit survey, mirroring those of the LACOE and Long Beach participants, were overwhelmingly positive. The most common comments

reflected a new vision of science and a new appreciation for how science can be integrated into everything:

[I got] "...a whole new outlook on science. I hated to plan for science in my classroom before this workshop. I never felt I was good at it or knew what I was doing. Now, I believe I am good at it and I can't wait to start implementing science in my room."

"Science is fun!" "Science can be simple, fun and informative."

"Science is everywhere" "...it's all around us in everything we do."

"Science isn't at one table or one shelf. It needs to be explored everywhere."

The comments also reflected a new appreciation for facilitated learning and questioning:

"allow the child to be a leader. Follow the child's questions with a question of your own."

Overall, the Syracuse Summer Institute benefited greatly from the strength of its local leaders. They gave the Syracuse Institute its own tone. At times, however, digressions from the original model presented some problems. In one room, for example, the leader strongly emphasized terms he called "Keys to Learning" (curiosity, problem solving, imagination, risk-taking, decision-making, coping, group participation, peer interaction). These "keys" appeared frequently in the teacher's journals, indicating that the teachers had paid close attention them. While they are certainly important elements in constructivist learning, adding them to science processes terms and ideas (like observing, classifying, hypothesizing, predicting, experimenting) may have been overwhelming to the teachers, and might have muddled the focus of the Institute. (The evaluator pointed this out to the leader, who emphasized more of the science processes terms for the remainder of the Institute.)

In another case, a brief introduction to “common scientific misconceptions” confused some teachers, who expressed concern that they might say something scientifically incorrect (like “my coat keeps me warm”). Introducing these kinds of subtleties to this audience appears to act contrary to some of the main objectives of the Summer Institute—i.e., seeing that science is fun and that teachers need not be concerned with knowing all of the answers or always being “right.” It also provoked discussion about the relationship between fantasy and science, prompting questions like, is it OK to read stories to the children about “old man winter” or the “man in the moon?” While some of the teachers clearly appeared ready for such discussion, others were not.

Although the response to the Institute was overwhelmingly positive, and many teachers indicated that the Institute had given them a new vision of science and comfort with it, the Syracuse Summer Institute—like the one for LACOE—might have been even more effective if some sort of “needs assessment” had been done beforehand, and at least some of the activities modified to take into account and build upon this audience’s strengths. As before, the evaluator shared her observations and suggestions with project staff.

## **Follow Up**

The evaluator visited Syracuse once in Fall, 1997 and again in Spring, 1998. During the Fall visit, she observed three sites and talked with the “A Head Start on Science” Syracuse staff. Since the classrooms at these sites had shown evidence of good science teaching before the Summer Institute, the evaluator was not able to see the kind of dramatic differences observed in Long Beach. Nevertheless, one supervisor (who had attended the Institute along with 7 of her 8 teachers, said that she felt the Summer

Institute made teachers more aware of what they were already doing. She felt that now they are more likely to ask children questions and wait for responses, and that they are less afraid of science. Although they might have known some of the material already, it was “not consciously...Now, they are more likely to use it regularly.” She said that before the Summer Institute, science was concentrated in just the science area; now it’s more available to children in all areas. She also said that the concrete activities in the Institute helped the teachers, and that she saw them showing up in the teachers’ lesson plans. Moreover, she felt that the Institute provided a common basis for her continuing efforts with the teachers. She felt that her being at the Summer Institute was very important, because she now knows what the teachers saw and heard, and she can support them. She also said that teachers in her Center were planning to do science activities with parents, and that some teams are sharing activities with each other.

In one class observed at this Center, the teacher reported that she had selected science activities (ooblek, frog, fish in a bottle, magnets, tornado tube, texture boards, books) to share with parents at their open house. She said that the parents were very interested, and asked if she were a “science teacher.” Indeed, all of the rooms at this Center showed evidence of meaningful science activity.

At another Center, although the total science environment was not as striking, the supervisor commented that teachers who were already tuned into science took the activities and continued to grow and move forward. She felt that others did more than they would have without the training. For example, one teacher, whom she thought would never be interested in science, ran and got a “bug box” (a plexiglass box incorporating a small magnifying glass) to observe an insect in the room. She felt that this was a big step forward for her.

The major concern expressed by the Assistant Education Coordinator, was that those teachers who did not attend the Summer Institute (50% of the teachers went, at least one from each class) were jealous of not being able to participate. There was also some confusion about who owned the materials handed out at the Institute, but it was made clear to the teachers that the materials belonged to the classroom and not to the teachers. She also felt that the Summer Institute could have benefited from more on how teachers can share what they had learned with other teachers at the site.

The evaluator returned to Syracuse on May 21 and 22, 1998 to attend the third follow-up session of the “A Head Start on Science” program and to visit some classrooms. During the first follow-up workshop the teachers had created and tested some new “A Head Start on Science” Activities, to be added to the Activity Book, *A Head Start on Science*. The second workshop was held in cooperation with the Syracuse Museum of Science and Technology, and consisted of a combined workshop on science for young children. The third follow-up workshop was to show teachers how they can use a common object (a bird) to relate a number of broad scientific concepts—like form and function. The teachers, using pincers for beaks, began to collect materials—hay, grasses, mud, Spanish moss—for their “nests.” There was a lively discussion about what kinds of birds could live in their nests. The leader tried to show the teachers how the bird could become the center of many investigations and activities (dealing with feathers, songs, migration, eggs, etc.). Although the evaluator sensed some confusion on the part of the leader about what was a general science concept (he put “construction” in the same general category as “form and function), the teachers really welcomed the idea of having some overarching concept to tie everything together. One teacher commented that she

had been looking for such connections in the activities in the *A Head Start on Science Activity Guide*.

During this visit, the evaluator visited three Head Start Centers (4 classrooms) with the magnets task, and conducted a focus group with teachers, as well discussions with the Assistant Education Coordinator, Project Director, and Principal Investigator. In two of the classes, the teachers did a well at presenting the task and helping the children become involved in meaningful inquiry. In one class, for example, the teacher examined the box of magnets along with the children and facilitated their exploration using good open-ended questioning strategies. The children were very involved, and the group kept small enough so that everyone could have hands-on experiences. The teacher in another class was not as confident in her approach, and tried to work with all of the children in a group on the floor. She tried to get the children themselves to investigate what sticks to the magnet and what does not, and was most successful when she encouraged the children to move around the room to find things that will/will not stick to the magnets.

In the fourth class, although the room was filled with evidence of science (pictures of animals on the walls, birds' nests, sea shells, etc.), the aide, who had been to the Summer Institute, wasn't able to facilitate the children in their exploration of magnets. Rather than letting them each try out the magnet and see what happens, she did a demonstration of what sticks to the magnet and what does not, and prompted them to recite, in unison, that magnets only stick to "metal objects." When the evaluator presented her with a key, the aide became flustered when it didn't stick to the magnet. The lead teacher (who had not been to the Summer Institute) then chimed in to say that "the key wasn't metal." The aide said, "it looks like metal to me," and the lead teacher got another key to try. The whole exchange provided a great (and missed) opportunity

for exploring nature with the children. But the lead teacher persisted, taking over the class and diverting the activity from one dealing with magnets (which she didn't understand) to one dealing with birds' nests (which she did). In this case it was clear that the aide was not able to transfer the approach learned in the Institute to her lead teacher. The lead teacher seemed unable to engender the "sense of wonder" among her self or her students.

Another teacher remarked that "A Head Start on Science" has made her more comfortable with science, and has presented a "different level of intrigue." She said, for example that bubbles had always been interesting before, but now they were "mesmerizing." She had always loved magnets, but now she had discovered many more ways for children to play with them, like putting bingo chips under paper plates and having races between magnetic cars on paper "roads." She said that "before, science was science and someone else takes care of it." Now, they see all of the alternative things that they can do with science, and how the children are interested. Another teacher also said that she has become comfortable with not having to know all of the answers, whereas before she felt compelled to find the "facts." One of the teachers did a 3 hour science workshop for the parents of her group, including activities from of the "A Head Start on Science" Teacher's Guide.

Looking back on the Summer Institute, one teacher commented that she felt that the hands-on activities to take back to the classroom, along with the mood generated at the Summer Institute, the sharing, language, and sense of excitement, remained most vividly in her mind. She felt that she was going in that direction anyway, but that the Institute helped give her a broader view of how to question children.

Comparing the pre-Institute questionnaires with those from the Spring, one can see a dramatic increase in the frequency with which science is taught every day the Syracuse classrooms (from 11% to 87%). Indeed, 97% of the teachers report that science is now taught at least twice a week in their classes, compared to 22% on the pre-Institute survey. (See Figure 6.) Similarly, 53% of teachers now report being “very comfortable” with science, compared to 10% before the training, with 96% now claiming to be “comfortable” or “very comfortable”, compared to 76% before. The biggest movement seems to be from those who were “somewhat uncomfortable” to some level of comfort. These percentages moved from 24% before to 0% after. (See Figure 7.)

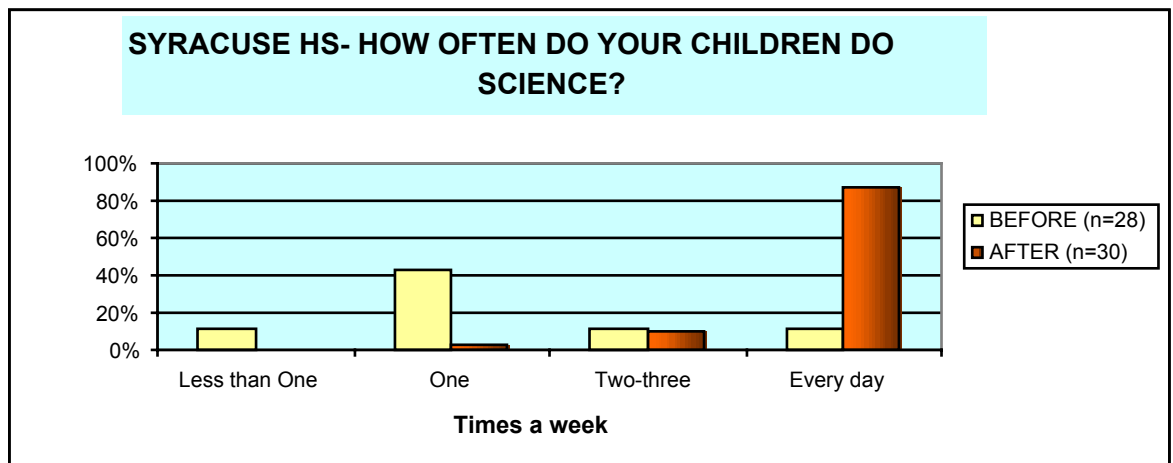


Figure 6

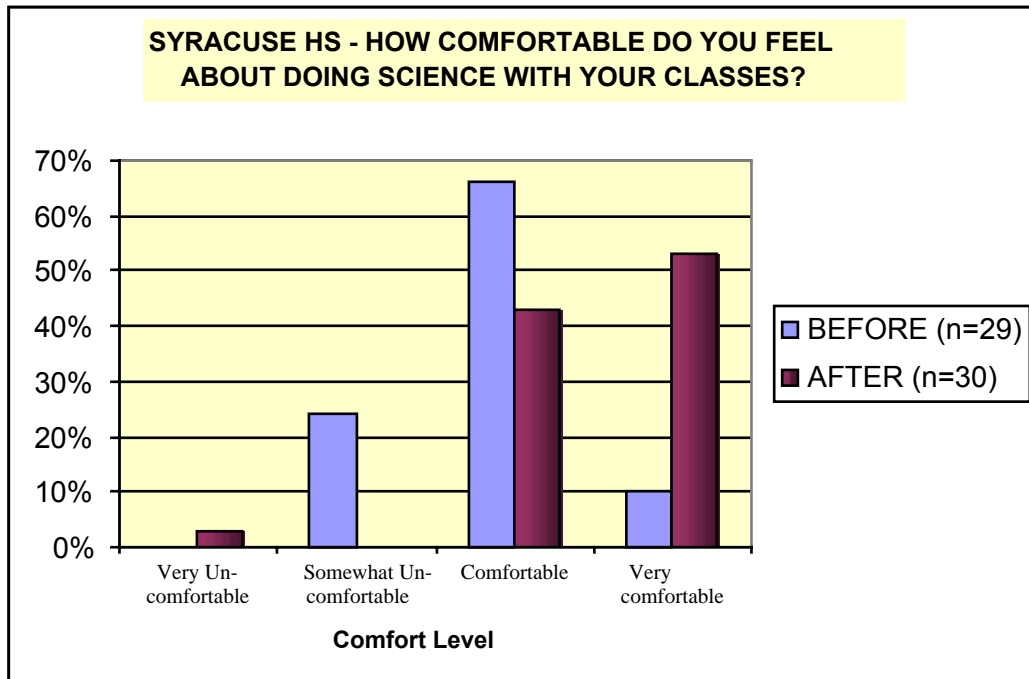


Figure 7

Similarly, reading the teachers’ journals showed that they had engaged their children in a wide variety of science experiences. They reported many activities involving plants and animals as well as nature walks, exploring the senses, and others that were reported by the teachers in both the Long Beach and LACOE Programs. As in the other programs, many activities were familiar to the teachers, but they now recognized them as good examples of science process.

One teacher reported in some detail how her children were responding to the science activities.

“Our kids are pros at speculating now. They are often assessing the outcome before they know. It also carries over into the various areas of the classroom...its great to

hear. This week we used salt, sugar, oil, sand, pepper, bath beads to test how they 'will act in the water.' Predictions [from the children] 'It will disappear if you stir it.' 'It will taste funny.' 'I'm not drinking that – yuck!' [Then, their comments on the outcomes] 'It disappear.' 'It's swimming.' 'It went down to the bottom.' 'It's not doing nothing.' The language shared, the new language learned has been fantastic."

The interviews with the Principal Investigator and Project Director revealed to the evaluator some of the dynamics underlying the Syracuse Program. One key difference between the Southern California and Syracuse experience was the emphasis put upon learning science concepts. Although the PIs at both sites have been colleagues, their approaches were slightly different. Whereas Dr. Ritz strongly emphasized the "encouraging a sense of wonder" theme, and downplayed (although not eliminated entirely) providing science content knowledge to teachers, Dr. Shafer believed that exploration should be the basis, but that teachers need some science concepts to extend the activities, to make conceptual spin-offs, rather than just getting more activities. This difference and the conclusions to be drawn from it are discussed later in this report.

Although it was clear that Dr. Shafer had not been involved on a day to day basis with the project over the year, he was able to identify those circumstances where having someone at the university direct such a project was of benefit. He identified the following areas:

- Making the initial contacts with Head Start. Once he had heard of the project, and was convinced of its potential usefulness, he encouraged the participation of the local Head Start agency. His standing at the university helped him in that effort.
- Finding competent people to run the program. He felt that this was his greatest challenge. Helped by his university connection, he found the very competent people whom he recruited.

- Negotiating with Head Start. Head Start in Syracuse evidently wanted to teach the Summer Institutes themselves, thereby keeping more of the money. Dr. Shafer, however, felt that they lacked the science expertise, and got the project to hire its own teachers. His clout as a university science education professor gave him standing to make this argument.
- Negotiating with the grants administration office at CSULB. Dr. Shafer handled the considerable back-and-forth as the financial arrangements were made, and he felt his own university connection was a plus here.

Greg Kelihan, the Syracuse Project Coordinator (who also runs the gifted program in his district and teaches a methods course at SU), observed that Dr. Shafer has brought tremendous knowledge and wisdom to the project, as well as broad perspective, and that he has been the “silent leader” of the program. He also felt that Dr. Shafer’s university affiliation with the project helped them to get a location for the Summer Institute, and helped with management details.

Greg described his own role as Project Coordinator as the one person controlling all communication and insuring that things got done. He spent many hours on this task, over and above his full-time work, but found his three responsibilities blended very well. He felt that one drawback to the Syracuse program was that they lacked the buy-in from Head Start they would have gotten by having someone from the agency on the program’s staff. (The Southern California programs had Dr. Wilmshurst, who was affiliated with head Start as a consultant, serve in the Project Coordinator role.)

Greg felt that the most challenging part of the Syracuse program was trying to live up to what had been done in California, and trying to get a working understanding of

early childhood and Head Start. But, he believed that ultimately the collaboration within the program and also with California worked very well, and praised the “encouraging a sense of wonder” and facilitated learning themes. Personally, he felt that the Syracuse program could have used a little more guidance from California, but recognized that one aim of the replication was to let Syracuse see what they could do and “run with it.” The role of an efficient and motivated coordinator in a project like this can’t be underestimated. Greg’s words of wisdom to other coordinators: keep track of communications; save everything; be organized; listen to everyone; offer gentle hints; let participants dictate a little more, have them become collaborators.

## **DISSEMINATION AND ONGOING EFFORTS**

Several elements from a Head Start on Science have continued after the completion of the grant. One important legacy is the *Head Start on Science Activity Guide* containing the activities that were developed, tested, and revised during the grant period. It has been distributed to over 230 teachers. Even without the accompanying training, these exemplary activities can help teachers include more science in their teaching. Moreover, as the project proceeded, a Training Guide with “scripts” for each of the days of the workshop was developed to help workshop instructors and staff prepare for and present each day’s activities. This Guide can help others replicate the Head Start on Science workshop experience.

Another legacy of the program can be found at the Head Start on Science website [www.csulb.edu/~sci4kids](http://www.csulb.edu/~sci4kids). This delightful site presents an overview of the project and a statement of beliefs about science for 4-year olds as well as offering two short essays on how to encourage a sense of wonder through questioning strategies, and on the importance of science process. The website also provides a sampler of Head Start on Science activities (including extension activities in English and Spanish and colorful photos of children engaged in science activities), and it presents a description of the ongoing training opportunities available through the project. The project is also developing an 8-10 minute video, which will provide an overview of the program and show it in action with children and teachers.

William C. Ritz, Ann Wilmhurst, the evaluator, and some of the instructors from the Institutes have also given presentations and workshops about the project at events such as the National Science Teachers Association national meeting, the National Head Start Association, and the National Association for Research in Science Teaching. These presentations help disseminate the ideas behind the project, the specific approaches and activities, and the evaluation findings. (See Appendix V)

A Head Start on Science workshop was held summer, 1998 for around 30 Head Start teachers, half of whom came from California, and the rest from all over the country. They came in response to fliers mailed to HS centers all over the country and from presentations at workshops.

Finally, the teachers trained at the Head Start on Science institutes continue to use the techniques and activities learned through the program. This is especially evident among the 27 Long Beach teachers who were facilitators the first year of the program, 5 of

whom have continued to help the Long Beach staff train other teachers, further extending the reach of the program.

## CONCLUSIONS AND “LESSONS LEARNED”

Both in its original form and in two subsequent replications, “A Head Start on Science” clearly appeared to be successful in meeting its two major objectives: (1) increasing Head Start teachers’ comfort level with science, and (2) increasing the number and quality of science-related interactions in the Head Start classroom. This occurred both in environments where the teachers were quite “science naïve,” and in those where teachers were initially more comfortable with science.

The project’s success appears attributable to several factors that were kept constant in each of the three different settings:

- **Positive Expectations:** Underlying the whole program was the consistent assumption that these teachers, many of whom had limited educational backgrounds, CAN learn to be comfortable with science and to facilitate powerful science interactions with pre-school children.
- **The “Encouraging a Sense of Wonder” Theme:** Especially for teachers just being awakened to science, but even for the more “science literate,” the simple notion that science can be just a matter of “encouraging a sense of wonder” had a profound impact on curing the “science phobia” unfortunately engendered by our current educational system.

- **Strong Overall Model:** The “A Head Start on Science” model, consisting of a Summer Institute plus ongoing support—hands-on activities to use in the classroom, follow up “friendly” visits, reunion meetings, keeping weekly journals, and offering college credit—proved to be both effective and transportable.
- **Effective Leadership:** The strong leadership from Professor Bill Ritz at CSULB and Professor Larry Shafer at Syracuse University was vital to the program’s success. The vision was clearly initially that of Dr. Ritz and Dr. Ann Wilmschurst, and to a large extent remained so even as the project was exported. Dr. Shafer, however, added to that vision his own special dimension, and both he and Dr. Ritz took advantage of their university affiliations to staff and house the “A Head Start on Science” program. More importantly, each had a deep understanding both of science and of how science should be taught, and they listened to input from those in Head Start and others about early childhood education, to make programs appropriate for both the Head Start teachers and their children. They provided the inspiration for the program, and they hired competent, efficient individuals to be their Coordinators, who assumed responsibility for the mundane (but extremely important) job of putting it all together and making sure that it worked.
- **Practical Institute Model:** Although the Summer Institutes differed slightly from the first to the second year, several features remained consistently effective:
  - *Leadership:* The knowledge, preparedness, and flexibility of the leaders was consistently cited by participants as a major strength of the Institutes.
  - *Informal Atmosphere:* All of the Summer Institutes offered a very, informal yet supportive atmosphere. Events such as morning “friendly time,” “pot

lucks,” and frequent sharings not only made participants feel more at ease, but helped alleviate the stuffy, formal image of academic science.

- *Well-chosen Activities:* From the opening activities, which served to “break the ice,” and help participants be more comfortable with each other, to the activities seen from the perspective of both an adult and child, to the family extension and “make and take” activities, the mix was well-selected. Some of the activities were modifications of ones that were familiar to the teachers, showing them how they can make a science experience out of an oft-used activity, others were created (or modified) especially for “A Head Start on Science”.
- *Appropriate Facilitation:* In Long Beach, the Head Start teachers trained during the first week facilitated the others during the second week; in LACOE and Syracuse, facilitators from the first year performed this function. Having Head Start teachers themselves facilitate other teachers served two functions; (1) it increased the number of facilitators in each training room, and (2) it showed the Head Start teachers that they, too could do these activities, and help their colleagues do them.
- *Modeling of Processes:* Teachers cited repeatedly that they appreciated having the leaders and facilitators model the processes that they were presenting. This may in part be a reflection of the number of workshops they have attended where they were simply “talked at,” without having a chance to see things in action.

- *Journaling*: Although some teachers found writing in their journals a chore during the year, most appreciated it during the Summer Institute, because it gave them a chance to reflect upon what they had learned.

The evaluation was not designed to distinguish which of the other features of the program (the follow-up meetings, “friendly visits,” Activity Guide, journaling requirement, and offering college credit) was absolutely essential for success. But, it is clear that all worked together to extend the powerful Institute spirit into and through the following year.

### **Considerations for exporting the model:**

Transplanting “A Head Start on Science” to a much larger program locally (LACOE), and simultaneously to a slightly smaller and geographically more remote (Syracuse) provided a good opportunity to examine what is necessary to make it work elsewhere. Clearly, all of those features mentioned above are crucial. But, issues arose that require thought before the model can be even more widely disseminated.

- **Dependence on Long Beach Staff.** Perhaps the biggest challenge, and one of which Dr. Ritz is keenly aware, is that all three Summer Institutes were heavily dependent on Long Beach staff. It was clear from discussions with Syracuse leaders that they benefited greatly from having attended the Long Beach Summer Institute and seeing it in action, and that they appreciated having a leader and facilitator from Long Beach at their own Summer Institute. They felt that having a set of Institute activities and even detailed scripts were not enough.

One obvious solution would be to continue with the facilitator model. After two years, the program now has a cadre of Head Start teachers trained in activities who have had a chance to use them in their classes. Institutes might be held in Long Beach and/or Syracuse focused on how to prepare them to facilitate workshops to others nationwide. Supervisors or others well-versed in early childhood science education might take on the roles played by the leaders at the Summer Institutes. Videos of Institutes activities and how they work in class would also help demonstrate both the spirit of the Institute and individual activities. Since large Head Start agencies often have their own training staffs, these individuals might be specially targeted to become prepared to lead these Institutes.

- **Need for Commitment of Time and Personnel:** Clearly the kind of transformation this program seeks can't be accomplished in a single, brief workshop. Participants repeatedly reported that the 4-5 day-long Institute was essential to learn to be comfortable with science and to use good techniques of facilitated learning. One short workshop experience, like those offered at LACOE by supervisors or teachers, simply is not sufficient. It is only a beginning. Furthermore, the glow of even a lengthy and effective Summer Institute tends to fade without ongoing support. Thus, for this program to work, there needs to be the recognition from the beginning by everyone that this is not a "one-shot" deal. Moreover, the program obviously had the greatest impact where a significant proportion of teachers and supervisors were trained. Thus, an agency adopting the program needs to be willing to expend the resources for training such numbers.
- **Strong Administration Support:** Including supervisors in the training informs the supervisors of what their teachers have learned, so that they can better support them

in teaching science. Such support can also help prepare individuals who can carry out further training in the agency, as was seen in LACOE. But, the “A Head Start on Science” program demonstrated that buy-in is needed from the administration at higher levels. In Long Beach, Jim Matlack, the Director of Long Beach USD Head Start provided early and full support for the project, even assisting in writing the proposal. Ann Wilmshust, who had ties to the Long Beach Agency (she has since been promoted to Education Manager) also helped ensure that the agency was solidly behind the program. In LACOE, although the Head Start supervisor wanted to support another Summer Institute this year, he claimed that the agencies were not willing to commit funds. Perhaps if agency heads attended a few days of the Summer Institute, they would be more inclined to support further training. (Six LACOE agencies did send participants this year, but without support from LACOE.)

- **Who Should be Trained?** Clearly, if possible, all of the teachers, teaching aides and supervisors within a Head Start agency should be trained to facilitate science. However, if that is not possible, it is probably best to concentrate on teachers and supervisors. Although it is extremely helpful to have aides well-prepared to support teachers in science, in most classrooms, it is the teachers who exert the strongest influence on what is taught and how. Observations revealed that, although some aides were competent after training, others did not have enough authority to institute changes. In any case, as typical for any systemic change, there needs to be a critical mass of teachers and supervisors trained to make meaningful changes within the agency.
- **Perform a Needs Assessment and Tailor the Program:** Before undertaking a program such as “A Head Start on Science”, the developers need to carefully examine

at what's going on in the classrooms and what teachers, supervisors, and administrators say they need. A pre-Institute survey, like the one conducted by the evaluator, might have helped fulfill that goal, if the institute were designed in light of the survey's findings. In LACOE and Syracuse, it was evident that some teachers were ready for a higher level of training, they said they could have benefited from learning more science concepts, and finding out how to tie activities together conceptually. In addition, especially in LACOE, where the program was training only a few individuals, there was a need for the supervisors and teachers to share what they had learned with others. Thus, more attention should have been paid to preparing participants to give their own Institutes. Although such leadership may have been beyond the scope of the original proposal, it was a reality in implementation, and attention to preparing participants for giving their own workshops and demos would have been useful.

- **Letting New Programs Develop Their Own Style:** Although the Syracuse program was based on the one in Southern California, Dr. Ritz made it clear that he didn't want the Syracuse group to simply "replicate" what they had done. Instead, he wanted Syracuse to take ownership of the program. To a large extent this happened. New activities more appropriate to central New York State were added, and the program emphasized more science content. Eventually, if the program is conducted at a number of other institutions throughout the country, it would be useful for the Project Directors to share experiences, and eventually prepare a brief "primer" of tips on how to make "A Head Start on Science" succeed in different local environments without losing focus.

These considerations aside, there is no question in the evaluator's mind that "A Head Start on Science" was successful, and that the ultimate beneficiaries will be the children whose earliest memories of "school science" will be those of fun, excitement and wonder. The challenge, of course, will be to keep that "sense of wonder" as they progress through the many years of formal education that lie ahead.