

4-H Teens as Science Teachers of Children

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The 4-H Youth Experiences in Sciences (YES) program allows volunteer teens to effectively teach science to five- to eight-year-old children in after-school care settings. The YES program is a complete package of recruitment strategies, training, child care program collaboration, curriculum, activities, materials, and logistics. The program allows adolescents to carry out the responsibilities and duties of science teaching on a readily supportable scale. Evaluation of the YES program provides evidence that teens can experience success and provide a demonstrably valuable educational experience for young children.

The contributions of the YES program are important because of the continued and increasing need for high quality school-age child care activities. In many non-formal educational settings, including school-age child care (SACC) centers, there is usually unstructured play, videotape viewing, recreation, and craft activities. Although a variety of unstructured activities have a place in the lives of children, these settings also provide an opportunity to bring significant interaction with science-related materials and activities. The need for quality programming is increasing with the ever-greater numbers of children whose parents need the collaborative care of the community because of work responsibilities. Current government welfare reform policies promise only to enlarge the numbers of children needing after-school care.

The benefit of the YES program to teens is that they are able to carry out the important social role of teacher in a guided setting and on a manageable scale. This experience pays off in a number of ways: teens' own learning of science is strengthened as they teach ideas and processes to others; teens practice the specific life skills of communication, planning, collaboration, and problem solving; and, teens' psychosocial development is enhanced through the successful experience of an important, socially generative role usually reserved for adults.

Background Literature on Teens as Teachers

A central feature of the YES program is the use of teens as instructors of the seven science curricula developed for children. While 4-H and other youth-oriented community organizations have long enjoyed the competence and contributions of adolescents, there is a need to further understand and develop programs for the productive involvement of youth in this society. The YES program has used the research literature on teens as teachers and tutors to extend understanding and application.

Despite a long tradition in school and non-formal educational setting of cross-age tutoring, and with strong support from practitioners, the research literature about the effectiveness and theoretical backing for having teens teach children is neither complete nor strong (Barron and Foor 1991; Deven-Sheehan, Feldman, and Allen 1976; Good and Brophy 1987). Most studies on the topic have been described as unsystematic and oversimplified in treatment of variables.

Paolitto (1976) discussed the theoretical dynamics and ways of looking at teens as teachers and tutors in three different conceptual themes. *Cultural Transmission* emphasizes learning as a process of committing to memory certain facts and concepts. For teens, the benefits of teaching include the idea that to teach something is to learn it, while younger children gain from the reorganization of subject matter by teachers lose to their age and experience. *Romantic ideology* centers on encouragement of the growth of both children and teens to their full potentials. While intellectual growth is important, the social-emotional goals of breaking down age and experience barriers between persons is paramount. The development of self-respect and self-actualization are key benefits according to this theme. Finally, *progressive models* of teaching support development of cognition, social functioning, perspective, and psychosocial stages. From this point of view, opportunities to interact with people, materials, and ideas is central to education. Construction of knowledge, meaning, and relationships are all facilitated by cross-age teaching and tutoring.

Forgarty and Want (1982) emphasized that teen teaching sessions characteristically are friendly, enjoyable, and helpful. They described the successful teen teacher's role as based more on friendship than a traditional teacher-like authority. The interpersonal dynamics are a kind of give and take around the subject matter. A great strength of teen teaching is that a kind of cooperative learning situation is formed in

which both the teen teacher and the younger child carry out roles that require each other. The authors reported the point of view that teachers have limited instructional repertoire, unless specifically taught, and therefore should be expected to be limited in their effectiveness.

Cohen, Kulik, and Kulik (1982) found that cross-age teaching is an instructional strategy associated with positive achievement and attitude gains. They concluded, however, that results are mixed and not always exceptionally strong. Levin, Glass, and Meister (1987) found that teen teaching was cost effective in comparison to computer-assisted instruction or lengthening the instructional day.

Good and Brophy (1987) reported that cross-age teaching is commonly found in elementary schools, although it is usually configured to pair upper grades with lower grades rather than using teens. These authors cited one advantage of cross-age teaching as providing a change of pace from usual instructions. Much of the effectiveness of cross-age teaching comes from the dynamics of interpersonal relations. For example, younger children are more likely to ask older students for needed help rather than feigning competence and remaining silent, as they may do in the presence of intimidating adults. Interpersonal conflicts are rare and more easily avoided. Other benefits derive more directly from the instruction itself. For example, cross-age teachers may use language or examples that are more easily understood than those provided by adults. Also, the recent experience of the cross-age teacher's problem solving may help them better assist children. Good and Brophy conclude that cross-age teaching is relatively more effective than adult-led instruction for supervised practice and follow-up, but less effective for advanced, stand-alone instruction.

Barron and Foor (1991) found that specific training programs are essential to the success of cross-age teaching programs. They reviewed the extensive literature suggesting that teen teachers need training in (1) general principles of teaching, (2) focused and practical instruction in specific methods of guidance, (3) specific training in the use of program materials and procedures, and (4) "elaborated" training about the underlying rationales and principles guiding the instructional procedures. These researchers found that cross-age teachers who have a full understanding of the task and its rationale are better prepared for learning or performing the task themselves, and better equipped to manage the demands of the task when they are required to instruct others.

Erikson (1968) described childhood and adolescence in terms of distinct psychosocial phases of life, each of which contains its own challenges and opportunities. In the early elementary school years, it is important for children to actively develop their own competence in doing the tasks that are valued by society. This means that children benefit from doing things that scientists and inventors do, and to manipulate the materials and ideas around them. For teens, growth means taking on the roles of teacher and leader, and otherwise building an identity that fits into the important needs of society. Erikson described the intense fidelity with which adolescents try out the positive and negative potential roles of adult life. He discussed the needs that children and teens have for each other as they complete the unique tasks of their respective phases. Sabin (1976) described how the teacher-pupil relationship is ideal for positive and mutual support for growing and learning.

Summary of the Literature on Cross-Age Teaching and a Reaction

The research literature on using teens as teachers of young children is positive regarding the anticipated benefits for both the adolescents and their pupils. The results are quite dependent on establishing good relationships between the two age groups. However, specific training is required for the benefits to happen.

Notable limits on the outcomes of cross-age teaching is the depth and type of learning and the type of youth best served (e.g., Allen and Feldman 1973, Good and Brophy 1987). Most previous authors hold that the learning fostered by teen teachers is fairly superficial (such as the repetition of previous learning patterns) and that cross-age teachers are most appropriate for lower achieving pupils. They attribute these limits to the teen teacher's relatively narrow repertoire of instructional techniques.

Designers of the 4-H YES program held higher expectations for the teen instructors involved in their program. They sought to achieve instructional results that uniquely used the advantages of teens as teachers, and to foster scientific learning optimally suited to the age levels of the children involved. Careful studies of the YES program suggest that these ambitious goals for effective teaching have been realized.

The Youth Experiences in Science Program

The 4-H Youth Experiences in Science (YES) Program teaches science in a variety of settings in rural, suburban, and urban areas in California, including school-age child care programs, summer camps, and migrant education programs. The program has demonstrated its effectiveness with a diverse range of populations, including those previously underserved by science education programs.

4-H YES offers thematically linked science education experiences geared to the needs of children and child care providers. The project includes seven units: making and studying bubbles, collections, snail investigations, kitchen science, earth-worm culture, forms of energy, and recycling. Activities in these units provide hands-on science meaningful to the five- to eight-year-old age group. The activities and processes have real-life applications and use inexpensive and readily available materials. For example, in the recycling unit, children learn how to use throwaway objects to design and make toys and games. Each curriculum includes five or six 2-hour sessions of sequenced activities, information, and instructional guidelines. While YES focuses on science, the curriculum integrates activities in mathematics, language arts, art, and music.

This program made extensive use of findings of an earlier science curricula and instruction program, Science Experiences and Resources for Informal Education Settings (SERIES). 4-H SERIES was developed for use by teens working with children ages nine through twelve. Experience with SERIES suggested the effectiveness of teens as teachers and pointed toward their potential as instructors for younger children. The YES components (including training, participant logistics, materials, activities, and evaluation) were pilot tested and refined in a two-year sequence of local applications.

To prepare for leading the YES sessions, the teen volunteers attend 10 hours of training led by professional educators. The teens learn to lead one or more of the curricular units by doing, reading, and talking about them. Under the supervision of an adult volunteer coach, the teens conduct the activities with elementary school-age children at participating child care sites. Teenage volunteers also help to plan and carry out family activity nights. Teens contribute approximately 30 hours learning, preparing, and conducting the 4-H YES Program activities. This model has demonstrated its effectiveness for both teen leaders and children participants (Ponzio and Fisher 1995).

The Need for YES

The 4-H YES project meets a critical need for developing science literacy in this society by engaging teens and young children in hands-on science inquiry activities and helping them to learn the scientific thinking processes found in school science programs (California Department of Education 1990) while solving interesting problems in a fun way. It is not at all apparent that public school science education alone can create citizens who understand science and solve social problems with scientific thought and resources (Ponzio and Fisher 1995). The benefits of the science content of YES extend to the teen teachers, children, child care center staff, adult mentors, and families of the children.

The need for an increase in science literacy comes at the same time that the American family has changed drastically. Increased numbers of women in the work force, single parents, and dual wage earner families have created a need for quality programs for school-age children in after-school care. Nationally, more than 7.5 million children between the ages of five and fourteen are enrolled in school-age child care programs. The majority of children enrolled in such programs are five to nine years old. Children can spend up to 1,450 hours each year in such programs (compared to 1,400 hours of school classroom experience). This after-school care situation provides an opportunity to develop children's science literacy. Child care programs are constantly in search of effective educational programs for their participants. The YES program offers planned, thematically linked science education experiences geared especially to the needs of children and child care providers.

Logistics and Procedures

Teenage participants in YES volunteer to teach science to young children after school. The teens are members of 4-H clubs or other youth groups. Most are interested in using the experience to fulfill service-related high school graduation requirements. When they sign up to become YES leaders, the teens commit to serve a minimum of 30 hours in the project. This includes training, preparation, travel, and actual teaching. Parental permission is required for the teens' involvement.

Training for the teens is specific to the unit they are learning to teach, and usually takes approximately 10 hours. The topics covered include the nature of science, science as hands-on inquiry, the characteristics

of young children, and the unit's specific science content (e.g., snail anatomy and behavior). A later section of this chapter gives a more detailed description of the training.

Each teen is supervised by a community mentor. These adults are recruited at the same time as the teens. Mentors often are associated with a youth service agency such as 4-H, YMCA, YWCA, Boys and Girls Clubs, or Future Farmers of America. Their responsibilities are to participate in the training with the teens and support the teens' delivery of the program in the child care center.

School-age child care (SACC) sites are chosen by the 4-H program staff. The agreements made with these sites are for a staff member to participate in training sessions with the teens, monitor the teaching sessions, provide the low-cost consumable materials, complete a brief evaluation form after each session, and fulfill the important role of behavioral management, so that the teens can focus on teaching the science.

The SACC staff works with teens to schedule the instructional sessions. Most often these occur immediately after school or during longer school holidays, and generally last 90 minutes. Most YES instructional materials are brought to the SACC site by the teen, while the SACC staff provide consumable materials (such as lettuce for the snails, paper, and crayons). Preparation and rehearsal times are expected of the teen. Supervision of each session provided by one or more SACC staff persons, the teen's mentor, and any other volunteers or parents who attend.

Evaluation of the sessions involves two brief forms. The first is a "lesson plan" card filled out by each teen that lists highlights and needed changes for the session. The second is a set of scale items reported by the SACC staff, which includes such concerns as overall effectiveness, child attention, use of materials, and problems requiring attention. These evaluation forms have been used by YES designers to solve logistical problems and improve the program.

It is quite natural for the children to take ideas and materials home with them to continue learning or to share with family or neighbors. Therefore, parent nights, as well as YES loaner backpacks containing written activity suggestions, materials, and a group log book, are important YES components that assist in moving the ideas from the child care center to the home and neighborhood.

At many local sites, collaborations with other community agencies strengthen the YES program. For example, local schools, clubs, PTAs, and others are often involved in helping with transportation of teens, securing materials, additional supervision, and cleanup of facilities.

YES Curriculum, Materials, and Activities

The YES program provides printed materials that cover teen leader recruitment and training, choices of seven curriculum themes, science learning centers, family backpacks, and family activity programs. The materials are designed to be inexpensive, safe, and flexible to meet the needs of local programs. For example, the backpack activities and materials are extensions and elaborations of the activities the child experiences at the child care site and trigger similar activity at home with family and friends in the neighborhood, and sometimes are even used in school site replication ("share and tell"). During the four-year development phase of YES, the materials were extensively field tested, reviewed by science education experts, and subjected to multiple revisions. Three of the YES curriculum units are available in Spanish-language versions.

The seven curriculum themes were selected for their intrinsic interest and accessibility to teens and children.

Magic Bubbles. The unit provides a fun and interesting medium for children to learn the processes of science. Ordinary household items combined with children's natural curiosity provide the magic. Children observe the colors, properties, and behavior (chemistry and physics) of bubbles. They invent new bubble holders, they make bubbles large enough to get inside of, and they discover ways to show off their creations.

Snail Trails. Common Garden snails allow observations and investigations of animals, habitats, and behavior. Comparisons of individual snails, predictions about snail movement, and learning snail anatomy and physiology all begin unique and individual child inquiry. The ethics of humane treatment of animals is also addressed.

Kitchen Science. Kitchen sights, sounds, smells, tastes, and touch begin exploration of tools (physics), foods and recipes (chemistry), and vegetables (biology) through hands-on experiences. Safety and creativity are important themes.

Wonderful Worms. Children explore the natural habitat of earthworms, observe their behavior, and learn firsthand how important earthworms are to our environment. Early ideas about cycles, energy, and material renewal are explored with opportunities to test, compare, invent, and draw.

Wee-cyclo-saur-us. Exploration begins with investigations of how to recycle and reuse products that otherwise are discarded daily. Children gain an understanding of what they can do to help recycle, and how recycling helps other things that live in the world.

Collections. Making, organizing, and sharing collections is fun for children. They enjoy collecting everything from rocks and leaves to sports cards and dolls. Not only is it fun, but it is a great way for children to learn more about using scientific thinking processes. Accumulations of everyday objects of interest help children to observe, communicate, compare and organize.

Children Looking Undercover for Energy (CLUE). Children become detectives searching for clues about energy in their daily lives. They use strings, straws, paper, and thermometers in their energetic investigations.

The kind of science presented in YES is designed to be of high practical significance for children. Participants are encouraged to use their own interests and imagination to guide the learning. Children work together and share ideas and information. At the same time, there are opportunities for individuals to pursue unique directions. There is an intentional avoidance of many kinds of “school science” distractions, such as pressure to complete coverage, converge learning in narrowly defined outcomes and standards, fill out paper and pencil reports, and give tests to monitor individual learning.

Training Strategies

The training sessions bring together the teen volunteers, their adult 4-H mentors, and the School-Age Child Care (SACC) staff. All participants are treated as equal contributors, and seating/activity arrangements are made to mix the teens and adults. A friendly environment with icebreaker activities and complimentary snacks for the participants assists in forming positive attitudes about science, teaching, and learning.

Training is designed for two sessions, 6:00 PM to 9:00 PM on a Friday evening, followed by a Saturday 8:00 AM to 4:00 PM session. Four key ideas are presented through hands-on activities in the first session: (1) science is experiential (rather than merely verbal); (2) a learning cycle of thinking and doing provides general principles of teaching (3) science processes (e.g., observing, communicating, comparing, classifying) are incorporated with context learning; and (4) developmentally appropriate (e.g., age related) educational practices are followed. The second, full day session is for teens to experience the curriculum activities themselves and to practice teaching the activities to peers.

Learning about experiential science is accomplished by having participants do discovery learning activities with bottles, balloons, vinegar, and baking soda. Simple instructions to manipulate the materials are followed by open-ended discussions in which the empirical and speculative nature of hands-on science is experienced. Teams are encouraged to continue their inquiry in unique ways. The emphasis on exploration is the common introductory thread of YES activities.

The training continues with experience of a learning cycle to provide the framework for teens to understand and guide the learning of children. The cycle emphasizes three distinct phases. First, *exploration* is fostered through introductory activities presented by teens, usually consisting of intriguing materials and discrepant events. Learning occurs through the individual’s own interactions with the materials and events. There is minimal guidance or expectation of specific accomplishments in this phase of the cycle. Second, *concept development* is led by teens. It begins with the introduction of a concept or principle related to the activity or unit (e.g., evidence of a chemical reaction). The concept leads participants to apply new patterns of problem finding and problem framing to their experiences. Finally, *concept application* extends the range of applicability of the new concept. It provides additional time and experiences for stabilization and cognitive consolidation of the new concepts and reasoning patterns. The aim of the YES program is not just to provide more information, but rather to develop scientific thinking skills and decision making through applications of what is learned. Application activities provide increased relevance and connection between what is being learned and the world by focusing on high intrinsic interest topics chosen by the participants themselves.

Training in developmentally appropriate practices is crucial to the success of the YES Program. Participants begin this training by being led through a process of “remembering when you were five to eight years old!” Next, information that outlines the general characteristics, capacities, and implications of childhood learning processes is presented, discussed, and illustrated. Particular physical, mental, emotional, and social characteristics are addressed. Tables 6.1 and 6.2 are examples of the type of information shared with teens that describes developmental characteristics and implications for children.

Table 6.1**Characteristics and educational implications of children ages 5-6**

CHARACTERISTIC	IMPLICATIONS
Physical development	
Physical growth is slower than during infancy and early childhood.	Plan activities that use large motor skills and introduce fine skills, one at a time.
Muscular coordination and control is uneven and incomplete. Large muscles are easier to control than small muscles.	Plan lots of physical activity with each meeting. Introduce new physical activities that require coordination, such as roller skating, bike riding, jumping rope, and simple outdoor games.
Able to handle tools and materials more skillfully than during preschool years.	Provide projects that don't require perfection.
Can throw different sized balls better than they can catch them. Most cannot bat well.	
Most can learn to snap fingers, whistle, and wink.	
Mental Development	
Ask questions and answer them in literal terms.	Give instructions verbally and visually. Don't expect them to read.
Can distinguish their own left and right, but not in other people.	Avoid a lot of paper and pencil activities that require writing.
Define things by their use, i.e., pencil is for writing.	Plan a series of small activities, with physical exercise in between, rather than one longer more intense session.
Most are just learning letters and words. By age six, most can read words or combinations of words.	Plan active learning around concrete objects.
Short interest span.	Provide lots of materials and mediums for learning, i.e., paper, paints, brushes, glue, building blocks, manipulatives.
Emotional development	
Sensitive to criticism; don't accept failure well.	Provide lots of encouraging words for effort.
Strong desire for affection and like adult attention.	Provide lots of opportunities for adult interaction with children.
Get upset with changes in plans and routine.	Provide opportunities for children to help in adult-like ways, such as setting up for an activity.
Say what they think and feel, e.g., "you stink," "you're ugly."	Give clear description of what your activity or schedule will be and stick to it.
Social development	
Developing cooperative play. Prefer to work in small groups of 2 or 3. Still like to focus on own work and play. May begin to pair up with a "best friend;" however, the "best friend" may change	Organize projects and activities that involve two or three children. If there is a larger group, break activities into sections so that only two or three are involved at one time.

frequently.

Mother (or parent) is still social focus as primary caregiver, however may “fall in love” with Kindergarten teacher.

Like being part of and around family.

Can be unkind to others, but extremely sensitive to criticism of self.

Like to practice different roles.

Help children develop friendship through learning to share, taking turns, following rules and being trustworthy (not tattling).

Organize activities with high adult/child ratios.

Develop projects and activities that involve or focus on the family.

Avoid competition or activities that select a single “winner” or best person.

Use imaginary play that involves “real-life” situations (playing store, house, etc.).

Table 6.2

Characteristics and educational implications of children ages 7-8

CHARACTERISTIC	IMPLICATION
Physical development	
Period of slow, steady growth	Will have difficulty with some fine motor projects such as gluing, cutting, hammering nails, bouncing balls, etc.
Learn best if physically active Still inept at some activities using small muscles, but have improved large muscle activities like riding a bike, skating, or jumping rope	Able to throw ball better than able to catch ball
May repeat an activity over and over to master it	Provide opportunities to practice skills, but use projects that can be completed successfully by beginners
Mental development	
May spend more time alone doing projects, watching TV, or daydreaming	Give instructions verbally and visually, however most children will be able to read and comprehend simple art instructions
Beginning to take in perspective of others	Can introduce some written assignments and activities; however most children will prefer to be active
Beginning to tell time	Activities that require sorting, organizing, or classifying are enjoyed
Humor takes on new meaning	Encourage children to develop or make collections
Enormous curiosity and delight in discovery	Encourage projects that can be done over and over in different ways
Are able to collect, sort, organize, and classify	Use lots of activities that require children to participate in a hands-on way
Can recognize some similarities and differences	Guide the children in reflecting on their learning experience
Can do some abstract thinking, but learn best through active, concrete methods	

Methodology

This study involved six school-age child care sites, four in Placer County (east of Sacramento) and two in San Diego county. The participant groups whose perspectives were sought included the teen instructors, the five- to nine-year-old children enrolled in after-school child care, SACC Center staff who monitored each of the instructional sessions, YES staff including program directors and developers, and adult mentors of the teens. The six sites included both urban and rural settings. Some of these program sites were carefully controlled and monitored by a single agency (4-H), while others involved somewhat looser collaborations of multiple agencies.

The data in this study were gathered using interviews, focus groups, observations of live and videotaped sessions, interviews with children explaining photographs of themselves doing YES activities, and analyses of postsession reports of teen instructors and child care center staff. Variables, as described by Ponzio and Fisher (1998), including science attitudes and motivations, were evaluated. The interviewers and observers included the YES project evaluator and paid graduate students. Half-hour interviews were held with fourteen SACC staff who knew the children well, had observed the activities, and occasionally talked with parents about the sessions. The central theme of these interviews was the interaction of teens with children and strategies distinct to teens (compared with adult teachers). Six teens were interviewed about their participation, strategies, and effectiveness. Experience in the program for these teens ranged from one to three years. Three focus groups, ranging from 20 to 70 minutes, were held with teen instructors. These sessions centered on their relationships with children, techniques for encouraging involvement, communication strategies, and how this work fit into their own lives. Six children were interviewed about their involvement, ideas, and relations with teens using photographs of the children in action during the previous session. These interviews asked for recollections and reason for their engagement. The videotape data consisted of content analyses of 17 hours of sessions of both instructions and training.

Data analysis for the perception and performance information collected in this study consisted of a content and structural analysis in which descriptions of performance from each of the sources contributed to a list of distinct interactive phenomenological patterns. That is, a categorization was made of suggested themes about what teenagers did as teachers that made theme effective with children in ways that could be distinguished from adult instructors. The list of suggested patterns was tested and refined based on information from each subsequent participant group. The observation of sessions (live and videotaped) allowed for behaviorally-based confirmation of the analyses resulting from the participants' descriptions.

Findings

Teens' Reasons for Participating in YES

Trends and responses for teens were similar at all sites. Reasons teens gave for volunteering in YES included an interest in teaching, enjoyment of children, a chance to give service, and a love of science. A few of the teens were considering teaching as an occupation, and other said this helped them complete high school graduation requirements. A small number tied YES activities to their own high school assignments. Interviews with the teens disclosed that they see themselves as having busy lives, but that teaching young children is an important activity for them and the children.

Why Teens Are Effective Teachers in the YES Program

Interviews, observations, focus groups, and discussions disclosed five distinct reasons why teens are effective teachers. These reason will be presented in this section with a brief description of the idea. The phrases in quotation marks are taken from teens, adults, and children to communicate the vocabulary and terminology used by the participants in this program.

1. *Teens are apt to do science activities themselves.*

Teens were seen as much more likely to *do* the science activities themselves, as opposed to merely talking about them, presenting them, or directing the children to do them. The teen leaders, therefore, became self-engaged learning instructors, particularly when they were presenting as part of a team. This means that the teens were seen to transform the materials and phenomena under their own direction. Participants (children, teens, adult staff, directors) described teens as "getting in with their own hands, rather than watching." They "get involved, not just stand around and monitor." They are seen to "try out their own activities and to use the materials themselves." Often they "work side by side with

children” or even “get down” in the program tasks to the physical, emotional, and cognitive levels of children.

2. ***Teens relate well to children.***

Teens understand children. Teens were able to understand children because they have common experiential links that adults lack. They were described as having a “closer association with children.” They had “ideas about being a child.” They were to some extent seen “more as peers.” Both age groups were still in school during the program and still doing school activities. Members of each group asked the other about what schools they attended and if they were involved in soccer, football, or other school activities. Many teens reported having daily contact with their own sisters and brothers who were the same age as the child participants.

Teens communicate well with children. Just as teens seemed to understand children, they are better able than adults to communicate with children through talking, listening, and nonverbal cues. There was general agreement that teens used their understanding and communication links to teach directions and subject matter, convey intent and enthusiasm, recognize and reward desirable participation, and monitor and adjust instruction to match children’s needs. Teens were said to “put it [scientific topics] more easily,” “explain it,” and “make it easier to understand.” They used “fewer technical terms” and made “learning less technical.” As presented by teens, science was “less academic and structured.” They were seen to emphasize “not as much material,” to “let [children] explore more, rather than emphasize details,” and to “address short attention spans.” Teens did more “hands-on science, and less memory work.”

3. ***Teens are valued by children***

Teens are a desirable age group for children. Teens were seen as “a magnet” for children. They brought the “enrollment” of children into activities and programs. They made activities fun. They brought an element of “magic” into program activities. Children liked teens and wanted to be with them. Children looked up to teens, and thought they were “cool.” Once teen leader said, “You’re what they want to be.” They were seen to be “role models.” Children reported that it was fun just to be around teens—certainly not just like being in school. They were reported to “light up” around the teens. ***Teens were novel presenters.*** Children were familiar with adult presenter such as child care center staff, classroom teachers, and activity directors. Teens represented a novelty as instructional leaders. They had all of the advantages of outside speakers: credibility, interest, and newness. The relationship was described as “a new toy.” As a result, the children paid greater attention and were more apt to comply and follow the modeling of the teen instructors. The teen role appeared to children to be unusual, one to be enjoyed for the moment.

4. ***Teens’ approach is positive, confident, optimistic, and certain.***

Teens communicated a sense of adventure. They were described as “bubbly,” “enthusiastic,” and “energetic.” They were “open” and “open to new experiences” and way of looking at things. They presented a “let’s see what happens” approach to activities, more like the initiative of the professional scientist. Teens were positive; they found ways to get things done. They were “motivated” and “there is no stopping them.” They appeared to be “confident” and to “know what they are doing.” Then teens showed optimism for the activities and the children; they minimized obstacles in describing their participation.

5. ***Teenagers are less apt to restrain children.***

Teenagers were seen as less likely than adults to restrain the initiative, behavior, and learning of children. The teens appeared to use less coercive control and to present fewer inhibitions to the children. As a result, children were able to participate with less concern about possible transgressions and the need to please adults. They also seemed to associate the activities with less negative and controlling interaction. These attitudes may have contributed to great intellectual freedom and consequently enhanced interaction and learning. These lessened restraints came from two areas of lessened responsibility on the part of the teens.

Teens were not responsible for discipline. Teens were seen as not having the prime responsibilities for controlling, obtaining compliance, and disciplining errant behavior. As a result, their behavior seemed to children to be less intimidating. Since the “kids don’t look at them as adults,” they felt less likely that “they are going to into trouble” with them. Teens were seen as “less adversarial” and not so much as “authority figures.” They were not merely “instructors, telling kids what to do.”

Teens were not responsible for overall program results. A further advantage of teens as teachers in YES is that they were able to focus on the immediate science activities and sessions with no responsibility for the overall program. They were able to rely on adults-coaches, parents, SACC staff,

and project leaders-to see that details extraneous to the science instruction were taken care of. They could leave the organizational problem solving functions to the adults. Thus, teens could be less inhibited because they did not have to consider as many aspects as did the adults. The result was that their instruction could be more concentrated, focused, certain, and “straight ahead.”

Table 6.3

I. Teens are apt to do science activities themselves

II. Teens relate well with children

- A. Understand children
 - B. Communicate well with children
-

III. Teens are valued by children

- A. Desirable age group
 - B. Novel presenters
-

IV. Teens instructional approach is positive, confident, optimistic, and certain

V. Teens are less apt to restrain children

- A. Not responsible for discipline
 - B. Not responsible for overall program results
-

New Findings in YES for Teen Teachers

The development and evaluation of the YES program found three important benefits of cross-age teaching in addition to those commonly cited in the literature. Two are instructional in nature, while one involves psychosocial dynamics and development.

Previous studies (e.g., Allen and Feldman 1973) emphasized cross-age teachers as limited to review and practice “specialists.” The YES program has found that when some of the goals are for interactive, hands-on, constructivist learning, teens are unusually effective as *instructors who are self-engaged learners*. That is, the children in this study were encouraged in their learning by their contact with teen teachers who were themselves learning about the science materials and processes.

A second instructional dimension benefit of teens as teacher is their “can do” approach which is characterized as positive, confident, optimistic, and certain. When compared with adult instructors of the same curricula, the teen teachers communicated a sense of problem solving, and sometimes of delayed closure, that allowed the kind of scientific inquiry intended by the curriculum designers.

An additional benefit for the children in this study is the psychosocial attraction, identification, and modeling provided by the youth disseminating (and engaged in) the science curriculum chosen and constructed by adults. This modeling benefit has frequently been alluded to in discussions of teen teaching.

Summary and Conclusions

Youth Experiences in Science (YES) provides teens with volunteer opportunities to provide high quality science teaching in after-school child care settings. Important benefits of development and learning are provided for both teens and children. The program is a complete package of collaboration with child care settings, recruitment, training, curriculum, materials, activities, parent follow-up, and evaluation. It can be supported with minimal costs and materials.

The need for the YES program is reflected in recent goals for increased science literacy in society, as well as the explosive growth requirement for child care facilities outside of the home. There is a burgeoning niche for educationally sound, yet realistically supportable, activities for children that go beyond unstructured play, videotape viewing, and repetitive craft activities. Additionally, there is a need for significant opportunities to involve adolescents in the important tasks of society, with benefits for both the society and the development of the teens themselves.

A central feature of YES is the use of teens as teachers. Developmental studies conducted as part of YES pilot testing indicated that teens were unusually effective instructors because they participated actively in content and tasks, related in optimal ways with children, and provided optimistic leadership. This allowed teen contributions in YES to consistently go beyond low level review to the more sophisticated patterns of inquiry and creative initiative that are at the heart of scientific learning. In addition to their important contributions to others, the YES teens benefited from the psychosocial growth opportunities inherent in the assumption of responsible roles and in contribution to the people, ideas, and material needs of society.

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