



# Investigating Rocks and Sand

## Addressing Multiple Learning Styles through an Inquiry-Based Approach

Uchenna Ogu and  
Suzie Reynard Schmidt

In early September, kindergarten teachers and parents noticed that children were very curious about rocks. Pockets and cubbies swelled with personal collections from the playground, the park, and other nearby outdoor places. Rocks and pebbles were exchanged like gifts, and crystals and fossils soon became classroom currency.

As they played, the children began to invent and develop a descriptive rock vocabulary to more clearly differentiate and communicate obvious and subtle differences. There were the sparkly ones, the marking ones, the volcanic ones, the ones that look like metal, the fossils, and the crystals. Then there were the kind that came from the fairies and even the ones from the moon.

Children asked each other questions based on their observations: How did you get that to be so sparkly? How

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**Uchenna Ogu**, BA, has been faculty at The College School in St. Louis, Missouri, since 2001. Her innovative teaching style and student work have been recognized by leaders in Expeditionary Learning Schools Outward Bound and the Cloud Institute for Sustainable Education. [uogu@thecollegeschool.org](mailto:uogu@thecollegeschool.org)

**Suzie Reynard Schmidt**, MAT, has been faculty at The College School for four years. She and the school believe in a constructivist pedagogy rooted in experiential and inquiry-based education. [sschmidt@thecollegeschool.org](mailto:sschmidt@thecollegeschool.org)

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do you think this rock was made? Where did you find that one? Thinking together in these ways helps children build deeper understandings and allows them to develop a scaffold on which to build more meaningful connections. By listening carefully to children as they ask questions and talk together, teachers can incorporate children's questions and interests into an inquiry-based curriculum that supports various types of learners.

### What is inquiry-based learning?

*Inquiry*—investigating to gather information—is a part of human behavior from the moment we are born. Infants use all their senses—seeing, hearing, touching, tasting, and smelling—to explore and to collect information. Babies observe and turn toward faces, grasp at objects to put in their mouths, and follow objects with their eyes, all to gain more information (Thornton 2003). When a toddler repeatedly drops a ball into a tube and watches it vanish, he exhibits his delight each time the ball disappears and then reappears somewhere else. It is as though he is wondering, "Will it



happen that way if I do it again, and then again?" These types of behavior are early indicators of human inquiry and of how humans use inquiry experiences to learn (National Science Foundation 2001). Because inquiry is such an intrinsic human learning strategy, it makes sense for teachers to use an inquiry-based approach in their curriculum.

Inquiry-based learning is a dynamic process. "[It] is an approach to learning that involves a process of exploring the natural or material world, that leads to asking questions and making discoveries in the search for new understandings" (National Science Foundation 2001). Children's inquiry is essential in constructivism, multiple intelligences theory, and the Reggio Emilia approach, as well as in cooperative and collaborative learning experiences.

### Asking good questions

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Every morning in our kindergarten we gather together in a circle to greet each other, share information, think about the day ahead, and discuss relevant learning experiences. After observing children's play and their developing curiosity with rocks, the teachers decided to ask some intentionally crafted questions at a morning meeting: What do you know about rocks? What is a rock? What is sand?

## SUPPORTING ALL KINDS OF LEARNERS

### What do you know about rocks?

**Anna:** If you see a rock that looks like it has a living creature in it, it is a fossil.

**David:** Some rocks are very sharp, and they can make a scratch on you. I found rocks that looked like metal. Another one looked like a crystal.

**Allison:** Rocks are very old. Some are millions of years old.

**David:** Can we study rocks?

### What is a rock?

**Brian:** A rock is a little pebble.

**Kate:** Rocks are mostly hard things, and God made them and dropped them.

**Bella:** I think a rock is a part of the ground, but it broke . . .

**Lily:** . . . Yes, rocks could have been little pieces of dirt from the ground that got really old—that got really smushed together and then got hard.

### What is sand?

**Matthew:** Sand is little tiny pebbles, little tiny broken-up rocks.

**Grace:** Sand comes from beaches.

**Allison:** Sand is from a volcano that exploded a long, long time ago—like fifty hundred years ago. When it got old from the volcano, it got cold and shrunk and then . . . sand!

**Joe:** Sand is something that is at the sea, and it came from the water. People get it from the beach and bring it to other places.

Asking questions is a critical component of effective teaching. During children's inquiry activities, a teacher's skillful questioning fosters high-level discussions with the whole class, in small groups, or with individual students (Jacobsen, Eggen, & Kauchak 1993). By asking open-ended questions and documenting children's ideas—and revisiting their questions and ideas—teachers not only collect data from the children about which direction the project may take, they also address various learning styles. Teachers model reflection by reading back the thoughts generated during the discussion to the class. This allows the children to reflect and supports those who are more comfortable observing, those who need extra time to think, or those who are not always sure of the "right" answer.

The children learn what it means to answer an open-ended question: there are no right or wrong answers, all ideas are accepted, valued, and appreciated and become a part of the learning process. As children share, they become models for children with other types of learning styles, providing visual and auditory cues that inspire more inquiry.

Over the course of a school year, children of all abilities grow as contributing and valued participants in group discussions (YouthLearn Initiative 2001). For example, at the beginning of the year, one quiet, shy girl rarely raised her

hand or contributed to lessons or took part in group discussions. Even when her teachers encouraged her to participate, she would politely refuse. After about two months of listening to different discussions and watching teachers repeat and reflect the ideas back to the group without judgment, this girl raised her hand and shared her ideas with the class. Her contribution was welcomed with a smile from the teachers. After this initial sharing, she became more comfortable and began to participate regularly.

Another student was often the classroom “police officer.” He focused intently on classroom agreements and guidelines and followed them without deviation. He projected his strict adherence to rules onto his peers and expected the same behavior from them. This behavior often carried into group discussions. He valued facts and would often want to know the right answer to a question. Later in the year, as a result of our discussions about rocks and sand, we noticed that he began to accept and develop an appreciation for multiple perspectives and an understanding that for some questions there is more than one right answer.

### Investigating new theories outside of children’s prior knowledge

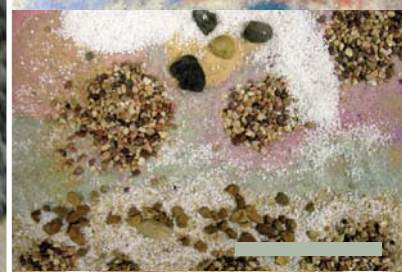
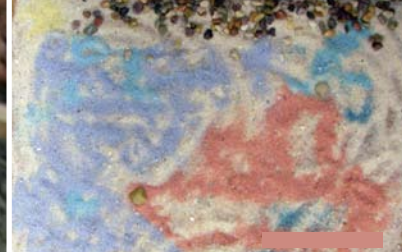
Teachers and children looked closely at sand the children had collected from various places—the playground, a class trip to a local creek, and on family trips to the beach. They observed the sand with the naked eye and with mag-

nifying glasses, and, using an overhead magnifying projector, they created an image that enlarged it more than 100 times its usual size. Children observed, documented, and discussed their findings in detail.

During the children’s investigation of rocks and sand, their initial questions were revisited, revised, and redefined by both the teachers and themselves. In the process, the children begin to make connections between rocks and sand. The focus of the study shifted and teachers shaped the curriculum to build on the children’s natural curiosities.



Florida Sand			
	Abby ☆☆	Chloe P. ☆☆	Sophie D ☆
I	[Sketch of a textured, circular shape]	[Sketch of a textured, circular shape]	[Sketch of a textured, circular shape]
[Sketch of a magnifying glass]	[Sketch of a magnifying glass over a textured area]	[Sketch of several small, oval shapes]	[Sketch of a textured area with small circles]
[Sketch of a magnifying glass]	[Sketch of a magnifying glass over a textured area]	[Sketch of several small, oval shapes]	[Sketch of a textured area with small circles]





### Reaching individual children

The teachers encouraged children to look closely, notice detail, pose questions, and reflect on what they learned. To guide the children's observation and support different learning styles, teachers asked children to draw and paint what they noticed when comparing and contrasting.

When it came time to mix the paint colors, a teacher asked one child with language and attention difficulties (and who was usually not interested in painting) to be in charge of the paints. The teacher explained that he would be the color captain and, with a small group of children, would be



#### What have you noticed about the sand?

**Ethan:** This is sand from a beach, and it has tons of crystals.

**Anna:** When I spread it out, there are tiny crystals, and it looks like cinnamon.

**Jeremy:** Some parts are big, like big rocks, and some are little like pebbles.

#### What did you discover about sand?

**Allison:** I discovered Abby's sand had millions and millions of crystals.

**Joe:** Sand has a lot of shells in it.

**Nicholas:** I found a crystal that curves. A curvy rock too.

### Ways to Promote Inquiry-Based Learning in the Classroom

**Ask questions that invite constructive input and validate prior knowledge.** For example, instead of "Has anyone ever seen a rock before?" ask, "What do you know about rocks?"

**Ask open-ended questions.** For example, "Tell me about what you're wondering?" "What do you think might happen if . . . ?" "What do you notice?"

**Encourage children to wait a few seconds before giving an answer to allow time for thinking.** Tell the children you are going to ask a question, but you would like them all to close their eyes and think about it for a few seconds before answering.

**Repeat or paraphrase what the children say without praising or criticizing.** This encourages children to think for themselves instead of seeking teacher validation. "Joe thinks that sand comes from rocks, and Andrea says it is dirt from the ocean. What do you think? Where does sand come from?"

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responsible for mixing accurate colors to represent the sand. Taking his job very seriously, this child looked carefully at the sand samples, communicated effectively with others, and stayed actively engaged in the project. “[Children] who have trouble in school because they do not respond well to lectures and memorization will blossom in an inquiry-based learning setting, awakening their confidence, interest, and self-esteem” (YouthLearn Initiative 2001).

In another example, two girls who exuded excitement about rocks and sand walked around with pockets bulging with their precious finds. Every day they both eagerly shared their latest discoveries with the teachers. Simply stated, they loved rocks. When planning the science investigation, the teachers kept the intense interest of these two children—and their peers—in mind.

The teachers designed a chart that the children labeled and used to organize and document their thoughts and observations. Teachers set up tables in the classroom with magnifying glasses and piles of rocks or sand that the children had collected. When it came time to work with the sand samples, one of the two girls squealed with excitement and delight, “I see broken seashells and tiny rocks in my sample!” All of the investigators came away proud of their latest discoveries and eager to share their work with others.

Another child, creative and with strong verbal skills, loved working with all forms of expressive media. He had strong artistic abilities and a knack for designing and building things with his hands. He had enjoyed the earlier painting activities connected with the magnified sand but was eager to create something new with rocks and sand. To support his interest and to enrich the class project, the



teachers provided materials so the children could create natural compositions out of rocks, stones, and sand.

The class traveled to the local supply store, where they selected and purchased various types of rocks and sand. Children used the large rocks to build temporary stone sculptures that expressed ideas and feelings, such as “I have been here” or “You are welcome” or “I am feeling very happy today, and the sun is shining.” They designed natural compositions with the smaller stones and sands. Using baby food jars, pastel chalks, and white sand, children made the sand earth colors by turning and mixing each pastel in sand-filled jars. Then the teachers and a small group of children filled jars and other containers with all of the materials to be used in the compositions. Children could work and play with the materials by creating and erasing and re-creating landscapes. During language arts, the teachers asked them to note differences in texture, shape, color, and size of the individual materials using descriptive language.

This part of the project offered children with a keen sense of aesthetics an open canvas on which to express themselves. It also allowed children with other strengths to explore an area of interest (rocks and sand) through the language of art. As Wallace states, “When we use the pure, simple materials of nature to create an expression of our-



selves, we can send a powerful message about our place in the world” (2004, 18).

### Reflecting on the journey

Children’s wonderings and reflections are essential to the learning process. Talking about their experiences with others allows children to articulate what they have seen or done in a way that makes sense. By listening to what others have experienced, children can understand multiple perspectives and reconcile these new ideas with their current knowledge. Listening to others’ insights and opinions and learning that these are of value is a key skill taught in any inquiry-based classroom.

Examining rocks and sand, noting differences and similarities, and talking with others about observations are all exercises in critical thinking. In his book *How We Think*, John Dewey defined critical thinking as reflective thought—an “active, persistent, and careful consideration of a belief or supposed form of knowledge in the light of the grounds which support it and the further conclusion to

**The teachers provided materials so children could create natural compositions out of rocks, stones, and sand.**



which it tends” ([1910] 2008, 6). Critical thinking involves children in the learning process by allowing them to probe and question while encouraging them to analyze and process the information through reflection and evaluation (Dewey [1910] 2008).

Throughout this project, children and teachers experienced rock and sand through many in-depth learning experiences—they collected samples, made observations, documented, counted, sorted, and classified. They created stories and wrote using descriptive language. Children built rock museums and invited friends to view the exhibits. They made artistic compositions using a variety of natural





**The children lived and breathed rocks and sand—they sang, danced, drew, painted, created, and designed with them.**

materials, some collected outside and others purchased from a local supply store. A geologist accompanied the class to a nearby creek, and children and relatives sent back sand from their vacations.

In this investigation, teachers and children became researchers, exchanging ideas and theories freely. Children learned to build special stone structures as a way to communicate ideas and feelings with each other. They posed questions and shared thoughts, allowing new questions to emerge. Reflection happened all along the way.

The children lived and breathed rocks and sand—they sang, danced, drew, painted, created, and designed with them. All of this work fostered a variety of perspectives and supported and nurtured a multitude of learning styles.

So what did this group of children learn? What were their reflections?

**What did you learn about sand?**

**Matthew:** That when you look through a big magnifier, it looks really different. You can see the small shells better.

**Claire:** It's made from little pieces of shells. Some looked like crystals, and they were different colors.

**Robert:** It can be all different colors. The water rubbed the sand smooth.

**Andrea:** Sand from different beaches looks different.

**Claire:** When we look at sand, it looks fuzzy. It can be coral, broken-down shells, and crystals.

**What other kinds of things have you learned?**

**Bella:** We learned how to work together.

**Allison:** We learned how to take care of nature and that respecting the Earth is better for everyone.

**Conclusion**

When teachers design an inquiry-based curriculum grounded in documentation and reflection of children's questions and ideas, it can provide a scaffold to support many learning styles. "[While] the traditional approach is sharply weighted toward the cognitive domain of growth, inquiry-

based learning projects positively reinforce skills in all three domains—physical, emotional, and cognitive" (YouthLearn Initiative 2008). By building on children's prior knowledge and interests, teachers keep them motivated and engaged. As the Chinese proverb states, "Tell me and I will forget. Show me and I may remember. Involve me and I will understand."

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