



Appendix 5



Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

A collection of vignettes, descriptions, narratives and agendas comprising diverse portraits of Schoolyard Ecology Institutes written by Leaders and teacher participants from SYEFEST. First are two narrative descriptions of entire SYE Institutes, from the planning to the follow-up phase. Then we hear from teachers to get a glimpse of their experiences both during a SYE Institute, and while implementing their new ideas with their students. Finally, we present a number of actual agendas from SYEFEST Institutes in tabular form.

Leaders' Portraits of SYE Institutes:

- [California Portrait](#): A portrait of a SYEFEST Summer Institute from June 24-July 8 at Cal Poly State University, San Luis OBISPO. An excellent description of a schoolyard ecology program with a strong science content focus and organization.
- [Michigan Portrait](#): A portrait of a SYEFEST from Hope College, 1994-1996 in Holland, Michigan. A contrasting program where pre-service teachers played a key role during and after the Summer Institute.

Teachers' Narratives:

- [Peggy Hanson](#): A SYEFEST testimonial. This teacher kept a diary as she went through the SYEFEST program, as well as comments from her students after she applied her new methods.
- [Jude Curtin](#): A teacher's perspective and observations of a SYEFEST experience.

Institute Agendas

- [Oxford, Georgia 1996](#)
- [Boston, Massachusetts 1994](#)
- [Tucson, Arizona](#)
- [Gainesville, Florida](#)
- [San Luis Obispo, California](#)
- [Missoula, Montana](#)
- [Hope, Michigan](#)



Appendix 5



Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

A Portrait of SYEFEST, California

By V. L. Holland (Lead Ecologist) and Lynne Dee Oyler (Lead Teacher)

Summer Institute June 24-July 8
Cal Poly State University, San Luis OBISPO

We began our Summer Institute with an introduction to the SYEFEST concept, followed by a discussion of participating teachers' concerns and hopes. The teachers reflected on our objectives and described their uncertainties and hopes about using their schoolyards for teaching ecological concepts. We discovered a wonderful synergy that developed as each of us contributed the best of our creative and intellectual abilities. Through SYEFEST we learned about ecological principles and processes that can be easily taught to all children using inquiry investigations on the schoolyard.

Introduction

The ultimate goal of the SYEFEST project is to promote quality ecological education for elementary school students by ensuring that they have the opportunity to learn ecological concepts using local organisms and environments directly. The more immediate goal is to support elementary teachers in using the environment most readily available - the schoolyard - for teaching ecology.

SYEFEST addresses the needs of teachers to:

- Understand and be able to teach the nature and processes of science (ecology).
- Be comfortable teaching outdoors.
- Have a sufficient familiarity with and knowledge of their schoolyard environment and its potential for ecological investigations and inquiries.

The SYEFEST California Summer Institute started on Friday, June 24 with excitement and enthusiasm and ended with a celebration on Friday, July 8. We worked together from 9 to 3 (sometimes longer) and also had take home assignments. Class meetings were held at Cal Poly and on every school site represented at the Institute. Going to each school site provided us all the opportunity to explore new and different schoolyard habitats that turned out to be a real plus. We conducted guided and open inquiry activities at each school, and we also worked together to develop our own unique inquiry exercises specific to each site. At the end of each day, the teachers were given a few minutes to reflect and write about the day's activities. We finished each day sharing and discussing our thoughts and insights about what we had accomplished. Teachers were encouraged to start thinking about some interesting ecological questions and bring any ecology books or materials they wanted to share.

Several follow-up sessions were held to check teachers' progress and to share ideas. The entire group met three times so we could share successes and failures that teachers and students had experienced as a group. We discussed ways to convert experimental "failures" into successful experiences that lead to further investigations. This was also a time when teachers could show us what activities they were using and how it fit into the curricular framework for their school. V. L. Holland (Lead Ecologist) and Lynne Dee Oyler (Lead Teacher) made follow-up

site visits to check on the various activities that had been incorporated into the curricula, try to solve problems or answer questions regarding schoolyard ecology, and provide assistance in using the SYEFEST philosophy in teaching ecological principles on the school sites.

Teachers' concerns and hopes regarding the Institute

We wanted to know what concerns the teachers had about the Institute and what they hoped to leave with in terms of knowledge and skills. The discussion that followed allowed us to establish a starting point. From this, we determined the most effective methods to work toward achieving the goals of SYEFEST. Some of the teachers' concerns and hopes are listed below.

Concerns

- What's for lunch?
- That we may be intimidated by SYEFEST.
- That we may be overwhelmed by SYEFEST
- That the schoolyard will not be enough to keep students interest
- That there is no water on the school site.

Hopes

- To feel comfortable with hands-on and inquiry approach
- To gain experience in the scientific method
- To learn to use the schoolyard for ecological studies
- To learn practical activities and the best way to use the schoolyard
- To create a nature study walk and area
- To learn to manage outdoor labs and classes
- To learn how best to have students work outdoors
- To learn to use habitats and ecological areas available
- To be able to apply learning to everyday life

The ecosystem concept - our guiding theme

The ecosystem concept and perspective were used as the guiding theme for the activities and learning during the Summer Institute. The teachers discussed and listed components of the ecosystem, attributes of ecosystem components, division of labor in ecosystems, interactions that occur in ecosystems, inputs and outputs in ecosystems, and feedback loops that develop if ecosystems are balanced (homeostasis). We then discussed how the ecosystem concept could be applied on the schoolyard and used in schoolyard ecology. The teachers developed a simple ecosystem model and had a lively discussion of how this could be used on their school sites.

We emphasized that all of the components of the ecosystem are interrelated and interconnected and that no one factor can be changed without affecting the other components in the ecosystem (holocoenotic concept). We asked them to explore what would happen if they changed just one factor and think about how that might affect the rest of the ecosystem. For example, if we simply raised the air temperature by 5 degrees, how might that affect other abiotic and biotic features of the ecosystem? How would the ecosystem change through time? We had an interesting and thought provoking discussion of all the interactions that would be affected and all the changes that would occur in the ecosystem by simply changing one factor. Later the teachers were given a homework assignment in which they compared an ecosystem and ecosystem dynamics with the human body. This included comparisons mechanisms that maintain balance in the a human body and in an ecosystem (organismic concept of

ecosystems). Teachers even developed some fascinating posters to present.

After our exploration of the ecosystem concept, we took a field trip up Poly Canyon (a natural coastal canyon behind the Cal Poly campus) to examine the diversity of habitats and ecosystems that occur in close proximity to one another. We had inquiry discussions trying to describe and explain the diversity we observed. How would we determine what caused the diversity? We also collected soil samples for laboratory and plant growth experiments. How will the same plant species grow in soil from the oak woodland compared to soil of the chaparral?

The teachers designed and set up decomposition experiments and compost buckets in the laboratory from soils collected in the field. A discussion ensued on how these activities related to nutrient cycles in ecosystems. Teachers examined the compost buckets regularly throughout the Institute to see how the decomposition processes work on different materials ranging from apple cores and banana peels to Styrofoam, plastic bags, and aluminum cans. How can these principles be applied to the schoolyard? Where do nutrients come from? How do nutrients leave ecosystems? Agricultural fields? Schoolyards?

Long-term experiments dealing with plant competition, plant growth, seed germination, and allelopathy (illustrations of ecosystem interactions) were also set up so we could analyze the results toward the end of the Institute. Teachers designed and set up plant growth experiments to investigate how plants grow under different environmental conditions and in different soils. Plants were grown both from cuttings and from seeds so that teachers could observe different types of growth. Teachers were also given the opportunity to design and set up inter- and intra-specific competition experiments in different soils. Activities from several sources were used as references.

After a discussion of how plants interact chemically in ecosystems, teachers were challenged to design and set up experiments to test for allelopathic or other types of chemical interactions in nature. They were given a sample lab from Cal Poly on allelopathy as a guide. Many interesting experiments were conducted using soil, leaves, twigs, and leachate from soils and leaves. The importance of understanding seed germination requirements in relationship to where plants grow was explored by the teachers. Several seed germination inquiries were set up to see how factors like moisture, light, and chemicals affect germination rates and plant establishment.

We finished the first day with a scavenger hunt around the campus to get an idea of the diversity of habitats and living organisms that one can find on a schoolyard if one looks carefully. The assignment for the weekend was for the teachers to draw a detailed map of their schoolyard keeping in mind the ecosystem theme.

As we began exploring schoolyard ecosystems in more detail, we starting by having the teachers list all the various abiotic and biotic components of schoolyard ecosystems and think of ways that they could study them using open and guided inquiry methods. The first ecosystem components we decided to discuss were the abiotic factors and how these factors affect the living organisms that occur in ecosystems. We discussed a diversity of factors such as soil and air temperature, soil characteristics (pH, texture, color, organic matter, moisture, compaction, etc.), wind speed, and light.

Each teacher was provided with a custom made soil testing kit for their school site that allowed them to examine the characteristics of the various soils found on their schoolyard. They had already collected soils from various ecosystems in Poly Canyon so they could try their soil testing kits. We posed several questions in the class such as how are the soils of the oak woodland different from those in the chaparral? The emphasis was always on how all these abiotic factors interacted with one another and with the various plants and animals on the schoolyard. How can we examine interactions? What role does soil play in an ecosystem and on a schoolyard? We gave the teachers examples of inquiries that they could use and also asked them to design their own. We provided various instruments to measure abiotic factors and they learned how to make simple instruments such as light and wind meters for children to use on the schoolyards.

After inquiries on abiotic factors, we focused on the diversity of living organisms that occur on schoolyards, their

characteristics, and how they interact. We started each session at a new school site with some form of treasure or scavenger hunt to sharpen the observation skills of teachers and to acquaint them with the habitats and ecological areas on campus. We emphasized that good ecologists are keen observers. V. L. even wore two different types of tennis shoes one day to see how long it would take before someone noticed. It did not take too long! They would not believe it was done on purpose.

After orientation activities on a schoolyard, we usually had a guided inquiry that focused on the theme for that day such as species diversity, plant and animal adaptations, food webs, populations, protective coloration, and plant and animal distribution. Activities from many sources were made available and used as guided inquiries. Teachers also developed their own open or guided inquiry activities dealing with the unique environmental factors that might influence distribution of plant and animals, growth of plants, etc. for specific school sites. We encouraged teachers to learn vegetative terminology, learn to identify plants using keys, and make a plant collection of all the plants on their schoolyard. We provided material to assist them in gaining this knowledge, and we assisted them with the collection and identification of the plants.

Guided and open inquiries varied from school site to school site but included treasure hunts, plant hunts, plant patterns, comparison of species diversity in different habitats, life in the soil, food chains and food webs, etc. Teachers made their own sweep nets to sample for insects and spiders. We discussed the various habitats on the schoolyards and what characteristics of these habitats were important in determining what species occurred in them and why some habitats had a greater species diversity than others.

Plant and animal adaptations and variations were explored using several activities. We designed an inquiry on predation and protective coloration in different habitats using various seeds as the prey. Seeds of different sizes, colors, shapes, and textures were scattered in different habitats, and the teachers served as the predators. We analyzed the results as a group and tried to explain why certain 'prey' species were taken in some habitats and but not in others. Teachers discussed how this inquiry could be applied to predator-prey relationships in nature. We talked about adaptations that make predators successful in different habitats (such as different bird beaks) and designed inquiries to demonstrate these adaptations in nature.

Peter Feinsinger joined us for a couple of days and presented a great talk on schoolyard ecology projects he has developed in other countries (Central America) as well as in Florida. He visited one of the school sites with us and led some fascinating inquiry activities including one on scale in ecosystems and one of food preferences of animals (ants). The teachers felt his visit was one of the highlights of the institute. Dennis Frey, a professor at Cal Poly, also guided some inquiries on dispersal, mark and recapture, and home range using sow bugs. We discussed how size of animal populations were estimated by ecologists. Using real data from a Monarch butterfly study locally, teachers were shown how to estimate population sizes using mark and recapture methods. These activities were also considered highlights of the institute and inspired the song "Sow Bug Blues" that we presented at the meeting in Georgia, February 1995.

Schoolyard maps prepared by the teachers were reviewed at each site. Suggestions were made about how the maps could be used and refined. Activities related to mapping and scaling were conducted at several school sites. These included looking at stratification in grasslands and wooded areas. We posed several questions such as: How does an ant visualize the schoolyard compared to a bird flying over? How can one estimate slope angle? size of trees?

Ecosystems and watersheds were explored using an excellent series from the San Luis Obispo 4-H Youth Development Program called From Ridges to Rivers: Watershed Explorations. Each teacher was provided a copy of the series which includes several activities and inquiries. We set-up several of the activities and conducted them as a group in the lab.

At the end of the Institute, teachers analyzed the various long term experiments that they had set up the first day dealing with plant competition, allelopathy, seed germination, decomposition and compost buckets, and plant growth. They were asked to analyze their data following the scientific method and decide the most effective way

to present their findings to the rest of us at a scientific meeting. We videotaped their presentation so they could review and critique them if they wished. Overall, the results were excellent and resulted in a very enthusiastic interchange of ideas and questions. Many new ideas for additional inquiries were generated.

On the last day, teachers were provided an opportunity to develop ideas for implementing schoolyard ecology on their schoolyards. We had an ecological materials fair with a local representative from a nature company who demonstrated various educational materials that could be used by students to examine ecological principles on schoolyards. Teachers put together individual Schoolyard Ecology Classroom Study Kits to be used to develop inquiry activities for their students during the next school year. Each teacher was also asked to share SYEFEST with the other teachers at their school sites. Some even did mini in-services.

The principals and superintendents from each school site were invited to our final activities and awards ceremony where we presented all participants with a certificate of completion and a small gift reflecting their unique contributions to our institute. We sang ecology songs for children and video taped "Sow Bug Blues" for the meeting in Georgia.

School year activities

We had three follow-up sessions with our teachers. One of our sessions emphasized fire ecology because the Highway 41 fire had just burned thousands of acres in San Luis Obispo County within close proximity of many of our school sites. We discussed various experiments and inquiries that students could conduct on fire ecology and succession.

At our follow-up session held at Winifred Pifer Elementary School in Atascadero, our class made suggestions and participated in planning an ecological and native American garden area that one of our teachers, John Beccia, was developing on the schoolyard. The inspiration for the design came from John's SYEFEST experience. The ecological area has now been constructed and is being used by the students and teachers at Pifer Elementary School.

Teachers were asked to provide anecdotes about SYEFEST on their school sites. These and our meetings show that our teachers are successfully using inquiry-based methods for teaching schoolyard ecology after shifting some paradigms. First, they learned that a diversity of habitats is actually present in the schoolyard. Second, they realize that ecology can be taught away from environmental camps, outdoor schools, and videos. Third, they overcame the idea that students cannot be managed outside the classroom, except for PE. From leaves to lacewings, weather patterns to nematodes and pesticides, our teachers are using their schoolyards in creative, new ways to develop inquiring minds.

Teachers provided us with some anecdotes, notebook entries including the items in Schoolyard Ecology Study Kits, inquiry questions written for their specific schoolyard, and sample work including songs inspired by and written for SYEFEST.

Both V. L. Holland and Lynne Dee Oyler have made follow-up site visits to check in with the teachers. Teachers are still using what they learned at the summer SYEFEST institute and have incorporated many new ideas on using their schoolyards. Many also ordered additional materials during 1995 to supplement their Schoolyard Ecology Classroom Study Kits and add additional inquiries. Teachers call us on a fairly regular basis to talk about schoolyard ecology and SYEFEST. We have all remained good friends and colleagues.

The SYEFEST experience led to other opportunities for both V. L. Holland and Lynne Dee Oyler. We received a special invitation to participate in another N.S.F. sponsored summer program on the Cal Poly campus called the San Luis Obispo Science Project.. This project was established to meet the science in-service needs for elementary and middle school teachers in northern Santa Barbara and San Luis Obispo Counties.

The project's summer institute provides a forum in which educators acquire and share science knowledge and skills focusing on the theme of Diversity and the Everchanging Coast of California. K - 8 teachers are introduced thematically to life, physical, and earth sciences using various activities. We were asked to lead a one day session on SYEFEST. During our session we explained the SYEFEST program and led the teachers in inquiry activities. We showed them how schoolyards and campuses could be effectively used to teach ecology. After the introductory remarks, we had them do a treasure hunt around the science buildings. Teachers from all levels were surprised at what they found once they started looking closely in different microhabitats on campus. The teachers worked in small groups and designed an inquiry experiment to test food preferences in ants. They were very creative and enthusiastic, and the results of their investigations surprised many of them. They presented their results orally to the group at a mini scientific meeting.

In July 1995, V. L. Holland and Lynne Dee Oyler joined other SYEFESTians and presented an inquiry activity for kids at the Ecological Society Meetings in Snowbird, Utah. The inquiry was "Abiotic factors--learning ecology using the inquiry approach". We had a good group of students and parents who were excited to explore the abiotic features of the forests and open areas around Snowbird. It was very well received by both the students and the parents that attended.

Since the SYEFEST summer institute, V. L. Holland and been responsible for a capstone course in Applications of Biological Concepts, a course designed to teach future elementary teachers how to teach biology. The SYEFEST experience resulted in some significant changes in the way we teach the course. We have incorporated many eco-inquiries and we use the Cal Poly campus for the schoolyard for many of them. These future teachers thoroughly enjoy schoolyard ecology once they become comfortable with the open and guided inquiry approach. Lynne Dee Oyler is now working on her Ph.D. at University of California, Santa Barbara and has introduced many SYEFEST ideas to students in her Biological Environment class.

Syefest teacher growth

The SYEFEST Summer Institute resulted in tremendous growth in the participating teachers as shown by their evaluations of themselves and of the workshop. Some characteristic quotations are provided below:

- I am now interested in the inquiry process. I'm looking forward to discovering ecology with my class.
- I would never have considered our sandbox, a tree trunk, or a weedy slope as ideal places to conduct experimentation. So now I feel we have an unlimited resources on our schoolyard.
- I look forward to sharing schoolyard facts with our school population via assemblies, ecology newspaper, etc.
- In looking over our concerns list from the first day, I'm feeling much better about schoolyard ecology. I think I have a grasp of the inquiry method. I feel more comfortable on my schoolyard.
- I loved the practicality of the SYEFEST summer institute approach, materials and experiments.
- Scientific inquiry can be applied in a variety of ways to one's immediate area and there are even more microhabitats on my schoolyard than I had previously imagined. Inquiry based investigations can be a reality using the SYEFEST system. I believe my students will be as excited as I am about this curriculum.
- I learned an incredible amount of information about ecology and the scientific method. I really feel a lot more confident about teaching schoolyard ecology to children.
- I realize now that there is an inquiry or experiment for almost everything you see on your schoolyard - both biotic and abiotic.
- Because we visited so many schoolyards and practiced schoolyard ecology, I feel comfortable about teaching it.
- Everything we did in the workshop has helped me grow as a eco-inquirer.
- This has been the best workshop I have attended. Not continuing it would be a shame and a waste for our kids and their future. The workshop has given me the tools to make science inquiry-based and relative.

- Before the workshop I felt my schoolyard might be lacking. Now I feel excited about the things kids can do on the yard.
- SYEFEST stressed getting the kids outside in nature, working cooperatively, using leadership skills, being curious and observant about our surroundings, and being respectful of nature.
- Yes, I feel empowered! Thank you.
- Now I look for interactions in the ecosystem as opposed to looking at something in isolation.

Reflections from V.L. Holland and Lynne Dee Oyler

Exploring the possibilities for ecological investigations on schoolyards is rewarding at multiple scales. Students learn to observe plants, animals, habitats, and processes in discrete areas on their own schoolyards. They begin to ask focused ecological questions based on observations of natural phenomena. Using questions derived from their own experiences, students and teachers begin to study mechanisms or controls on interactions, behaviors, or processes that they have observed. As they learn to recognize ecological patterns and processes, students can relate them to core concepts in ecology and are eager to apply these concepts to phenomena observed or discussed beyond the schoolyard.

Philosophically, we sometimes found it difficult to withhold answers from our students (teachers or elementary children) as they pursued ecological investigations on their schoolyards. We wanted to provide a wealth of information. Through our SYEFEST experience with our teachers, we learned the value of empowering our students' abilities to develop an understanding of ecology. By NOT providing all the answers to their ecological questions, they no longer deferred their concerns or misunderstandings to us, but learned to investigate their own questions. Our job was to ASK more questions that provided perspective or helped alleviate potential misunderstandings. Our job was also to provide suggestions for materials and methods when their own creativity was stumped, and to supply equipment as necessary for ecological inquiry on their schoolyards.

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Appendix 5



Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

A Portrait of SYEFEST, Michigan

Hope College, 1994-1996
Holland, Michigan

Narrative report

Syefest at the Hope College, Michigan site was a teacher development program designed to help teachers learn how to use schoolyard resources for teaching investigative ecological science. The Hope program was led by Kathy Winnett-Murray (Lead Ecologist; Associate Professor of Biology) and Gail Van Genderen (Lead Teacher; elementary school teacher at Waukazoo School and Science Coordinator for West Ottawa Public School District). We were assisted by David Zwart (Assistant Professor of Education, Hope College) in establishing links with local schools, in setting up course credit for the pre-service teachers, and in evaluating student follow-up work.

Our site was unusual among the 1994 groups in the significant involvement of undergraduate, pre-service elementary teachers. We believe that the pre-service component was a particular strength of the Hope program in at least 3 significant ways:

- Students provided needed assistance during the implementation phase at each teacher's school.
- Students gained significant hands-on experience teaching children ecological science outdoors and learned valuable insights on teaching and classroom management from their teacher-partners.
- Students became more positive about teaching science in general, and for most, this was their first exposure to inquiry-based science teaching. We believe this will have an overall positive impact on the quality of science teaching of these individuals.

Planning the Summer Institute, 1994

The leads drafted and distributed fliers, letters and posters to advertise the 1994 Summer Institute in 3 school districts: West Ottawa Public Schools, Holland Public Schools, and Holland Christian School District. In addition, David Zwart advertised the Syefest program, and offered applications through the "Partners in Science" newsletter he edits as part of a Kellogg Foundation funded program. We distributed 200 applications at about 30 schools; the newsletter is received by about 300 individuals and schools. We received 13 applications from teachers in all 3 targeted districts and selected 10 participants based primarily upon evidence of commitment to the program. Students were selected on similar criteria, but we also considered GPA and education courses completed: 11 of 31 student applicants were accepted, but 4 students were unable to attend by the end of the summer, so we ended up with 7 students (Table 1).

Kathy and Gail attended the Syefest Leadership Workshop in Gainesville, FL during February 1994 and found that the time spent there living and working together was instrumental in forging our equality in the Syefest partnership. It also helped us lay the groundwork for concepts and contexts that would be important to both of us in producing a Summer Institute that attempted to reach multiple goals in science education. In retrospect, the Leadership Workshop was an absolute must. The personal and professional contacts formed with other Syefest

teams ranked a close second in important outcomes of this conference.

Kathy and Gail met several times during April and May of 1994 to plan the Summer Institute. During some of those meetings, Kathy visited Gail's first-grade classroom. Twice, we pilot-tested a Syefest activity (e.g. Ant Cafeteria) with Gail's class, and often, I observed Gail teaching science. This experience also had a tremendous impact on the equality of our professional relationship. We think it is imperative that Lead Ecologists spend at least a few hours observing how their partner operates in the classroom - it is the only way a college professor can gain an appreciation for HOW teachers accomplish what they do. In addition, it will help the ecologist "know where to aim" in terms of concepts and content that will be relevant to elementary students.

Although Kathy was away conducting research in Costa Rica during June and July, she sent drafts of potential inquiries to Gail often and re-wrote them based on Gail's feedback.

Kathy and Gail chose bulk supplies to order for the Summer Institute (we distributed the same items to all teacher participants in a "kit" at the end of the institute) and met again twice in August just before the Institute began. We continued to meet about every other day during the Institute to revise details of the schedule as needed (Table 2).

The Summer Institute, 1994

Our Summer Institute was 2 weeks, August 15-26. We began on the first day with inquiry brainstorming at a local schoolyard, and allowed small groups of participants to design and carry out their own investigations (OTS model, after Leadership Workshop I). Afterwards, we decided this was an essential starter. We presented 3 major themes in ecology and assigned each inquiry to an appropriate theme (Table 3). We made a concerted effort to connect those themes to each teacher's building-specific curriculum, as well as to the Michigan Essential Goals and Objectives in Science Education (MEGOSE).

On most institute days, we engaged in Activity Smorgasbords (small groups rotated through guided inquiries led by Kathy, Gail and David) at the schoolyards of teacher participants, followed and/or preceded by reflective discussions and journal-writing (Table 4). The smorgasbords were interspersed with other activities, the highlights being:

- Small groups created "visuals" for defining inquiry learning.
- Schoolyard Organism Coffee Breaks (throughout the first week we displayed specimens of schoolyard organisms from the Hope collections, with natural history information), culminating in a Schoolyard Organism Q/A Contest.
- Schoolyard Resource Treasure Hunt (teacher-student partners) did these at their own school and returned with special finds and/or items that they wanted to have identified by professors at Hope.
- Teacher/Student partners designed and then led inquiries at a Day Camp - Kid Connection - at a local school. This opportunity also enabled us to reflect on classroom management skills and inquiry learning in larger groups.
- Each participant selected one schoolyard plant and one animal for which they researched the natural history and wrote an inquiry. All of these write-ups were compiled into an Institute booklet of participant-generated activities. The booklet is entitled "Schoolyard Ecology: Information and Activities for Schoolyard Plants and Animals of the Holland, Michigan Area", and has been distributed at all of the workshops listed in this report. It has also been distributed in each Methods in Science Teaching class that has been taught at Hope College.
- Resource Materials Coffee Break - During the second week we displayed science, natural history, and inquiry teaching resources in the break room.
- All participants received an introduction to the Van Wylen library's Curriculum and Media Resources Center by Ms. Linda Linklatter, Hope librarian, and received Hope library cards.
- Mini-workshop on assessment presented by Regina Calnin.

- Planning time for teacher-student partners to discuss their schedules and inquiry plans for the (minimum) five times that students would be visiting schools during the fall semester to assist in implementation.
- Syefest coordinator Catherine Corey visited our site during the first week of the Summer Institute.

A schoolyard ecology kit (Table 5) was distributed to each teacher participant on the last day. The kits consisted primarily of materials required for the guided inquiries we presented for institute smorgasbords, but we also paid close attention to selecting items that could be used for a wide range of open inquiries (e.g. thermometers, hand lenses, insect nets, measuring devices, etc.). In addition, we gave participants numerous books, field guides, make-it, take-it items, and supplies purchased for the Institute guided inquiries - some as "prizes" for our daily "ON-TIME" drawings and for the Schoolyard Organism Q/A Contest.

Of the various institute activities outlined above, those that we feel were the most important program ingredients in meeting our goals in teacher development were:

- Connecting inquiries and ecology themes to each teacher's curriculum.
- Planning time for implementation (teacher/student partners).
- Doing the activity smorgasbords at teacher's own schools.
- Allowing participants to choose creatures they were interested in for the self-generated inquiries.
- Open inquiry on Day 1.
- Allow teachers to define what inquiry is based on own experience (provided, at least in part, from the Day 1 activity).
- Lead Teacher and Lead Ecologist participate EQUALLY in planning agenda, giving presentations (e.g. I did science themes and Gail did educational themes/curriculum), and leading activities. Clear demonstration of partnership.
- Downplay the perceived need to attach a name to a creature BEFORE doing an inquiry on it. Doing the inquiries served as a way for generating interest in, and wanting to know more about, the natural history and ecology. We think that doing inquiries first helps create a "need" for content - hence, gives relevance to content.
- Spending part of one day with real kids doing inquiries.

Follow-up workshops

We held two all-participant follow-up workshops (1 October and 19 November 1994). Our third follow-up workshop was a planning workshop (7 February 1995) for the 10 participants who prepared presentations for the Michigan Science Teacher's Association Meeting (3 March 1995; Appendix C). The Fall Syefest follow-upworkshopp (1 October; Table 6) was held at the J.H. Campbell Nature Center of Consumer's Power Co., Port Sheldon, MI, and attended by 15 of our 17 participants. Consumer's Power has established a classroom trailer on the site to facilitate use of the nature center by area science teachers. We shared our initial results of Syefest implementation at the schools. The leads presented an integrated thematic workshop on the question of "Who Eats What?", a theme reflected in the elementary MEGOSE. Three new guided inquiries were presented as a "smorgasbord."

We had a brainstorming session on Trouble-shooting Outdoor Classroom Management Problems. The list generated by our participants has become one of the handouts we distribute at our workshops (Table 7)! The Winter Syefest follow-up workshop was held at Southside Christian Elementary School on 19 November 1994 and was attended by 15 of our 17 participants (Table 8). In addition to presenting a smorgasbord of winter inquiries, we enjoyed a mini-workshop presented by teachers Linda Jordan and Sheryl O'Connor on brain-compatible learning and children's learning styles.

Follow-up visits, in-service workshops, and dissemination

Visits made by the Lead Ecologist, Kathy Winnett-Murray, to schools of teacher participants are outlined in

Appendices A and B. In addition, Gail planned, and Kathy assisted with, two teacher in-service workshops at Waukazoo Elementary School in the fall of 1994 (Appendix C). Ten Michigan Syefest participants (Lead Teacher, Lead Ecologist, 3 teachers, and 5 students) presented 6 back-to-back workshops on Schoolyard Ecology at the March 1995 meeting of the Michigan Science Teacher's Association meeting in Lansing (Appendix C). All but one of the presentations was attended by over 50 elementary teachers. Kathy and Gail presented a contributed paper on Syefest for the 1995 meeting of the Ecological Society of America, organized and participated in the "Eco-Activities for Kids" event at ESA, presented an invited workshop in November 1995 for the Regional Math-Science Update for teachers at Grand Valley State University (Grand Rapids, MI), and another workshop for the National Science Teacher's Association meeting in St. Louis in March 1996 (Appendix C and D).

At each meeting and workshop we have distributed Summer Institute booklets (about 100) and about 350 packets of guided inquiry handouts. We have received much positive feedback from attendees, including letters for requests for more information and more activity handouts. An additional 50 booklets have been distributed to elementary and secondary education classes taught by David Zwart each semester at Hope College.

Pre-service teacher follow-up and development

Students assisted teachers in the implementation of Syefest at local schools during the fall semester, met with Kathy and David throughout the fall semester for evaluation, critique of science education articles, and discussion of assessment methods, and were required to give Syefest presentations in their science education courses (Appendix E). Five of the students also presented at the MSTA meeting in March 1995 (Appendix C). Several students did Syefest inquiries as part of their teaching placements during 1995, and one student taught a Syefest course as part of the summer enrichment program (Quest) for Holland Public Schools in 1995. Student evaluations indicate that this program was one of the most useful and rewarding learning experiences they had while at Hope College. In-service teachers evaluations of student performance are very positive (Appendix E).

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Appendix 5



Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

SYEFEST Testimonial, Millbrook, New York, 1995

By Peggy Hanson, Millbrook Ecology Institute

What am I doing here??

The question kept rolling around in my head. I had decided to take the two-week SYEFEST summer course on the enthusiastic recommendation of another fourth-grade teacher, who had participated the previous summer. I didn't share her enthusiasm, but I had concluded the experience would be good for me. I therefore approached it with the set of attitudes normally associated with painful but necessary medical treatments. For the introductory meeting, we had been instructed to bring a bag of dirt from our schoolyards. I chose a spot as close to the school building as possible and quickly shoved some dirt into a plastic bag, muttering, "I can't believe I'm doing this." I imagine I must have made quite an impression at the introductory meeting. When asked to share concerns we might have about the upcoming experience, I volunteered, "Well . . . I don't like the outdoors!" The truth is I don't bike, hike, camp, jog or even picnic! I might well have added: "And I don't like science very much either."

As we examined the dirt samples we had brought, the other teachers were exclaiming over their discoveries. I sat glumly looking at my pile of dirt, in which I saw: dirt. Many of the other teachers had all kinds of insects in their samples. I had none whatsoever, and tried to fight off that familiar high-school science feeling that said, "See? You're just no good at this. Even your dirt is no good!"

July 10, 1995

I drove to the first day of the two-week summer institute. It was eight in the morning on a very hot day in July. Taking a deep breath, I steeled myself for whatever was to come.

We were asked to keep a Journal, and on this first day I wrote, "I am impressed by other teachers' openness to new ideas and approaches." Looking back, this seems significant - the first cracking of defenses and a dawning awareness that other attitudes were possible.

We were assigned to small groups and asked to list fifty questions about the schoolyard. I remember wandering about aimlessly, feeling unfocused and inadequate. I wasn't used to looking beyond the surface of things, and I had long ago lost the habit of wondering about the world. I didn't really have any questions--other than "What am I doing here?"--but I tried dutifully to comply with the instructions and to contribute something. Time seemed to slow to a crawl, and I remember the relief with which I finally noted question number fifty and headed back indoors.

That first afternoon, we split into groups for outdoor investigations. My group decided to examine which way vines twine. As we tromped through the woods looking at vines, I learned about galls for the first time. I was astounded to discover that there were something this commonplace about which I know absolutely nothing. It was like discovering in middle age that there were these things called chairs you'd never noticed before. Although I cannot report that I was enchanted by being in the woods, I did experience powerfully how much of life I had been screening out. This realization is reflected in my Journal entry the next day: "I am so much more comfortable with words and ideas than with physical objects. The physical world feels sometimes threatening, sometimes boring -

something to be endured rather than appreciated."

Four days after my initiation into SYEFEST, I wrote in my Journal:

July 14, 1995

For me, the activities have gotten more interesting and comfortable each day. The concept of "population" helped organize what we were doing and put it in a context where I could use it (and will be more likely to remember it.) I seem to need to know "what 's the point." I seem to need a theoretical framework to hang things on. Otherwise it's kind of like busywork. . .something to do--but what does it mean? Does open inquiry work best late, rather than early, in a unit? For learners like me at least, I think this is the case.

Around this time, we did an activity with sticky traps, and discovered that the yellow traps seemed to attract a greater number of bugs called leaf-hoppers. As we examined these bugs under a hand lens, I was amazed by their dazzling color and intricate design. Again, I had the powerful experience of realizing how little I knew about common objects I had passed by every day of my life.

July 20, 1995

On the last day of SYEFEST, I wrote in my Journal:

I see the schoolyard as a real, rich, readily available resource now. It seems crazy not to take advantage of it. I have learned a lot of specific techniques that will give me confidence in guiding activities. I have learned some content that has been helpful. Most of all, I have learned about seeing. I find I am beginning to observe more, and feel more friendly toward that physical world as it has more familiar, recognizable things in it. I notice more every day. More than anything, this is what I'd like to give my students. I am looking at the world in a new way!

May 7, 1996--SYFEST Follow-Up Session 3

As I stepped outside with my group of fellow teachers, I felt eager to look around and see what questions we might come up with. The first thing that caught our eye was moss on a nearby tree trunk. We began talking about moss and lichen, and soon realized we had dozens of questions. This is unbelievable, I know, given what I have already written, but they were questions about which I really was curious! We quickly jotted down an entire page of questions, including the following: Does moss grow in more abundance on a particular side of trees? Does lichen? Does moss or lichen grow in greater abundance in sun or shade? In wet or dry conditions? On certain kinds of trees? Is moss or lichen good or bad for trees? Believe it or not, I was sorry we had to limit ourselves to one question!

I had an absolutely wonderful time that day choosing a question, designing an investigation, carrying it out, and reporting our findings to the group. In the process, I learned a lot about moss and lichen. I also learned something about myself and how much the SYEFEST experience had changed me. I was amazed at my own level of participation and involvement. Was this person moving through a scientific process with confidence and enthusiasm really me? How on earth did this transformation occur? To my knowledge, I was not brainwashed during my ten days at SYEFEST, yet this brief experience changed profoundly my attitude toward science, my teaching of science, my understanding of science process, and my interest in the natural world. My husband of twenty-five years watches bemused as I stop to point out a gall or kneel to observe an insect. I cannot honestly think of another experience that has had a comparable impact in such a short period of time--changing lifetime attitudes and practices.

So, the obvious question is, How did this happen? What are the ingredients that made this experience so powerful and effective? Though it is difficult for me to be objective, I will attempt to step back from the experience and analyze the key factors.

First, the co-leadership of a scientist and a classroom teacher was critical. I doubt very much if the experience would have worked nearly so well if either party had been missing. Each lent credibility to the enterprise. I couldn't say, "Yes, but he doesn't understand the realities of the classroom, "or "Yes, but she doesn't have

specialized science training." Furthermore, the mutual respect these two individuals (Alan Berkowitz and Linda Olsen) showed--both for each other and for each other's professions--was enormously important. I never felt patronized, but I also never felt overwhelmed by a bunch of incomprehensible scientific information. Finally, the expertise and careful planning that the facilitators brought to SYEFEST were obvious factors in its success.

Clearly another element that had a great impact on me was the hands-on nature of the program. As I became excited about what I was learning, I became eager to teach similar lessons to my students. We didn't talk about teaching ecology using schoolyards; the schoolyard became our classroom as we became the learners. Having experienced a number of activities as a learner, I could appreciate their instructional value, and I gained confidence in my ability to lead students through them.

As important as it was to be a learner, however, it was equally important to have time to reflect on the experience and to think as a teacher. Keeping a journal allowed us to step back from the experience and analyze what was happening, making an important bridge from hands-on learning to our future classroom practices.

Closely related is that SYEFEST allowed us time to develop unit plans with support from a rich collection of resources that were provided to us. This was a key component. So often teachers leave workshops with a pile of handouts and the best of intentions, only to return to their regular classroom routines, filing the handouts in a pile to "think about later." Again, the unit planning time helped build the bridge between our learning and our classroom practice. When the school year started, I pulled out my unit plans and walked effortlessly over that bridge.

Time for discussion with colleagues was another important element. Teachers rarely have time to talk to one another, and yet this is such a valuable means of professional development. The impact of other teachers' attitudes on my own the first day of the two-week institute has already been noted. As time went on we had ample opportunity to discuss our understandings, questions, plans, and concerns with each other. We helped each other to grow.

Once the school year started, I attended several follow-up sessions. This structure provided a great deal of support as we tested our plans in the classroom, encountering unexpected problems and benefits. The follow-up sessions also allowed us to continue to develop as learners, and to reflect on the ways we were changing.

A final, and for me most powerful, factor was the accessible and logical nature of the material itself. Prior to SYEFEST I had long ago come to the conclusion that science simply didn't make any sense. From memorizing the chart of the elements in the third grade to cramming for Physical Science 101 exam as a college freshman, I had become convinced that there was no point in trying to understand "this stuff," because logic didn't seem to have any utility at all. To my astonishment, in SYEFEST I began to have "right" answers to many content-oriented questions. I had never experienced even a minimal level of success in science before, and I had therefore avoided the subject whenever possible. Suddenly I began to feel that somehow, for some reason, I could learn "this stuff!"

This is also, I think, why schoolyard ecology makes such an ideal introduction to science for elementary school students. It is rooted in concrete experiences, and taps into children's natural curiosity. Anyone who has spent time with young children knows they are famous for asking a million questions; here is an approach to science that richly rewards that tendency. Also, as children learn to become good observers, they become fully engrossed in child-sized details in a way most adults can only envy.

Although I was clearly "converted" by the end of the two-week summer institute, I had not really anticipated how well-suited the curriculum would be for my fourth-grade students. For the first time, I had the experience of teaching science in a way that seemed perfectly matched with the way children think and learn. Their enthusiasm and responsiveness fed my own. I will therefore let my students' voices conclude, as they expressed their thanks to Alan Berkowitz after a classroom visit in June:

"I really like the way Mrs. Hansen did science this year. It used to be just a real boring subject. But now it's a fun thing.- Billy"

"I had a great time having you here with our class. I was the child who asked you about the caterpillar that turned out to be a beetle. I named him Justin after myself. I enjoyed learning about insects and bugs.- Justin"

"I think it's really fun going outside for science. I used to hate science. But now it's really cool.- Lindsey"

These are sample inquiries submitted to our SYEFEST evaluator as part of a "Teacher Reflection Task" - a request for lesson plans, handouts, or descriptions of activities they were doing with their students during the 1995 school year. We include them here to give SYEFEST Institute Leaders a sense of the kinds of inquiries teachers actually do with their students. We've tried to select common inquiries used in a variety of grades.

I. SYEFEST activity notes

Kindergarden activities from a California SYEFEST teacher

- Pick a Tree: A year long ecology project for second grade from a Georgia SYEFEST teacher.
- The Listening Walk: An interdisciplinary activity for second grade from a Utah SYEFEST teacher.
- Ways to Sample a Population: Beat sampling for forth grade from a Georgia SYEFEST teacher.
- Dandelions in Transect: An investigation for sixth grade from a Utah SYEFEST teacher.
- Pine Trees Young and Old: A habitat comparison for all grades from a Michigan SYEFEST teacher.
- Earthworm Squirm: A habitat comparison for all grades from a Michigan SYEFEST Teacher.

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Appendix 5



Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

Syefest Testimonial, Millbrook, New York, 1995

By Jude Curtin, Millbrook Ecology Institute

The sun was shining. There was just a hint of fall in the September air. 23 fourth graders were hunched over their white dishpans, excitedly sorting through their samples of forest litter. So began a series of lessons designed to have students generate questions, create investigations, and ultimately, come up with answers.

Lesson 1: Noticing Details

My experience has been that children need to be trained to be good observers. My first lesson has children examine a sample of forest litter, sorting every item they discover, recording their results in science journals.

Lesson 2: Classroom Discussion:

Open vs. Closed Questions: Many generic samples of both types of questions are generated, first by the teacher, then by students.

Lesson 3: Creating Questions about Forest Litter Samples

Students were told to generate as many "interesting" questions as possible, questions that they would really like to know the answers to. Students are reminded to apply what they have learned about open versus closed questions. No further instructions about the nature of the questions was given at this time. After students have been given time to generate questions, each student was given the opportunity to contribute their favorite question to the class.

Questions were as follows:

1. I wonder if roots of the same plant look the same when the plants grow in different areas?
2. I wonder why pine needles turn brown?
3. Why is one side of a cocoon a different thickness than the other side?
4. I wonder how long an ant can live without water?
5. Do all spiders have eight legs?
6. Do bugs prefer rotted wood?
7. Does moss grow better in damp areas than dry areas?
8. Why is the rotted wood soft?
9. Are pine cones of the same tree always the same size?
10. Are all pine needles of the same tree the same size?
11. How does grass grow?
12. How far does an ant travel after it's born?
13. Do the leaves on one part of a tree fall off faster than another part of the tree? (Example: top versus bottom)
14. Do worms prefer damp soil?
15. Why are roots so squiggly?
16. Why do pine cones of different trees look so different?
17. How is bark made?
18. Why do plants shrivel up when they die?

19. How many different kinds of moss grow in our schoolyard?

Lesson 4: Discussion: How Would You Find the Answers to the Above Questions?

As a class, we went question by question, trying to determine how we could find the answers. It became apparent that there were basically three types of questions: Those that you could answer by conducting an investigation, those you could answer by doing some book research, and those questions you could not easily answer. Students were told that while all the questions were valid and interesting, the ones we would be interested in would be the ones answerable by conducting an investigation. It became apparent that comparative questions would best suit our needs, while "why?" questions were the least suited to being answered by investigation. As a class, students created an actual investigation, designed to answer one of the above questions. In our case, through the democratic process, we chose to create an investigation to determine if worms show a preference for damp soil over dry soil.

Lesson 5: Conducting the Investigation

Working in six research teams, students conducted the above investigation, sharing data to allow for replication. Based on their results, students were able to reach their own conclusions about the investigation.

Lesson 6: Schoolyard Questions

Now that students were guided in the process of generating questions, creating an investigation, and reaching conclusions, using the very controlled sample of forest litter, I broadened their research field, by now including the entire schoolyard as the basis for generating questions. Students were taken on a tour of the schoolyard, notebooks and pencils in hand, with the instruction to generate questions of interest. Students were reminded to try to emphasize questions which could be answered through investigation. Students were also told to voice their questions aloud, since I have found that that seems to stimulate questions from other students. Throughout this "question walk," I was modeling questions as well.

Lesson 7: Classroom Discussion: Schoolyard Questions

Once again, students are asked to contribute their favorite questions, we discuss which ones can be answered by conducting an investigation, and finally, as a whole class, we create an actual investigation.

Questions were as follows:

1. How long does it take a maple tree to grow?
2. Does poison ivy prefer certain types of trees?
3. Do pine trees prefer wet or dry soil?
4. Why do trees leaves turn color in the fall? (Obviously, some students still didn't get it....)
5. Is there more variety of plants in the unmowed field than the mowed field?
6. Why does poison ivy turn red?
7. Do caterpillars prefer a certain type of tree?
8. Why does poison ivy have three leaves?
9. Is there a difference in the amount of worms in the mowed field versus the unmowed field?
10. Do bugs prefer colorful flowers better than white flowers?
11. Does poison ivy affect animals?
12. Can people eat moss? (I guess you COULD investigate...!)
13. Why does poison ivy itch?
14. Why are berries different colors?
15. Do the same kinds of trees have the same kind of bark?
16. Are all the pine needles on a tree the same length?
17. Are there the same number of seeds in all burrs?
18. Why is moss green?

19. How many different colors can poison ivy turn?

Lesson 8: Independent Practice: Creating an Investigation (Student Assessment)

As a way of assessing student achievement, students were asked to create their own investigations based on one of the above questions. Students must:

- State the question.
- State the Hypothesis, including the Null Hypothesis.
- Make a prediction.
- List the steps to their investigation.

Results were outstanding!! Students definitely understood the process of creating an investigation. It was exciting to give students such an independent task, and see them create appropriate investigations on their own. (Please let me know if you would like to see some of their notebook, now, or at some later date. I'm real proud of my students!) In conclusion, the process of developing questioning techniques is a lengthy one, but my experience has been that the progression of lessons leads to a student's understanding of the process of inquiry science.

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Appendix 5 Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

Oxford Institute for Environmental Education – June 17-28, 1996

WEEK ONE – DAY						
	1	2	3	4	5	
morning	Welcome Introduction	Lake sampling	Intro. to history and culture of river systems	Teacher-designed investigation testing their hypotheses about two site along an urban stream	Schoolyard enhancements - Palmer Stone Elem. (GA SY wildlife spec.)	
	Outdoor observations & questioning		Stream sampling investigation – unpolluted stream			Discuss participants' schoolyards and investigations
	Ecological Principles					
LUNCH						
afternoon	Institute assignment – Investigation Plans	Lake food web and ecosystem investigation	Lab identification of stream organisms.	Lab identification of stream organisms.	Tree identification and plant pressing	
	Intro. to Taxonomy & Keys		Integrating the curriculum with ecology	Data analysis		Presentation of results
	Identifying aquatic insects			Discuss sampling, reps., controls, etc.		
WEEK TWO – DAY						
	6	7	8	9	10	
morning	Schoolyard observations / investigations – East Newton Elementary	Field trip – forest and field.	Complete Berlese funnel investigation	Field trip – Campbell wetlands, Gum Pond, Turner Cabin wetlands, Lake Varner & wetlands mitigation site	Presentation of schoolyard investigation projects – 10 minutes/teacher	
	Plan Berlese funnel studies	Tree identification	Identify leaf litter organisms			
	Ant Cafeterias	Pollen slides & Crisco boards	Group reports			

		Leaves of steel investigation	Complete all collections		
	LUNCH				
afternoon	Set up Berlese funnels	Resource Fair	Schoolyard investigation plans – work and discussion time	Field trip (continued)	Certificates Future plans Evaluation Final Exam – scavenger hunt
	Presentation of results & critique of investigations	Plant pressing & mounting			
		Ecology literature			
Discuss open & guided inquiry	Tardigrade investigation	Discuss student management in the schoolyard			

Key

color	main type of activity involved
clear	logistics, evaluation, etc.
yellow	developing plans & materials
turquoise	ecology and nat. history instruction
l. green	guided and open inquiry
lavender	reflecting, discussing & practicing
rose	exploring & enhancing schoolyards

Outdoor observations & questioning - write up of instructions

Outdoor observations & questioning - write up of questions generated

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Appendix 5 Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

Boston SYEFEST Summer Institute - July 11-22, 1994

WEEK ONE – DAY					
	1	2	3	4	5
morning	Welcome Introduction	Meet friends, donuts	Outdoor work with children in teams	Outdoor work with children in teams	Discussion of building a science question, and children's knowledge and making a science question
	Outdoor observations & questioning	Outdoor work with children	Outdoor exploration	Outdoor exploration	
	Discuss student-centered learning				
LUNCH					
afternoon	Make-it Take-it: bug collectors	Organism role play. What problems do organisms face?	Thermometers	Ecology vs. natural history vs. environmental studies	Ecosystems
	Asking questions, collecting data	Reflect on morning's work with children	What happens if they give the wrong answer?		What happens to margin kids?
WEEK TWO – DAY					
	6	7	8	9	10
morning	Reflective practice: What do you want your children to learn?	Outdoor work with children	Outdoor work with children	Outdoor work with children	Science and pedagogy wrap-up
	Outdoor exploration	Outdoors	Outdoors	Outdoors	ALERTA Exercises
	Student-centered learning				
LUNCH					

afternoon	Make-it Take-it: Balance	Ecology vs. natural history vs. environmental studies	Using thermometers: four small animals	Ecology vs. natural history vs. environmental studies	Evaluation. Where are we? Where do we go from here? OUTDOORS!
	Four questions: plant size, geometry, leaf protection, herbivore habitat	How do you turn open ended inquiry into scientific inquiry?	Short term vs. long term science goals. Giving up the textbook.		

Key

color	main type of activity involved
clear	logistics, evaluation, etc.
yellow	developing plans & materials
turquoise	ecology and nat. history instruction
l. green	guided and open inquiry
lavender	reflecting, discussing & practicing
rose	exploring & enhancing schoolyards
orange	working with children

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Appendix 5



Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

Arizona SYEFEST Institute: July 11 - 22, 1994

Day 1 Schumaker School

Theme: Institute Orientation & Developing Observation Skills

Introduction to the SYEFEST Project

Observation and Concept Mapping with Pillbugs

Designing and Setting Up Pillbug Traps

Introduction to Reflective Practice

Journal Reflection

Prep for Next Day

Day 2 Schumaker School

Theme: Cycles

Background Information on Concepts of Cycles in Ecology

Outdoor Inquiry - Energy Cycle

Group Investigation of School Grounds

Discussion/Reflection on Teachers' "Limitations" to Doing Science

Hows and Whys of Setting Up a Controlled Experiment

Setting Up Allelopathy Experiment

Invited Speaker

Wrap Up / Questions

Journal Reflection

Prep for Next Day

Day 3 Holladay Magnet School & Schumaker School

Theme: Adaptations

Background Information on Adaptations in Ecology

Outdoor Inquiry - Leaf Adaptations to Microhabitats (leaf strength)

Group Investigation of School Grounds

Journal Reflection on morning inquiry

Indoor Adaptations Inquiry

Hows and Whys of Constructivist Teaching

Invited Speaker

Making Sweep Nets

Wrap Up / Questions

Journal Reflection

Prep for Next Day

Day 4 Duffy School & Schumaker School

Theme: Interactions

Background Information on Interactions in Ecology

Outdoor Inquiry - Predator/Prey Interactions (predator approach distance)

Group Investigation of School Grounds
Journal Reflection on Morning Inquiry
Indoor Interaction Inquiry
Hows and Whys of Figuring Out What Your Data Mean
Invited Speaker
Wrap Up / Questions
Journal Reflection
Prep for Next Day

Day 5 Cragin School & Schumaker School

Theme: Interactions
Outdoor Inquiry - Small Mammal Investigations
Group Investigation of School Grounds
Journal Reflection
Indoor Inquiry - Allelopathy
Discussion: Relating SYEFEST to TUSCD science Curriculum and Arizona Science Essential Skills Mandate
Wrap UP / Questions
Journal Reflection
Prep for Next Day

Day 6 Townsend Middle School & Schumaker School

Theme: Communities
Review of Communities in Ecology
Outdoor Inquiry - Dr. Strangeplant Curriculum
Group Investigation of School Grounds
Invited Speaker - Dr. Strangeplant Curriculum in the classroom
Journal Reflection on Morning Inquiry
Discussion: Managing the Outdoor Classroom
Bottle Biology: Using Plastic Bottles to Study Community Ecology
Wrap Up / Questions
Journal Reflection
Preparation For Next Day

Day 7 Erickson School & Schumaker School

Theme: Communities
Review of Community Ecology
Outdoor Inquiry - Sweep Net Investigation
Indoor Investigation of Insects in Sweep Nets - I.D. and using keys
Browsing through SYEFEST Resource Materials
Invited Speaker - Schoolyard Ethnobotany
Wrap Up / Questions
Journal Reflection
Prep for Next Day

Day 8 Schumaker School

Theme: Developing Open-Ended Inquiries
Hows and Whys of Developing Open-Ended Inquiries: Answerable VS Unanswerable Questions, Data Collection, Designing a Controlled Experiment
Teacher Pairs Ask Questions on School Grounds and Design an Investigation to Answer One
Data Analysis From Teacher-Generated Inquiry Projects
Journal Reflection of Morning Inquiry

Concept Mapping of Their Inquiry
Eco-Inquiry Video
Invited Speaker - Pima County EE Resource Center
Browse Through SYEFEST Resource Materials
Journal Reflection
Preparation For Next Day

Day 9 Schumaker School

Theme: Developing Open-Ended Inquiries
Teacher Pairs Continue Their Investigations
Design Project Presentation For Last Day
Discussion/Reflection of Modifying Teachers' Inquiry Project for their Classes/Students
Browsing Through SYEFEST Resource Materials
Journal Reflection
Prep for Next Day

Day 10 Schumaker School

Theme: Conclusion/Closure of SYEFEST Summer Institute
Teacher Pair Project Presentations
Planning and Followup Support from SYEFEST into School Year: Undergraduate Help With Schoolyard
Inquiries, Buying Supplies, SYEFEST Evaluation, Other Logistics
Distribute Teacher Supply Kits
Graduation Festivities

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Appendix 5



Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

Florida SYEFEST Institute: June 20 - July 1

Day 1 Norton Elementary

Introduction
Pre-Test in Ecology
Schoolyard Survey
Scavenger Hunt
Set up Mosquito Traps
Begin allelopathy Experiment
Tiger Beetle Larvae Hunt and Video
Begin Allelopathy investigation
Discussion - Adaptations
Discussion - The process of Science
Insect and plant collections - how to begin them
Developing Teacher Teams
Introducing Journaling

Day 2 Prairie View Elementary

Survey Schoolyard - observation of dung traps set up night before
Set up Mosquito traps
Sweep netting the schoolyard
Tour of the schoolyard with mini-lectures on various insects
Introduction to the SYEFEST National Project
Prep for tomorrow - making wind and light meters
Journals

Day 3 Littlewood Elementary School

Survey Schoolgrounds
Sweep Netting Schoolgrounds
Set up Mosquito Traps
Terrestrial High-Low OBIS investigation
Ant Cafeteria - feeding preference investigation
Continue allelopathy experiment
Visit to Florida State Arthropod Collection
Journals

Day 4 Talbot Elementary

Survey Schoolgrounds
Set up Mosquito Traps
Sweep Netting
General Collecting
Video - Ants

Sharing Biology Lessons from Insect Collections

Day 5 Hidden Oak Elementary

Survey Schoolgrounds
Set up Mosquito Traps
Antlion Investigation - insect length vs pit diameter
Litter Critters Activity - using Tullgren Funnel Extraction
Continue Work on Collections

Day 6 Norton Elementary

Quadrat Diversity
Investigating Pine Cones
General Collecting
Journals
Tour - American Biological Supply Company
Invited Speaker - Dr. Eugene Gerberg - butterfly scientist

Day 7 University of Florida & Norton Elementary

Video - Termites
Termite Hunt
General Collecting
Journals
Visit to Environmental Education Center -looking at resources

Day 8 Norton Elementary

Invited Speaker - Linda Cronin Jones - Schoolyard Wildlife facilitator
Videos - Mosquitoes and Butterflies
Collection Work
Journals

Day 9

Visiting a new site - Teacher Teams work on Plans for Teaching SYE There
Sharing Plans
Analyzing Allelopathy Results
Biological Lessons from Collection Specimens
Journals

Day 10

Team Presentations for Schoolground Teaching Plans
Tentative Dates for Visits
Post-Test
Closing Program

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Appendix 5



Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

California SYEFEST Institute: June 24 - July 8, 1994

Day 1 Cal Poly

Introductions
Lecture on Ecosystems
Collect Soil and Leaves. Install Decomposition Experiment.
Prepare for Allelopathy Investigation
Scavenger Hunt
Reflect, Write and Share
Sketch Your Schoolyard - assignment

Day 2 Cal Poly

Share Schoolyard Maps and Description
Review Day 1
Lecture on Abiotic and Soils
Investigating Abiotic Factors of Soil - Temp., pH, Color, Compaction
Terrestrial High-Low Hunt - OBIS Activity
Discussion of Data
Reflect, Write and Share

Day 3 Winifred Piper Elementary

Leaf Variation and Seed Dispersal Investigations
Design an Animal - microhabitat activity
Analyze and Present Data on Morning Inquiries
Present Ideas for Other Activities on Schoolyards
Reflect, Write and Share

Day 4 Los Ranchos Elementary School

OBIS Activities: Shake It, Plant Hunt, Animal Diversity (Sweep Net)
Discussion of Schoolyard Ecology Opportunities on this Site
Reflect, Write, and Share
Observe, Discuss, and Mark Sowbugs for Mark-Recapture Investigation
Begin Allelopathy Experiment
Release Sowbugs

Day 5 Ocean View School

Species Diversity and Populations Activity
Explore / Sample Communities on Schoolyard
Analyze and Present Data
Invited Speaker
Reflect, Write, and Share

Day 6 Cal Poly Campus

Invited Speaker - Mark Recapture

Revisit Sowbug Mark Recapture activity

Discussion of Ways to Integrate Activities into Grade-Level Curricula

Bean Activity

Collection of Sowbug Data and Present Results

Day 7 Shell Beach Elementary

Evaluate Schoolyard for Potential Investigation Opportunities

Scavenger Hunt

Mapping a Study Site

Library Visit

Reflect, Write, and Share

Day 8 Guadalupe School

OBIS Activity - Litter critters

Additional Activities - Food Web, Food Chain Game, Ants

Teachers Design an Activity on their Schoolyard

Evaluate Allelopathy Investigation

Develop Lessons to Integrate into Grade-Level Curricula. Share Ideas with Group

Day 9 Pacheco Elementary

Evaluate Impact of Students on the Schoolyard - Teachers design the Investigation

Present Results

Predator-Prey/Protective Coloration Activity

Reflect, Write, and Share

Day 10 Cal Poly

Erosion Activity to Evaluate Human Influences

Evaluate Results from Other Experiments During the Week

Reflect, Write, and Share

Luncheon

Materials Fair - Order materials

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Appendix 5 Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

Montana SYE Institute, 1994

WEEK ONE July 5 - 9					
	Tuesday	Wednesday	Thursday	Friday	Saturday
morning	<p>Welcome</p> <p>Introduction</p> <p>Overview of SYEFEST</p>	<p>Focused Writing</p> <p>The Nature of Ecological Questions</p> <p>Developing Ecological Inquiries</p> <p>SYEFEST Goals & Expectations of SYEFEST Participants</p> <p>Ecological Observation Inquiry - using field notebook and handlens</p>	<p>Open-ended & guided inquiries on diversity & disturbance at Target Range school</p>	<p>Open-ended & guided inquiries at Paxon School</p>	<p>Focused writing & discussion</p> <ul style="list-style-type: none"> ● What am I frustrated about? ● What am I excited about? ● What would help me next week to fit schoolyard ecology into my curriculum? ● Make-it/Take-it Workshop ● Nets, Quadrats, Funnels, Squirrel Bags
afternoon	<p>Asking & answering ecological questions - question posing with scientists</p> <p>Share questions & what we've learned</p>	<p>Focused writing</p> <p>Reflection selves as scientists</p> <p>Constructivist teaching & themes of ecology approach distance in squirrels</p> <p>Wrap Up/Paper Assessment</p>	<p>Focused writing, reflections & discussion</p> <p>Challenges & opportunities at one's own schoolyard</p> <p>Similarities & differences between Target Range School & one's own school</p>	<p>Teachable moments on walk back to University List All Opportunities</p> <p>Invited Speaker, Peter Feinsinger</p> <p>Schoolyard ecology in Central & South America</p>	<p>Local ecology resources</p> <p>Building collections of organisms for classroom use</p> <p>Review resources</p> <p>Make-it/Take-it continued</p>

WEEK TWO July 11 - 15					
	Tuesday	Wednesday	Thursday	Friday	Saturday

morning	<p>Invited Speaker</p> <p>Cultivating a schoolyard natural area</p> <p>Objectives, Plans, Costs: Hawthorne School</p>	<p>Succession inquiries</p> <p>Crack ecology</p> <p>Plant distribution (allelopathy)</p> <p>Making these inquiries fit your grade level</p>	<p>Reflective Writing</p> <p>Compare confidence of leading ecological investigations today versus first day</p> <p>Planning an inquiry activity</p>	<p>Schoolyard resource scavenger hunt</p> <p>Classroom management in the schoolyard</p> <p>Developing inquiry skills</p> <p>Resource fair</p>	<p>Teacher-led inquiries continued</p> <p>Workshop Assessment</p> <p>You develop a tool</p>
afternoon	<p>Strategies for planning schoolyard ecology activities</p> <p>Eco-inquiry video</p> <p>Learning cycle and assessment of schoolyard ecology activities</p> <p>Informal assessment strategies</p>	<p>Planning schoolyard ecology units</p> <p>Idea sharing</p>	<p>Adaptation inquiries</p> <p>Leaf toughness</p> <p>Isopods</p> <p>Adapting inquiries to classroom</p>	<p>Teacher-led inquiries</p> <p>Discussion of Inquiries/Reflections</p>	<p>Implementing SYE next school year</p> <p>Inservice workshops and release time, etc.</p> <p>Celebration and awards ceremony</p>

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Appendix 5 Schoolyard Ecology Leaders' Handbook

Schoolyard Ecology portraits

Michigan SYE Institute, 1996

WEEK ONE August 15 - 19					
	Monday	Tuesday	Wednesday	Thursday	Friday
morning	Opening introductions OTS model of inquiry Glerum School	Sharing journal responses Group presentations Discussion Inquiry based learning Set up investigations Real scavenger hunt Bugs & color State & district curriculum	Activity smorgasbord Waukazoo Elementary Animal diversity Litter Critters Animal populations Colonization Journal writing Forming partners between teacher & students	Share treasure hunts & results from activities Introduce & assign plants & animals for schoolyard field guide Planning time for field guide	Work with kids at "Kid Connection" & implement own inquiries Journal writing & discussion
afternoon	Presentation creation Journal writing	Activity Smorgasbord Longfellow Elementary Ant Cafeteria Tough leaves Journal writing	Activity Smorgasbord Pollinators Mystery Marauders/Herbivores Schoolyard Treasure Hunt	Planning time for tomorrow's work with kids Sharing plans with group	Allelopathy investigation Schoolyard organism contest & prizes Designing solutions to management problems

WEEK TWO August 22 - 26					
	Monday	Tuesday	Wednesday	Thursday	Friday

morning	Expertise exchange	Activity presentations	Assessment workshop	Share results on allelopathy experiment	Planning for Fall session
	Resource materials	Resource materials	Activity smorgasbord	Create implementation plans	All weather teaching
	All weather teaching smorgasbord	Journal writing	Lakewood School	Resource materials	Evaluation/wrap up
	Van Raalte School	Investigation at Harrington School	Asphalt Jungle	Journal writing & discussion on schoolyard ecology implementation	Celebration at Dutton Park
	Moisture makers	Nature Preserves	Super Soil	Make-it/Take-it	
	Wings on seeds		Traffic Impacts		
	Animal antifreeze		Decomposers		
	Seed Robber Detectives				

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