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ABSTRACT

One key to effective conceptual change teaching is to discover each student's conceptions about the conditions before instruction. The teacher then provides experiences that create dissatisfaction with existing ideas and models a new conception that is intelligible, plausible, and fruitful. The purpose of the Acorn Project of the Chicago office of the Illinois Nature Conservancy was to involve city children with earth keeping experiences connecting them to particular places and developing active attachment to and tending of a natural space. The curriculum was specific to and generated from the characteristics of three Cook County Nature Preserve sites. Trained adult volunteer docents accompanied and assisted students in the field and the classroom. Students drew concept maps of "the environment" and what they expected the woods would look like before they traveled to the nature preserves. After the nature experience, students were asked to write about what they expected to see at the preserve the next time they visited. Notes and reports from teaching docents and student responses showed that when students went into the woods in small groups with a volunteer adult leader, participants changed their conceptions of nature and the importance of human interaction about our natural environments. (LZ)

Into the Woods: Nature Experience and Conceptual Change

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Abstract

Within the past year, a project began in Chicago, sponsored by the Illinois Chapter of the Nature Conservancy, that aimed to involve youth from urban areas in interpretive nature walks, hands-on stewardship projects and other direct experiences in the prairies, savannas, woodlands and wetlands of the Cook County Forest Preserves in coordination with classroom exercises. Trained adult volunteer docents accompanied and assisted students in the field and the classroom. The goal was to establish a ratio of five students to one adult in the outdoor sessions. Students learned about ecology through studying a particular "adopted" site over the course of a year. This paper describes some of the activities, docent responses and student responses to first experiences as students went, many the first time, "into the woods".

> We eat lunch at the picnic tables. I assume that lunch will settle the kids down again, but they seem energized, and they want to run and play as they eat. I try a summary discussion during a moment that we're all sitting. I ask them if they had fun on our adventure, and it is an overwhelming "Yes!" I ask them to tell me what they liked most, or will remember the most to tell the others about this place (given that we're explorers). Here's what I hear:
>
> > Naming plants (Angelo named three, freckle flower, yellow sprout, white spring.)
> > The deer
> > The algae
> > Keesha in the mud
>
> --Lisa, volunteer docent

Countless notes and reports from teaching docents and student responses showed us that when students went into the woods in a small group with a volunteer adult leader, participants changed their conceptions of nature and the importance of human interaction about our natural environments. In this paper, I describe the Nature Conservancy Illinois Chapter Acorn Project and present evidence for how inner city students enlarged their worlds to include appreciation for and better understanding, often new discoveries about nature. I will begin by providing background about the essence of conceptual change in science understanding and the importance of socially mediated and constructed science knowledge. Within this framework, I will show how students' experiences in nature with volunteer docents and their subsequent responses demonstrated that the experience of going into the woods with volunteers changed students' conceptions and appreciation of natural environments.

Learning and Conceptual Change in Science

The goal of teaching science concepts is to help students understand the world of science, and to make science concepts useful as students make sense

of their worlds. Much of science seems difficult to usefully conceptualize for many students (Anderson & Roth, 1988; Anderson & Smith, 1983; Carey, 1986; Glaser, 1982; Posner, Strike, Hewson & Gertzog, 1982). Often learners come to science with real-world conceptions about phenomena that interfere with their ability to understand and use new science concepts. Students may not make the shift required in the kind of learning that requires them to accommodate their knowledge to fit new information. They especially have difficulty making the shift from real-world explanations of phenomena to scientific explanations when they are unable to make the new science concepts useful (Carey, 1986; Driver & Easley, 1978; Anderson & Roth, 1983). Learning that requires students to change their concepts about phenomena appears to be a difficult kind of learning to accomplish, and often students do not make the switch. Students have been seen to take several alternatives to accepting scientific explanations: They will write scientific terminology and algorithms on their tests, but when provided a real-world event to explain, they revert to their common understandings, not necessarily scientifically based. Sometimes tudents will incorporate new science concepts within their already existing schema without changing their common explanations or theories about how the world works, sometimes retaining conflicting theories (Carey, 1986; Driver & Easley, 1978; Gunstone, Champagne & Klopfer, 1981; Roth, Smith & Anderson, 1983). Students have difficulty making the shift from their real world conceptions to more scientific ideas when in classroom contexts. Most of the knowledge about how students change their conceptions has been carried out in classrooms and laboratories (cf. above cited studies).

Researchers have found a body of instructional practices that encourage conceptual change: There must be dissatisfaction with existing conceptions, the new conception must be intelligible and appear plausible, and the new concept should be fruitful (Posner, Strike, Hewson & Gertzog, 1982). Often discrepant

events are used to create conflict between the student's naive conceptions and the scientific conceptions (Nussbaum & Novick, 1982). Smith, Blakeslee and Anderson (1993) proposed that there are four recursive levels involved in helping students change their thinking:

1) Establish a problem that is intended to create dissatisfaction with existing conceptions;
2) Model scientific thinking using new conceptions;
3) Coach students as they practice using the new conceptions; and
4) Fade support by gradually allowing the student to take over as he or she becomes more capable.

One key to effective conceptual change teaching is to find out each student's conceptions about the conditions before instruction. The teacher then provides experiences that create dissatisfaction with existing ideas and models a new conception that is intelligible, plausible and fruitful. In the nature experiences that students had with adult docents, students were presented with direct experiences that may or may not have conformed to their prior conceptions about woodlands and prairies. As docents modeled their attitudes and language understandings of the nature experiences, they provided children with models of new conceptions that were intelligible, plausible and fruitful. Evidence of how children change their scientific conceptions as a result of direct experience in small groups in the company of adults adds to the conceptual change literature about the effectiveness of these teaching practices.

Experience and Social Constructivism

Knowledge as a socially-constructed system. Another important aspect of learning science is that thinking about science is located not only in children's conceptual thinking, nor is it objectively found in nature and reproduced in an individual's mind, but knowledge resides in the physical and social contexts of the experiences (Greeno, 1989, as cited in Marshall, 1989). Science learning is

a constructive process requiring active involvement of the learner and the teacher (Inhelder & Piaget, 1958; Piaget, 1964.) Learners construct knowledge by recognizing their existing understanding and testing them with relationship to their experiences. Knowledge is socially constructed through experience in a social environment mediated by language (Gergen, 1985; Vygotsky, 1962). The social context of the learning experience and interaction with an adult communicate the values of the knowledge and forms of learning, which ultimately influences the form of the science knowledge understood by the student. In a socially constructed learning experience, language is used to confer and question ideas to make sense of the learning encounter.

Language mediation and modeling by adults. The adults in the learning experience play a major role in helping students mediate their experiences with language. According to Vygotsky (1962) the beginning stage of concept acquisition is at the everyday or spontaneous level formed through children's daily experiences with their world in meaningful, first-hand encounters. Students acquire scientific concepts through social interaction with older or more experienced members of the culture. Students' social interactions with volunteer docents about their nature encounters and observations of docent activities and attitudes may play a major role in students' developing understanding. Vygotsky claimed that individual thought processes (intrapsychological) originate in conversations with others (interpsychological). New ways of thinking begin in conversation with another. Not only is thinking mediated by language, but the attitudes and activities modeled by adults contributes to students' thinking. As students in this project engaged in experience, observed docents, and discussed their discoveries, new ideas should have formed as a result of the interactions.

Learning and the Human Brain

Meaningful learning requires multiple complex and concrete experiences, making connections through ongoing experiences. "The primary focus for

educators, therefore, should be on expanding the quantity and quality of ways in which a learner is exposed to content and context" (Caine & Caine, 1991, p. 5). Talking about what they are doing and learning as they view, act and value enhances the meaningful learning that can take place for learners. The role of teaching is to encourage the learner to generate useful, more sophisticated and personally meaningful interconnections. Humans do not learn automatically from experience; how experience is used determines how much we learn. Teachers and adults can help students profit from their experiences by "orchestrating the immersion of the learner in complex, interactive experiences" in personally meaningful ways as they encourage the learner to actively process and analyze the experience (Caine & Caine, 1991, p. 104). As students reported here engaged in social interaction withing the rich, complex context of Forest Preserves, guided by adult conversation, their experiences make for meaningful learning about nature.

The brain is a social intellect. All regions of the brain interact and activities with the community and the environment become part of understanding (Gazzaniga, 1985). We receive and create meaning on our way to understanding. This understanding is often socially constructed (Vygotsky, 1978).

The Context: Nature Conservancy Acorn Project

In fall of 1992, several members of the Chicago branch of the Illinois Nature Conservancy met to plan interactive nature experiences for inner city school children. The purpose of the program was to involve city children with earth keeping experiences that connected them to particular places and developed active attachment to and tending of a natural space. The curriculum was specific to and generated from the characteristics of each of three Cook County Nature Preserve sites, Spears Woods (containing oak woodlands, wetlands and prairie), Markham Prairie (containing wet and dry prairie), and

Somme Prairie (containing marsh, wet prairie and oak savannas). Fourth grade classes were identified at several city schools, particularly school where students have little access to natural spaces. Parents, teachers and adult volunteers were invited to become docents for each site. Docents were trained by visiting the sites, reading literature about prairies and woodlands, and discussing with teachers and site stewards how to be effective nature guides for children. The first children in the project visited Spears Woods in the spring of 1993. Usually students would arrive at the site on a bus between 9:45 - 10:00 a.m. and spend the next three hours with volunteer docents, parent chaperones and their teacher(s), walking the prairies and woodlands, eating lunch, and sharing activities, such as pulling garlic mustard in the spring and collecting seeds in the fall. Teachers prepared students before the visit using classroom activities based on what each teacher's goals were for the students' learning. The program was planned so that beginning in fall of 1993, students would visit the same site during fall, winter and again in the spring.

Data Sources

This report is compiled from several data sources. One source is children's products before and after their nature visits, such as writing, concept maps, and drawings. Another source of information about the experiences is from docent journals written about their activities with the children. Videotapes also provided glimpses into students' attitudes and verbal exchanges about their nature experiences. Student experiences from three schools and students in fourth, fifth and eighth grades are included in the data. The number of children in each sample of data differed, but there were 20 children and three docents who provided much of the information in this report. All of the children whose experiences are reported here were students in inner city schools, and most lived in the neighborhood of the schools, often in low income neighborhoods and housing projects.

Descriptions of Experiences

Students' Conceptions Before Nature Experiences

Concept maps. 23 students drew concept maps of "the environment" or "Spears Woods" before they traveled to the nature preserves. The average number of concepts that each student added to their center concept was six. Ideas the added were commonly words such as trees, flowers, plants, people, woods, water, grass, bugs, animals, the earth, moon, and cars.

Drawings. 23 students drew pictures of what they expected the woods would look like. All of the children's pictures contained trees and most contained flowers. Often the trees also contained leaves and fruit, such as apples and oranges. People were often seen walking or standing under the trees. In two drawings children had added water, such as a pond or lake. Rain was present in several drawings. Four drawings had houses among the trees. Only one drawing contained an animal.

Students' Conceptions After Nature Experiences

Student writing. After the nature experience, students were asked to write about what they expected to see at Spears Woods the next time they visited in winter. The main ideas that students presented were about snow, trees without leaves, animal footprints, deer, horses, other animals, bird nests, frozen wetlands, fungus on the trees, rotten logs, deer, deer tracks, frogs, squirrels, and insects under leaves or logs.

Student verbalizations. Many of the docents documented students' verbalizations during and after their experiences, revealing what students were thinking. For instance:

> Most of the kids do not know what a prairie is. Two think it is a kind of house. (Cynthia)

> DeAngelo told me he wants to bring his children here. He said, "I didn't want to come but now I'm glad I came. I saw some interesting things. . .deer and living plants. . ." (Nancy)

> In nature experiences each child latches on to something that gives him identity in this new place. One becomes an artist, drawing what he sees; one becomes the garlic mustard pulling queen; another sights a deer and stalks it. . . (Laurel)

> The children talked about the things they were afraid of in the woods, bears, rattlesnakes. . . one girl asks to go back to the bus because she is afraid, but later is joining the others crossing a stream by walking across a log. (Cynthia)

> I asked how many children have been in the woods before. None. (Cynthia)

> We go down the road after picking up the lunch area. I divide them into two groups and send them through the woods towards a small wetland. I tell them to quietly sneak up and see if they can see the ducks up close. They go sneaking through the woods. They are full of confidence now. When they reach the wetland they keep sneaking up on the ducks, even in the mud. (Cynthia)

> Back on the path, one of the boys in my group suddenly said "Shhhh. Hear that woodpecker?" Everyone listens carefully, but we do not hear it. "It was there", one boy says confidently. . . they do it exactly like I did it when we were in this same spot earlier. (Cynthia)

> I have told them that there is a special place up ahead where we will find our snacks waiting. Kateena tells me that she "loves special places". She wants to know if it is a little house where we will stop to eat. Kevin thinks it will be a vending truck like the kind that sell snacks to the construction workers. I tell them it is neither, but keep the secret. (The snack spot was two large fallen logs in a forest clearing.) (Lisa)

> I pull a picture of garlic mustard out of my pack and everybody gathers around. . . we walk to a large tree which is ringed by garlic mustard and I show everybody. I tell everybody to go find one, and stand by it, and that I will check to make sure it is garlic mustard. Everybody is quick to catch on and immediately all seven want to show me at the same time! . . The kids separate a little and three of the girls move farther out. In no time, they have a handful. . . Alicia, Bonita and Lola take their job very seriously and continue to pull. (Lisa)

Drawings. Drawings that students made after their experiences were close replications of things they had actually seen and experienced during their visit. Trails and animals were added to the drawings, and prairies, also fungi and fallen logs and birds, toads and worms. No houses appeared in these drawings (except for the two outhouses that were present at the site). Students seemed to be trying to tell a story in their drawings about the things they had discovered in the woods and the prairie. Figure 3 is typical of many students' drawings.

Discussion

With the brief representation of the data above I hoped to show the richness of students' experiences with their docent leaders. I also wanted to show the kinds of conceptions that students had about natural areas before their experiences, the kinds of encounters they had, and what their thinking was like as a result. If the goal of teaching about science is to help students understand and make sense of their world, direct experience with nature in the company of adults appears to be one way of helping students connect with living things. Not only did students directly experience the environment of woodlands, prairie and wetlands, but they got dirty in it, played in it, conducted stewardship activities in it, and talked about it with adult volunteers. The adults mediated the children's experiences, and modeled the attitudes and thinking appropriate for participating in nature: When LaToya was frightened and wanted to return to the bus, the docent was able to calm her and talk about the protection of the trees and the leaves and the calmness of the woods. When students encountered living things, like flowers and toads, docents explained the importance of leaving the living things in their own "yard" so they could continue to grow and populate the forest. Students later talked about the importance of leaving the living things in the woods. Students began to mimic the docents in their approaches to nature, such as the example above, when students were listening for woodpeckers in the trees.

The Acorn Project of the Chicago office of the Illinois Nature Conservancy is still in its early stages. We have plans to continue to add more schools from both the city and suburbs each year. We have evidence to show that direct nature experiences with adult volunteers has helped some of our inner city children to broaden their view and appreciation of the world and what life is like in nature. Children changed from being timid and unsure and even frightened about their surroundings to showing more comfort, some showing a sense of

"knowing" about life in the woodlands and prairies. One of docent Cynthia's stories exemplifies the changes we saw in children's attitudes:

> We leave the woods and go towards the prairie. "Are we going to get to run in the beautiful grass?" a boy asks. "Yes," I say, "you can run and be free." We put down all our packages. The children take off down the trail. I expect the group to go down the gully, up the rise and turn around before they get to the woods. No. They disappear into the woods. I go running after them, but they have a huge head start. I run calling, "Let's eat lunch," but when I get to the woods, they are no where to be seen. I keep going down the path, calling to them. No answer. They are gone. I stop and listen. No sound of them. I did not tell them to stick together. I did not tell them to turn around and come back. I imagine the newspaper headlines. 8 Cabrini youngsters lost in Forest Preserves. Giant manhunt. Lawsuit filed. I never expected this to happen.
>
> I keep running down the trail. Across the next field. Into the next bit of woods. I come out of the woods and hear someone just around a clump of bushes ahead of me. Suddenly the group comes toward me from behind the turn in the path. They are running in perfect formation, in perfect time with one another. I step off the path and watch them run past me. The large boy in the lead says, "We had to teach the girls how to run." A girl hands me her red sweatshirt as she runs by. "We can run as good as the boys now," she says proudly. "Look at these beautiful strong children", I say. I am amazed by their sense of confidence. "Meet my back at the road and we'll eat lunch." They disappear into the woods. By the time I got back to the road they were getting out their lunches.

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