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An Informal Elementary Science Education Program's Response to the National Science Education Reform Movement

Phyllis Katz

J. Randy McGinnis

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Abstract

This report presents the experience of an informal elementary science education program, Hands on Science Outreach (HOSO), that is striving to maintain its identity as an informal program within the context of the National Science Education Reform Movement. We provide an overview of informal elementary science education programs in the United States including a definition and a historical summary. We then depict how HOSO has reacted to the National Science Education Reform Movement by establishing links between its programmatic and science content and the National Science Education Standards. *We end by presenting three insights constructed as a result of HOSO's efforts to maintain its informal elementary science education identity during a time of national discussion on who constitutes membership in the science education community.*

Introduction

Informal elementary science education within the United States of America (USA) provides young learners opportunities to engage in science in ways that complement formal settings such as public school. Informal science education is increasingly recognized as playing a significant role in engaging elementary students in science experiences oftentimes unavailable in formal settings (Dierking & Falk, 1994; Tuckey, 1992). While there are shared goals and standards between informal and formal science educators, there are also distinct ones which need to be identified and maintained. During this time of national reflection on standards for science education, it is important to understand the impact of the science education reform movement on informal elementary science education programs. In particular, the informal science education community is wondering exactly how much informal science educators should connect to the specific curricular goals of formal science education if they are to preserve their unique qualities? This report details insights emerging through one informal elementary science education program's efforts to come to terms with the National Science Education Reform Movement yet maintain its identity within the informal education community.

Methodology

To understand better the impact of the National Science Education Reform Movement on informal elementary science education within the USA, it is helpful to focus on a specific case, Hands On Science Outreach (HOSO). Theorists such as Atkinson (1990) argue that "exemplars" (p. 82) present readers with compelling evidence of complex issues embedded in sociological settings. HOSO's case is one telling example from which insights can be drawn by those interested in the impact of the National Science Education Reform Movement on elementary science.

A case study enables researchers to develop an in-depth narrative which provides a framework from which other teacher researchers can reflect on their experiences and which can inform future research (Romberg, 1992). While a case study has been applied to both quantitative and qualitative research methods and is itself not a methodology, a "case study is characterized by the main researcher spending substantial time, on site, personally in contact with activities and operations of the case, reflecting, revising meanings of what is going on" (Stake, 1994, p. 242). We chose a case study because we were interested in describing and interpreting the impact of the National Science Education Reform Movement on a specific informal science education program as perceived by the founder and ongoing director of the program, Katz, a coauthor of this report. Her continuous association with the program since 1980, accompanied by her desire to reflect on the program in consultation with a university science educator, McGinnis, her coauthor for this report, fulfills the conditions for a case study.

This case study is bounded by a unit of analysis that provides guidance on what is relevant and not relevant (Merriam, 1988; Ragin & Becker, 1992). The unit of analysis is the informal science education program, HOSO, and its reaction to the National Science Education Reform Movement. The research question is, "What is the impact of the National Science Education Reform Movement on HOSO from the perspective of the program's founder and ongoing director?"

Structurally, the case is presented in five parts. The first part is a historical summary of informal science education in the USA; the second part is a brief history of HOSO; the third part is a summary of the National Science Education Reform Movement from HOSO's perspective; the fourth part is a comparison of HOSO and the *National Science Education Standards* (NSES); and the final part presents HOSO's distinct goals. A discussion follows in which we present three insights constructed as a result of HOSO's efforts to maintain its informal elementary science education identity during a time of national discussion on who constitutes membership in the science education community.

A Historical Review: Informal Elementary Science Education in the USA

There is a long tradition of informal science education institutions within the USA. Significant public resources have been allocated to informal science education, including parks, zoos, botanical gardens, museums, and television science shows. Yellowstone National Park was set aside for "the benefit and enjoyment of the people" in 1872. Zoos brought exotic animals to public view in numerous sites in the nineteenth century. Botanical gardens and aquaria were available in major cities. The Franklin Institute was founded in 1934, and the Exploratorium in 1969. Televisions first began receiving Mr. Wizard in 1951. The public went underwater with Jacques Cousteau in 1968 and tuned into NOVA starting in 1974. Community-based programs were pervasive. Boy Scouts, Girl Scouts, Campfire Girls, ham radio groups, and later computer user groups existed in every corner of the country as the twentieth century unfolded, providing experience and practice in science and technology related activities. These informal science learning opportunities allowed time for amateur field work, engineering, and instrument use. They enhanced the participants' abilities to understand their world. They were called entertainment and recreation.

These were well-established places and programs, but their impact as informal science education offerings were largely ignored by formal educators and policymakers. Tightening resources and a broader vision by the academic community in the 1970s led to a more inclusive view of who were science educators, however. The message of lifelong learning and everyday science—not a new concept, but a dormant one in the rush to produce top notch scientists after Sputnik was launched—was championed by proponents such as Lazar Goldberg (1971), who advocated socially responsible science for children, and Schmidt and Rockcastle (1982), who focused on experiences with common materials. This message became the science education challenge to the nation (AAAS, 1993; California Department of Education, 1990; National Research Council, 1996; Rutherford & Ahlgren, 1990). Informal science education was targeted as being able to provide resources and settings that traditional schooling could not. It allowed for low risk experiences and self-motivated participation. For example, taped TV programs such as *Square One*, *Newton's Apple*, or *The Magic School Bus* reach millions of families in the comfort of their homes, where parents can regulate the viewing and do follow-up. To support formal science education, these projects now have produced teacher material for supplementary use in the formal classroom as well as parent material for home use. Community-based informal science programs were perceived as providing convenience and the chance to play and practice, to experience science in familiar surroundings without tests and grades. Just as new *de facto* partnerships were springing up between museums, the media, and the schools, community-based programs began to offer schools a partnership of involvement that brought parents, graduate students, retirees, and businesspeople into the mix as teachers, organizers, or funders.

In 1983, informal science educators were heartened when *Educating Americans for the 21st Century* was published (National Science Board [NSB], 1983). For the first time, the role of museums, the media, and community programs was legitimized for its work in the renewed effort to bring science literacy to a broadly inclusive range of students. Unequivocal statements such as the following both helped to define and promote informal science education within the science education community:

> Much that affects the quality of formal education occurs outside the classroom and beyond the control of the school—a great deal of learning takes place unintentionally and unconsciously through casual reading and experiences. The process has been referred to as informal or experiential learning and offers an important opportunity for improvement in our overall educational system. Such opportunities are particularly helpful for the sciences and technology. . . . Formal education must be supplemented by a wide range of activities that can reinforce

the lessons of the classroom and lend meaning and relevance to the rigor and discipline of formal study. (NSB 1983, p. 59)

In addition, others at that time promoted the significant role of informal elementary science education. Boyer (1991) writing in a Carnegie Foundation report, *Ready To Learn*, suggested that preschool children are prepared for learning partly by their parents' use of informal resources (p. 91); the U.S. Congress' Office of Technology Assessment (1988) reported that informal enrichment increased school success (p. 23); and the California Framework included informal resource use as part of its comprehensive statewide standards (California Department of Education, 1990, p. 180).

History of HOSO

The HOSO program began as a local community school experiment in Montgomery County, Maryland. Its primary goal was to provide a regularly available recreational science option for children by working with parents in school communities or other public gathering places. Its secondary goal was to develop an organizational structure to support this mission. The county PTA adopted the program in 1981, where it quickly spread to almost all of the county's 120 elementary schools by word of mouth through parent enthusiasm. User fees supported the packing of materials, the teachers' stipends, and the development/operations. Grants from the U.S. Department of Energy and private sources were sought to assist some participants who could not afford the fees. While classroom teachers were sometimes interested and willing to add an hour to their day, the preponderance of HOSO teachers (called Adult Leaders to distinguish them from classroom teachers) were parents. Educating these group leaders was a key goal. All were required to attend a short, but continuing set of training sessions, prior to each new set of activities for the fall, winter, spring, or summer series. An informal science curriculum of broadly based themes—*Patterns, Structure and Change, Energy*—was designed for interdisciplinary activities in such a way that continuing children would not need to repeat a specific set of activities from preschool through sixth grade. As the program grew nationwide, the goal of quality control required activity guides that adapted to differing environments. Children were grouped by age and grade: pre-kindergarten, kindergarten-1st grade, 2nd-3rd grade, 4th-6th grade. They took home materials each week. Materials had to be sufficiently plentiful to be given to each child, yet they had to fit standardized packaging and be safe and cost effective. In the first week, children received a set of questions and references for adults so that they could continue the activity conversations with their parents beyond the program hour. Goal setting was therefore operational as well as educational.

The science education goals included projects that provided experience in the science concept theme; could be paced to accommodate the children's interest; and that used readily available, safe materials with play value. Activities included experiments, songs, models, games, stories, and toys surrounding the target theme. In the Anatomy (K-1) sample on Figure 2, for example, children use a hand lens to compare fur and hide samples, play games to sense differences in methods of animal movement, and do a puzzle relating bone structure to visible animal shapes. On a walk, they look for evidence of local animals and consider their habitats through the concepts addressed during the games and explorations they have done. Evaluation of delivery success was accomplished through content and procedure analysis, anecdotal feedback from children and families, and Adult Leader discussions and questionnaires. The increasing registration numbers bore witness to perceived value for the audience—a necessity for informal science education operational survival.

Growth at first remained local. The HOSO program existed for three years before applying for National Science Foundation funding in late 1984. It received its first NSF grant in mid-1985 to pilot and to seed its work in other test locations. The project design called for eight sites to be up and running in Chicago, Illinois, San Diego, California, Albuquerque, New Mexico, Wilmington, North Carolina, Portland, Oregon, Atlanta, Georgia, Minneapolis, Minnesota, and Houston, Texas, by the end of the three year grant in 1988. Such was the climate and interest around the country in this setting for informal science education that HOSO was able to report 26 sites in thirteen states using its material by the end of that first NSF project. In 1994-1995, there were over 41,000 registrations in HOSO programs, and there were community adult leaders sufficient to join the children in confirming that together, simple science explorations were a part of their lives.

Increased registration and expansion of HOSO programs throughout the USA speaks to the belief that HOSO classes meet community needs and interests. By providing structure and content for science enrichment in an easily accessible format, school communities are able to offer experiences that supplement science education programs in the classrooms. When an elementary school offers HOSO, parents observe that school leaders value science as an enrichment option along with the more traditional choices of sports, crafts, and music. Parents of elementary students then promote the perception that science exploration is a pleasurable pastime by voluntarily supporting their children's participation in HOSO classes. With the opportunity for parents to participate as Coordinators or Adult Leaders, parents can become science education advocates, involved administratively or as co-learners with the children. For the small number of formal educators who initially voiced some concern that an after-school informal elementary science program could be interpreted as signs of dissatisfaction with science teaching during the regular school day, the carryover benefit of HOSO students' increase of enthusiasm for classroom science alleviated almost all misapprehensions. Community participation, advocacy, and contribution in an informal elementary science program such as HOSO assists in the establishment of a culture that supports science learning during formal elementary schooling.

During the first major grant period, much was learned about how informal elementary science education was perceived by formal educators and their communities. In some communities, formal educators felt threatened by a regular after-school science program. Some questioned if its existence implied that they were not doing a sufficient job in teaching science. In many communities, since there was no policy for regular community use of school buildings, new procedures needed to be developed before HOSO could be offered. Some parents, who regularly had their children in music, dance, and sports activities, expressed that the notion of informal science education as another enrichment option was alien. And, as the program spread, school districts increasingly made demands for educational assessment of the program. HOSO learned that it needed to communicate better its informal science teaching goals to these stakeholders.

The support of informal science education in *Educating Americans for the 21st Century* was particularly influential to HOSO in communicating its educational goals to parents, school administrators, and formal educators. As a referent within the larger scale education discourse community, that publication formally conferred membership within science education to informal science educators and to their informal teaching/learning domains. Local formal science educators no longer were supported by their formal discipline discourse community to exclude informal science education. It could be effectively pointed out to the science educators, parents, and school administrators that informal science education was now accepted as contributing to the primary science education goal: science literacy. Instead of the perspective of optional enrichment, the formal and informal science education communities could now be considered as working cooperatively to educate the same student in complementary ways. As formal science educators made progress in defining their goals, informal science educators responded by studying those goals for collaborative opportunities.

Findings/Insights

The National Science Education Reform Movement From HOSO's Perspective

Over the last decade, HOSO has welcomed the growth of the National Science Education Standards Reform Movement. The statements of the importance of science in everyone's lives, and the goals for achievement of science literacy have stimulated visibility, discussion, and funding for all science education programming. However, while most informal science educators, including HOSO, have sought and gained recognition for their role in this effort for stronger, more extensive science participation, a concern among informal science educators has emerged as the National Science Education Reform Movement has been codified in books (e.g., see *Benchmarks* [AAAS, 1993]) and the *National Science Education Standards* [*NSES*] [NRC, 1996]). History suggests that the informal science education community has reason to proceed cautiously in matching informal science programming to formal science education goals if they are to maintain their identity as complementary, but different, science offerings. Therefore, to be an active participant of the science education community, the leadership of HOSO sought to identify and to study the documents of those organizations which are in the vanguard of the National Science Education Standards Reform Movement. The three organizations identified are the AASS, the National Academy of Sciences through its NRC, and the National Science Teachers Association (NSTA). What follows is a review of the documents HOSO studied from each of these organizations.

The NSTA (1992) document *Scope, Sequence, and Coordination,* focused on secondary science, but was studied by HOSO as providing insight into the direction future NSTA documents would take in elementary science education. The primary innovation in curriculum design advocated in this document is to do away with the layered cake curriculum in the secondary school (defined as grades 6-12 in this document). Instead, a coherent science program that included some science from every discipline in every year is promoted.

The AAAS (1994) document, *Benchmarks for Science Literacy,* came about as a result of the success of *Science for All Americans* (Rutherford & Ahlgren, 1990). In that document, a set of adult science literacy goals were promulgated; in *Benchmarks for Science Literacy,* a set of tools for meeting those goals is presented. These goals are envisioned as being used to guide science educators who design K-12 curricula. Notably, the goals integrate mathematics and technology with a consideration of science.

The NRC (1996) document, *National Science Education Standards*, is the latest of the National Science Education Reform Movement books. The *NSES* project was started in 1991 with funds from the U.S. Department of Education at the request of the NSTA and with the participation of the AAAS, the American Association of Physics Teachers, the American Chemical Society, the Council of State Science Supervisors, the Earth Science Education Coalition, and the National Association of Biology Teachers. It had three working groups dealing with curriculum standards, teaching standards, and assessment standards. The outline for the standards is divided into three sections (K-4), (5-8), and (9-12), respectively. Its goal is to present a vision of a "scientifically literate populace" (p. 2). It is blunt in its purpose: "Science standards for all students" (p. 2).

From HOSO's perspective, a common goal promoted by these three associations is that all students should become scientifically literate. Differences exist among the associations, however, in the type and extent of the science content needed to achieve scientific literacy. A scientifically literate person is generally accepted as being familiar with the nature of science and how it is performed, the key components making up the body of scientific knowledge, and the human contexts of science—including science's reciprocal development with technology. With this understanding about aspects of science, the scientifically literate person can then better participate in personal decisionmaking and in civic life. The documents mentioned all advocate dramatic changes in the teaching of science. Primarily, large portions of content are suggested to be eliminated ("less is more") so that more emphasis can be placed on students' sense making, translating, and placing knowledge in a social, cultural, and historical context. Aspects of good teaching described in the documents include the following:

- Choosing worthwhile scientific tasks
- Orchestrating classroom discourse
- Placing an emphasis on the classroom environment
- Recognizing a need to increase knowledge and beliefs about science

The following are the implications for teaching science:

- Using "hands-on, minds-on" activities
- Investigating a few questions in depth as opposed to "covering" vast amounts of science content in the abstract
- Connecting school science with the everyday world of the student
- Allowing students to share and test ideas with their classmates and beyond

HOSO and the *NSES*: A Reaction and a Comparison

The *NSES* has played the most significant role of these in influencing how HOSO continuously positions itself within the science education community. Since the *NSES* were published in 1996, HOSO has received numerous requests to respond to where HOSO fits within the *NSES* vision of science education. The requests are often made by those seeking local facilities or funding. This is compelling evidence that the concept behind the national standards movement is having an impact in local school decisionmaking. School systems have put mechanisms into place to tune themselves to the anthem of some kind of unity. The concern from HOSO's perspective is whether the call is to march in stolid 4/4 rhythm or to appeal to the subtle harmonies of a suite? The success of local organizations in installing HOSO programming under the current requirements will reveal the limits or flexibility of the formal-informal science education partnerships for this particular context. Meanwhile, for HOSO to remain securely within the science education discourse community, HOSO has responded to the requests by generating new tools to document and justify its program within the *NSES* vision. Figure 1 graphically depicts how the HOSO Director believes HOSO's program fits the six general goals of the *NSES*. Figure 2 graphically depicts how a HOSO session on "Anatomy" (grades K-1) aligns with the *NSES* content standards.

Within "Teaching," the *NSES* speaks of "communities of science learners" (p. 51) who actively participate in planning. HOSO programs not only give children added time to do investigations and to think and talk about their findings, they also involve many parents and other adult participants in the program delivery. These adults continue their own learning in science and science education as they interact within the program and become a more knowledgeable resource to their communities.

Museums have been sites for professional teacher development for years (New York Hall of Science, 1993). Now, in North Carolina and Tennessee, classroom teachers can receive career ladder credit for teaching HOSO classes. When classroom teachers allow HOSO classes to take place in their rooms, they will often stay and observe. There is more potential for this kind of formal-informal collaboration.

Formal science education requires formal assessment. While the *NSES* is concerned with issues of quality, fairness, and opportunity to learn, informal science presents the learner with the alternative of self-assessment. In HOSO programs, as in museums and media projects, learners come with varied agendas, prior knowledge bases, and motivational levels. They can become excited and more curious, suggesting many kinds of further investigations, or they can gratefully move on to another activity. The stress of achievement testing, in whatever form, is not part of the HOSO process. This is not to say that testing is to be avoided. Testing is an essential part of compulsory education, but the alternative of self-assessment in informal science education is an important part of its complementary nature, helping children develop into self-motivated learners. Nevertheless, there was a need to research the program's match to its goals. A study funded by the National Science Foundation concluded that most children both learned in and enjoyed their HOSO classes (Goodman, 1993).

Programmatically, HOSO meshes with the *NSES* vision of schools as communities (NRC, 1996, p. 222). As an enrichment, it is a resource. Systematically, HOSO is part of the science education discourse community and does what it can to bring its mix of complementary experiences to children and adults.

HOSO does not attempt to align its content choices with those of any school system. As a program with national scope, that would be impossible. However, its topics weave in and out of the major disciplines outlined by the *NSES*. A session on inventions, for example, has children applying their own ingenuity while the leader introduces a weekly game including women and minority inventors to bring together history, the nature of science, the role of creativity in science, and the pleasure of problem solving. The second figure takes a specific HOSO session's activities and aligns it with the *NSES* goals for children's concept development at the target age/grade group. There is convergence between the formal and informal aspects of programming in all of the content components as appropriate to the theme of the "Anatomy" session at this level. There is an anatomy series at each of the age/grade groups, each higher one assuming an increased level of prior knowledge and manipulative skill.

Figure 2 has vertical boxes outlining the *NSES* statements. The shadow boxes speak in shorthand of HOSO's fit. Within "Unifying Concepts and Themes," anatomy cannot be studied without consideration of form and function. Children observe adaptive characteristics of animals in their habitats and make simple arguments for animal behaviors by using their observational evidence. The process of examination and the formation of questions is the essence of "Science as Inquiry" and an important part of the learner-centered approach that HOSO takes. Materials manipulation is key to a HOSO class. Children are offered familiar materials to be used in unfamiliar ways or novelty items to explore. As part of "Physical Science," they are always asked to talk about properties of objects and materials. The connection to "Life Science" is easy in a session on anatomy, and sample explorations have previously been noted. The dotted line around "Earth and Space Science" indicates that there isn't any match within this particular series. The "Science and Technology" category includes experiences for the comparison of natural and human creations. Children play a game to classify living and nonliving objects and further refine the latter to those made by people and those found in the environment. They use simple lenses in their observations and experiment, stacking them for greater magnification—a simple exploration of technological design and function.

Each HOSO class ends with a "So, what?" question. The purpose of the question is to bring thoughtful closure to the activities by asking children to consider what they have just done in a larger framework. In the K-1 Anatomy session, for example, after exploring the characteristics of skin, the leader asks "What would be the advantages and disadvantages if humans had fur?" which aligns with the goals of "Science in Personal and Social Perspectives." As the children's worlds expand with increasing age, in other HOSO classes, the questions address more global concerns, moving beyond their earlier, more limited experience.

HOSO's Distinct Goals

What is not evident in Figures 1 and 2 are the differences in the environment of HOSO and the formal classroom, precisely because they are outside of the *NSES* framework. Research emphasizes four areas where informal science education's alternative settings differ from and complement formal science education: (1) the concern for pleasure in the setting; (2) the nonthreatening nature of participation; (3) the multisensory stimulation that evokes curiosity and leads to motivation; and (4) the social, as opposed to individual, nature of the learning experience (Semper, 1990).

HOSO groups are smaller than the average formal class (10-11 children) and are quite social, with cooperative learning strategies in place. Each child handles materials and takes home that material for display, recognition, or reuse within the family. Intensity of interest guides time use rather than coverage of content. There are no required assessments. These characteristics change the nature of the experience from one of science education as child's work (formal), to that of play or recreation (informal), where the stakes are lower and the pace and motivation are more child determined. Informal science educators like to quote Frank Oppenheimer, founder of the Exploratorium in San Francisco, who said, "Nobody ever flunked a museum" (Association of Science-Technology Centers, 1987; Semper, 1990). The same is true of HOSO programming.

Discussion

The NSES movement is a strong pressure towards defining what constitutes science education in this country. It cannot be ignored by those involved in science education within the USA. The *NSES* derive from a need to show the public what is to be expected in science education in teaching and learning and how to get there. Informal educators need to find ways to prove their value to survive the vagaries of funding and public acceptance—two necessary conditions informal science must fulfill. It must be remembered that informal science teaching addresses somewhat different needs within the inclusive science education community.

An analysis of the goals of formal and informal elementary science (AAAS, 1993, p. 322; NRC, 1996, p 13; New York Hall of Science, 1993, p. 22) does, however, indicate four shared goals upon which a complementary relationship can be maintained:

1. The increase of science knowledge (process and information)
2. The increase of science activity and career access to parts of the U.S. population that have been traditionally underrepresented
3. The increase of the whole population's participation in what has come to be called science literacy
4. The increase in understanding that comes from research in the teaching and learning of science

In *Informal Science Learning*, a landmark collection of research reports and discussions assessing impact of informal science exhibits, programs and projects, Crane, Nicholson, Chen, and Bitgood (1994) suggest six consistent challenges for informal science education (pp. 4-6):

1. To foster the public perception that science is an important positive endeavor in our lives.
2. To leverage the experiences external to school in the pursuit of science.
3. To maximize the flow of talented youth into the sciences for study and careers.
4. To reach people with science information when they have left formal learning.
5. To keep the public up to date in science.
6. To create an informed public, however small, that will become involved in science issues.

HOSO is clearly involved with four of these six goals: The importance of science as a positive endeavor is enacted when children enjoy their time in HOSO and spend more time on science learning, leveraging the experience of school. Children have a chance to discover or employ their talent at an early age. The adults who lead the HOSO science activities are learning about science and the teaching of science beyond their formal education.

Implications

As informal science educators seek the acceptance that validates their work through matches to *NSES* three insights emerge from HOSO's experience:

1. The *NSES* is an effective marketing tool for all of science education in terms of gaining visibility and setting public expectations. However, its utility as a

common referent has a different balance for formal and informal science educators. Formal science educators, because of the compulsory nature of their task, seek to establish a common body of knowledge within a defined time line (K-12). Informal science educators must attract their audiences by focusing on pleasurable, self-motivating activities that encourage participation through all ages (not necessarily at one instance) in their alternative settings.

2. In order for informal science educators to do well what they do best, they must maintain their independence for creativity. Those things that distinguish HOSO from formal education have not been influenced by *NSES* precisely because they are beyond the scope of the *NSES* even though the *NSES* recognizes their value.
3. It is imperative that informal science educators participate in research in their settings and that they be fluent in the research on learning so that they can continue to be part of the discourse on what constitutes science education. By doing so, informal science educators assert themselves as legitimate members of the science education community.

Conclusion

The existence of the *NSES* will continue to influence informal science education because of the *NSES* public visibility and the general need to improve science literacy in the USA. For HOSO, the *NSES* confirms its approach that science learning generally occurs when materials manipulation, inquiry, and relevance are key features of the science learning experience. As an informal elementary science education program, HOSO has responded to questions about its fit with the *NSES* by engaging in an analysis of its program to develop graphic displays that clearly detail the link between its program and science content with the *NSES*. The *NSES* are also a tool that HOSO can use for public understanding of science education, in much the same way as the formal community—it is a common reference. As mentioned, those things that distinguish HOSO have not been influenced by *NSES* because they are beyond the scope of the *NSES*. As a result, HOSO maintains its identity as an informal elementary science education program that complements formal science education by working with community members as group leaders, by offering its program outside of regular school hours, by using a playful and interdisciplinary approach, by limiting its sessions' memberships to small groups of learners, and by offering sufficient material for each child to keep.

Correspondence regarding this article should be directed to

Dr. J. Randy McGinnis
University of Maryland
College of Education
Department of Curriculum and Instruction
Science Teaching Center
2226 H.R.W. Benjamin Building
College Park, MD 20742-1175
jm250@umail.umd.edu

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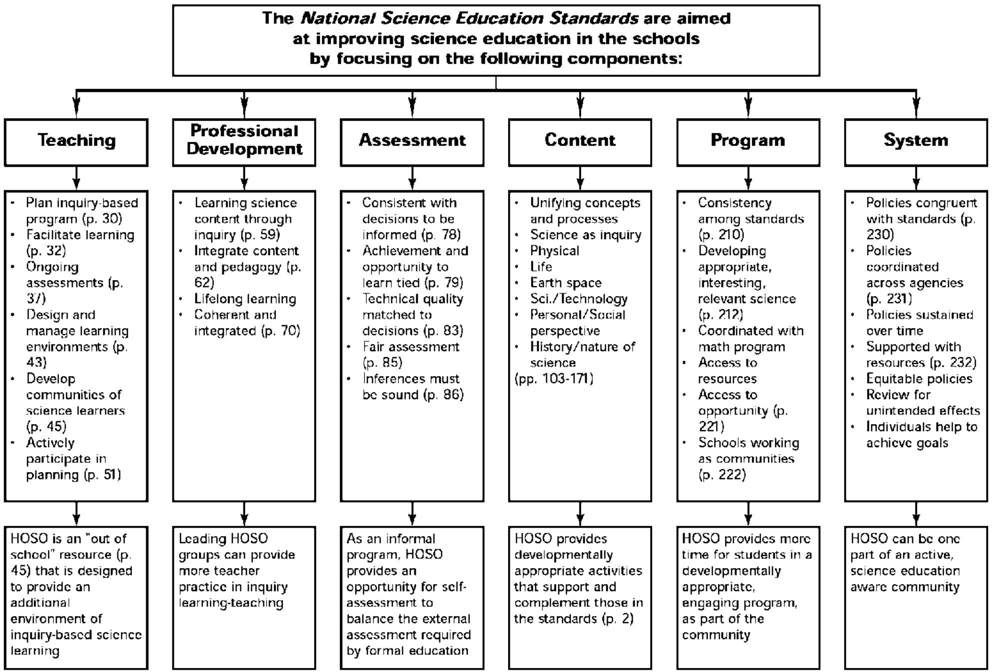
Figure 1
The HOSO Fit in the *National Science Education Standards*
(page references are to the 1996 National Research Council publication)



Source: NRC, 1996

Figure 2
National Science Education Content Standards and HOSO Programming, K-1 Sample