Celebrating a Young Learner at Work:

Marcus the Scientist

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This article is about seeing the world from the perspective of young children and developing an appreciation of the many wonderful strengths of each child. *True* stories of young children *in action*—learning about their world—offer direct evidence upon which to build insights about children's potential as learners and thinkers. Once we appreciate children as remarkable thinkers, we can develop a much broader understanding of the learning that is *possible* within our classrooms!

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Looking for air

The wonderful feeling of a cool breeze on a warm day is hard to match. It brings with it a sense of contentment and well-being. Well, for some of us it does. For children, just experiencing wind on their faces can be disturbing!

Five-year-old Marcus was on the playground with his class, enjoying the breezy autumn day. His friends were busy playing games, running, and laughing, but Marcus had other things on his mind. He approached his teacher, Joan Dubay, to seek her assistance.

"Ms. Dubay," he asked, "how come you can *feel* air, but you can't *see* it?"

Joan hesitated for a moment as she considered his question. "Marcus, that's good thinking," Joan replied. "I'm really not sure how to answer. We'll ask Ms. Trout [the science teacher] about that."

In the next few days, Marcus approached Joan several times, wondering, "Did you ask Ms. Trout yet?" Finally Joan found a few moments to meet with Lori Trout about Marcus's question.

"That's a pretty sophisticated concept," Lori told her. "The molecules are actually so tiny that we can't see them," she explained.

Ready with new information for Marcus, the next day Joan pulls him aside to share what she has learned. "Marcus, I talked with Ms. Trout. She said that air is so tiny that we just can't see it." After a reflective pause, Marcus seemed satisfied with this explanation and returned to his work.

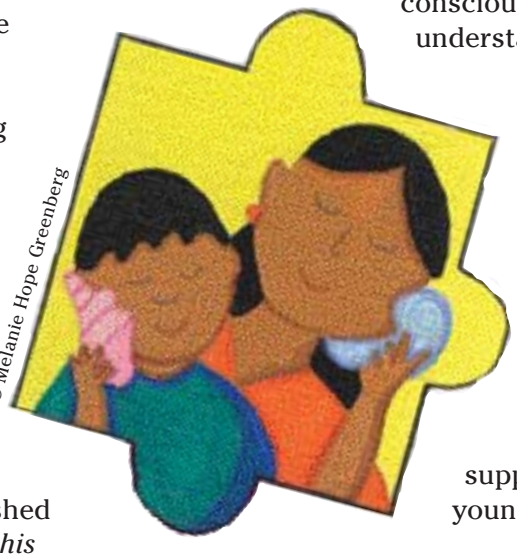
About a week later, Joan caught a glimpse of Marcus from the corner of her eye. He was slowly walking around the classroom, a magnifying glass six inches in diameter held up to each eye transforming his usually large brown eyes to a comical size. She could not imagine what he was up to. "Marcus, what are you doing?"

"I'm looking for air."

Anomalies: Surprises or confusions that prompt learners to question their world

Most young learners are focused, resourceful, and determined. Marcus's story is really a celebration of the diligence and tenacity of young learners and the remarkable strategies children use when they have a clear agenda or intention. Propelled by an experience that, given what he knows, defies explanation, Marcus is completely dedicated to reestablishing a coherent sense of his world.

The springboard for Marcus's inquiry, as is often the case with all learners, is an *anomaly*—something unexpected that he has experienced. This anomaly created confusion for Marcus: something exists in nature that can be felt, but cannot be seen? The irregularity prompts him to take action to resolve the cognitive discomfort coming from such confusion—to solicit help from one he perceives to be an expert, his teacher. His ability to ask questions, a skill he learned years ago, serves him well, helping provide a focus that narrows his investigation.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But his question is far from easy to answer. So, pushed into her own anomaly, even *his teacher* must seek assistance from someone more knowledgeable to answer this thought-provoking query. In the process Joan provides an important demonstration of what adult learners can do when confronted by anomalies: they sometimes consult even more learned experts to answer their questions.

The abstract answer ("It's too small") to his very concrete question, leads Marcus to seek tools that can extend his capabilities. Because magnifying glasses are readily available in his classroom, Marcus can expand his investigation and conduct an experiment that leads to discoveries about the limitations of a magnifying glass. His decision to choose these tools to augment his vision provides evidence that he has observed others using them and that he understands their function—to enhance his ability to *see*. Perhaps he tried a single magnifying glass, found it insufficient, and then decided that two—a larger number—might *amplify* his chances of seeing air. Perhaps he reasoned that together the two lenses resembled a large pair of eyeglasses, which are also designed to help with seeing.

We were intrigued by Marcus's question and sought further clarification from Dr. Sherry Brown, a science education professor in our department. We learned that air molecules are not just tiny, they are also very far apart and move rapidly, qualities that contribute to their invisibility.

An adult with a similar question might have tried to conceal confusion or ignorance from peers. Marcus, however, is completely unselfconscious and unrelenting in his pursuit of understanding. By the end of our story, by virtue of his tenacity in seeking to understand the nature of air, Marcus is poised to learn some very important concepts about chemistry and physics. What a remarkable inquiry for a five-year-old scientist to undertake!

Supporting young scientists

Here are some ideas for how to help support and extend the learning of young inquirers like Marcus.

Invite and celebrate children's questions. Marcus's encounter with the anomaly about why air isn't visible compels him to push . . . push . . . push until he gets what he needs: a clear answer to what for him is a very direct question. His question reveals his logic: If X, then why not Y? He felt the presence of wind on his face and body. That observation, paired with his belief that everything that can be felt should be visible—a misconception about the world—is captured in his question.

We can learn a great deal by attending to the questions children ask. First, the questions tell us what they understand to be so . . . and what they *mis*understand. Further, their questions reveal the anomalies at the root of the inquiry, the collision of their current beliefs with new evidence they've encountered. With knowledge

of children's understandings and the anomalies that have them perplexed, adults can lead children both to the answers they seek—if answers exist—and to more refined understandings about the world and how it works.

Joan Dubay's response to Marcus is quite wonderful: she celebrates his personal inquiry *and* provides support for it by soliciting help from an expert. And note too that because there are powerful tools in the science center—in this case, magnifying glasses—Marcus extends his inquiry and sense of independence as a learner. This leads us to another suggestion for supporting young children's inquiries.

Offer tools, objects, and specimens to pique children's natural curiosity. Even very young children learn much of what they know by observing those around them. A recent experiment exposed one-year-olds to just 20 seconds of a videotape of "an adult actress reacting to a toy with a show of either negative or positive emotion" (Goode 2003). After observing for but one-third of a minute, the infants "displayed similar emotions in their interaction with the toy" (Goode 2003).

Showing children the power of tools invites them to respond to the world in powerful ways. Marcus's decision to seek out a particular tool indicates that he has seen others make successful use of it. What could be learned by investigating a bit further, asking Marcus, "How did you decide to use two glasses?" He seems to understand that if he can magnify something he knows to be *there,* he will be able to see it. Imagine his disappointment at discovering that this tool he knew to be such an aid to seeing failed to offer the visual display he seeks. Another anomaly!

When situations present themselves that could showcase the value and the limitations of particular tools, that's the time to bring them out. The Montessori principle of providing children with toys and other manipulatives they are *ready* for can be seen here in microcosm. Marcus may or may not be ready for a microscope to attempt to see air. However, he is primed to learn the limits of the magnifying glass for the kinds of explorations in physics and the life sciences that currently drive his curiosity.

Emphasize direct experiences. Rather than just offering verbal explanations in response to children's questions (which on a busy day help us move past what may seem like interruptions or diversions), teachers can enhance the focus of a child's study by introducing other related experiences. In this case, it could be helpful to find ways for Marcus to see the *impact* of air. Inviting children to look for visible evidence of wind would help too.

Careful observations in and around a dusty outdoor sandbox or field on a windy day would help children get a better sense of the shape and movement of wind currents, what they actually look like. Afterwards, children could draw what they observe to help them process their observations and perhaps come up with more questions. Drawing can clarify anomalies and is a valuable tool for young observers and learners.

Invite children to offer theories. Early childhood educators who employ the Reggio Emilia approach to teaching and learning engage children in ongoing theorizing in response to investigations such as Marcus's. For example, his teacher might invite Marcus to speculate about why he thinks air can be felt and not seen, how he believes magnifying glasses will reveal that elusive air for him, or how something so ephemeral can be seen to move huge trees and push immense clouds around the sky.

Such thinking could position Marcus to refine his theories about air, magnifying glasses, and invisible forces. And just as children's questions provide important information for parents and teachers, their theories about life will reveal their understandings. This will allow adults to engage the children in explorations and discussions that will move their understandings along.

Be learners alongside children, speculating, observing, and demonstrating what more experienced learners do when confronted by an anomaly. Marcus's inquiry is quite sophisticated, and not commonly considered, nor easily answered by most adults. In fact, this five-year-old's question set into motion a series of questions, prompting adults (including

us) to seek help from experts to fully understand the phenomenon that captured Marcus's attention.

What if we worked alongside Marcus to find an answer to his question? Speculating about how to find the answer would demonstrate how to research a topic. "I wonder where else we could look to see what wind does, Marcus?" "I wonder if our friends have noticed anything about wind." "Maybe if we draw what we see and feel, we'll have a better idea about the wind, even though we can't see it." "I wonder what other tools might help us see."

Imagine how Marcus's theories about adults and learning would change once he discovers that adults (beginning with Joan) don't know everything, that they sometimes struggle to understand too. There is much for the keen young scientist to learn about the resourcefulness of mature learners for finding answers through means he or she has never considered.

Get ready, Ms. Dubay! Marcus's next question may be about gravity . . . or magnetism, instincts or vacuums, rainbows or . . . .

References

Goode, E. 2003. TV's effect on babies. *Louisville Courier Journal,* 24 March, A9.

If you are interested

. . . in more about Reggio Emilia

ERIC.EECE Clearinghouse on Elementary and Early Childhood Education Website: is part of the Department of Education's ERIC system and collects a range of Websites for educators. For a focus on the Reggio Emilia approach to early childhood education, visit **http://ericeece.org/reggio/reglink.html**.

. . . in invisibility

Kid Wizard offers some fun experiences dealing with the "magical" in nature on its page "Invisible Hand," online: **http://www.kidwizard.com/Spells/InvisibleHand.asp**.

. . . in touch

"Touch (Somatosensation)," by University of Washington educator E.H.Chudler, offers a series of experiments and experiences, predominantly for elementary ages, designed to explore the nature of touch. Online: **http://faculty.washington.edu/chudler/chtouch.html**.