Kids and Science — Magic in the Mix

by Sally Cartwright

A valid introduction of science in the early childhood classroom can enliven children's curiosity and their drive to learn from observation, invention, and discovery for the rest of their lives. But this seldom happens, because it requires a process of education shot through with magic. Here's a look at the magic and some ways to achieve it.

One autumn morning in our small, rural preschool here on the Maine Coast, Nina brought in a cardboard carton containing a short milkweed stem and leaves.

"Look what I found! A chrysalis! It's very *deckilate*." And so began a science experience, totally unplanned.

Nina, usually awkward and shy, took charge. I was delighted: instead of *hanger-on* she now became our expert. She advised a single layer of cheesecloth be placed across the top of the box. We complied. The gauze deterred probing fingers, allowed sufficient air and light to reach her specimen, and we could see through its airy mesh with ease. The monarch chrysalis, leaf green and flecked with gold, was captivating.

Two children, a parent in tow, went to our village library and found a picture book of the monarch butterfly's life cycle. I read this aloud to the whole group. Later, in the shelter of the reading corner, the children, quite on their own in twos and threes, continued *reading* the pictures to each other. All avidly discussed various "*callipitters*," even became them, creeping to *caterpillar music* from my accordion, and curling into pupae at the music's end. A creative if unscientific rash of eggs, larvae, and pupae appeared spontaneously in clay; a wonderful smudge of colors at the wall easel was called a butterfly; and our tiny green and gold monarch-in-the-making became our friend.

"Can we keep him?" asked Mark. "No, monarch butterflies go south," Nina answered.

"Like the geese we saw," put in Jan.

"Yup, where it's warm in winter," said Tom.

I wondered where "south" meant, but I didn't elaborate. How important not to distract these young children with an intrusion of more information than they can use!

Over the next few days, the children, entirely on their own volition and with mounting interest, watched the chrysalis darken. Distinctive markings developed beneath its pupal shell. One morning they found an orange and black butterfly, huddled and wet, the frail shell split open, still dangling nearby. Without a word from me, the children from all parts of the room put down their paint brushes, left their blocks, their clay, their dramatic play, and wordlessly gathered by the box. This tiny but remarkable metamorphic climax in nature was for us a shared wonder and brought us very close. Mark's hand slipped into Nina's.

Earlier, Lisa had puzzled why the pupa darkened, and I asked her if she might like to check its color with a picture of the adult butterfly. She slipped away with a quiet purpose. Moments later, she startled us, for she sprang up shouting, "Wings! It's

wings!" Her sense of discovery was part of our magic, but her shrill exclamation drew four young skeptics to her side. She explained her find to them by again comparing pupa and pictures. (Good science learning means not only understanding but *using* the information to one's own purpose.) And when the real butterfly emerged, these youngsters knew for sure they'd seen the wings forming in the chrysalis. They laughed and hugged each other. My job as teacher was often to stay clear. Children need to find and feel their competence.

Next morning, when the monarch's wings were dry and strong, we sat around its box on the school porch in hushed excitement. Nina drew back the cheesecloth. Our monarch fluttered up over the playground and zigzagged southward. Almost every child watched until our fragile friend was a tiny speck that vanished in the pale sky. Not a sound came from the kids. Then Mark whispered, "I'm glad he's free."

Part of the magic in this experience was its sense of adventure. I did not want to decide ahead of time what should be taught. I purposely didn't ask the children to learn a thing. Nor did I ask them to verbalize their experience. My aim was not to give the kids a broadside of information. They each have a lifetime in which to learn facts. I wanted them to *get the feel* of learning through compassionate initiative, participation, observation, and intuitive insight. They had to do this through their own action, not through talking about it.

To be sure, young children are more physical than verbal, but any child (or adult) needs to know this kind of deeply felt, right-brained learning *through direct experience*. In our society, with its left-brained, linear, intellectual rationale dominating our schools, experiential/intuitive learning seems, by comparison, sheer magic. Nevertheless, infants and toddlers depend on it. Both walking and talking are best learned in this way. We teachers need to

nurture our children's innate curiosity, their imagination, their creativity, their purposeful, child-initiated work toward discovery.

It's so easy to drown a child's resourceful learning initiative in teacher-directed procedures. Instead, I warmly supported the children with my own genuine interest. But I wouldn't steer them. I trusted these young kids to use their intrinsic curiosity, intuition, and compassion. I trusted them to make connections, to see relationships, to really think, and then to test their findings on their own. This process, using both right and left brain, the yin and yang in each of us, is not only valuable learning—it is the essence of scientific discovery.

A good teacher knows with caring respect not only this wonderful child process of learning, but also that a child develops unevenly, in spurts, plateaus, and setbacks. Physical, social, and cognitive achievements are interdependent and inseparable from emotional development. For example, as Nina's self-esteem grew, her coordination improved, and sometimes her leadership (social competence) became as deft as her fingers. When the monarch flew off, Nina partially reverted to her somewhat clumsy, uncertain self. It takes a long time to grow. And for teachers it takes our finest knowledge of child development, our patience, our compassion, our detachment, our humor, integrity, and trust.

The nursery child has a wonderful drive and capacity to learn on her own. She finds out what she needs to know through her own effort quite as she learned to walk. There need be no contrived motivation. Learning is hard work. It's often frustrating. At the same time, it can be an exciting challenge, a living, expanding adventure for the children. I've worked hard over the years to quicken this magic in the mix—a child's curiosity, wonder, intuition, purpose, and caring.

Magic for a good science program depends on the setting and spirit of the entire curriculum. A small child needs to feel assured and easy in his surroundings if he is to turn his full energy to building skills and to learning effectively. Thus, along with the steady, warm support of the teachers, the setting and routine were intentionally simple, consistent, and predictable. We had a large, sunlit classroom overlooking the sea. It was a workshop for the 12 children, and its simple furnishings formed a quiet background for child activity in a child's world. The design and use of space—each piece of equipment, each material, each toy—was carefully chosen to encourage active, resourceful learning, cooperative endeavor, and the child's deep sense of himself as an able learner who was liked and valued by his peers. Structured toys were few because they tended to dictate function to the child, whereas the carefully chosen basic materials invited child autonomy, creativity, and—in group work—remarkable cooperation and friendship. It was a joy to be with these children and feel their ingenuity, humor, and compassion for each other as well as for their work of learning.

Science was no exception, and most of it was a natural part of our daily experience. For example, in block building and play, *children learned through experiment* both the perception and use of dimension, weight, balance, levers, and cantilever. At the water table, *they discovered for*

themselves, as it served their own purpose, such usually non-verbalized phenomena as floating and sinking, centers of gravity ("what's top heavy tips"); an intuitive sense (with continuing awe and delight) of water qualities—its fluidity, viscosity, transparency, surface tension, and wetness (!); a fantasy world of bubbles, iridescent in sunlight; an incipient feeling for air pressure; and 2 of our 12 youngsters, with remarkable persistence, made and used siphons. Outside, the rock and sand sea edge was an intertidal biology world of endless fascination.

In conclusion, my field notes of a science venture on the edge of the sea (see box) illustrate some of the magic in good child learning.

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May 8: Drift-in Beach

No one here but us (12 kids, 2 teachers). Sea shining in the sun. Light, warm breeze. Clean, salt smell. Children ran pell-mell over the sand, its level expanse at ebb tide inviting freedom and joyous movement. They explored the rocks, tide pools, boulders. They found tiny animals and shells and seaweeds. They tested their skills—leaping, jumping, climbing, sliding, falling, and dodging pools to stay dry. Ha! Nearly all feet were wet, with Josh in up to his knees and his arms soaking to his elbows, heavy jacket and all. We poured water out of sneakers and boots, but no one was cold.

The children aided each other over the rocks, exploring together, shouting their findings, sharing their joys. A couple of kids were digging in rock-strewn sand when they discovered water rising in their hole.

"Where does this come from?"

"It's impossible. The sea is way down the beach."

"How can water come out of the sand?"

"Come on! Let's find out."

They dug with their hands. They removed heavy rocks, one by one, gradually uncovering a hidden stream. Jason took the lead as other children joined the work. Within 15 minutes, every child was there and working hard. Some rocks took three kids lifting together to budge them.

Jason tasted the water.

"It's fresh!" he shouted. Others checked his assertion. They tasted the spring water and ran down to the sea to taste its salt for comparison. Then they were back at work, intent on the process of discovery. Although they found where the clear, cool spring water welled up through the rocks, that goal seemed unimportant. What caught their hearts (and mine) was their concerted action and spirit. These preschool children excavated—through rock and sand with their small, bare hands—28 feet of hidden, winding stream. They were helping each other, deeply involved, eager, joyous, and determined.