

Helping Children Ask Good Questions

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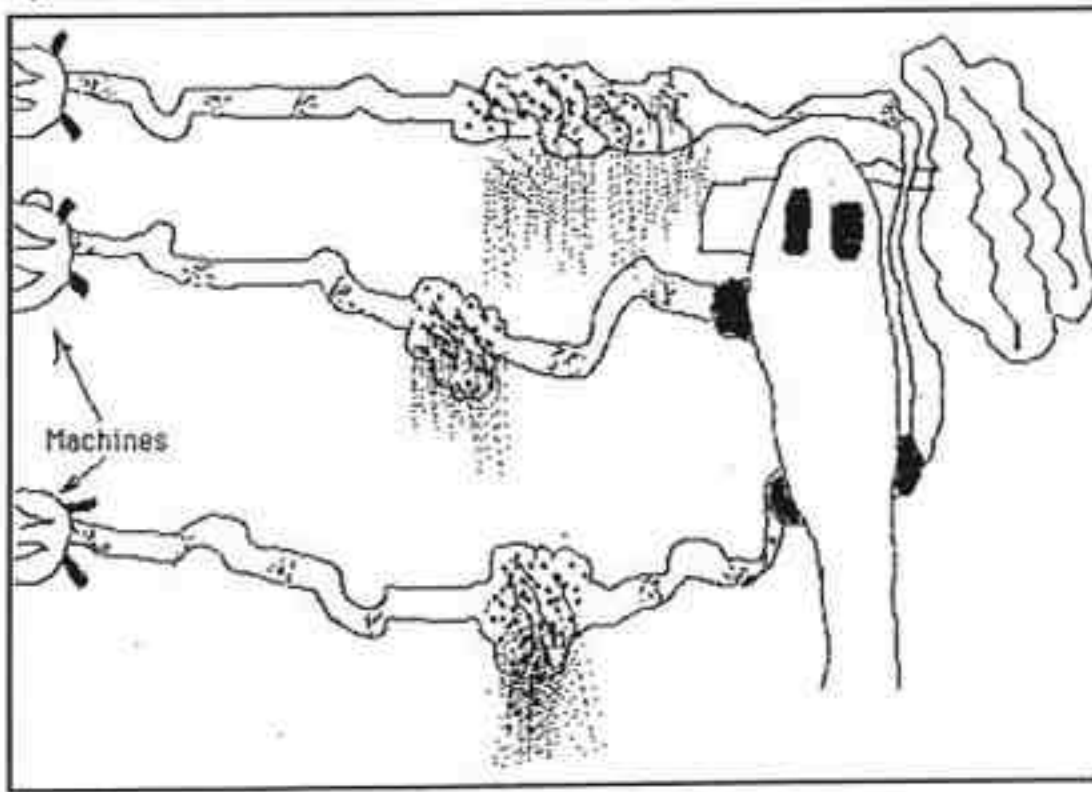
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(This article is a slight revision on an earlier article by the same name published in The Wonder of It: Exploring How the World Works, B.Neugebauer, editor, Redmond, Washington: Exchange Press, Pg. 21 - 24, 1989).

Helping children to ask good questions is a matter of helping children to think about their thinking. We should help children be curious about their own understanding of events. But how do we help children look at their own thinking, since thinking is such a private affair?

Consider this question: "Why does it rain?" The question is ill defined. Is the child asking for the purpose of rain, meaning, ": What does the rain do?" Or is the child asking about the relation between clouds, moisture, and rain, meaning, "Where does the rain water come from?" And, of course, it is possible that the child is only trying to engage the teacher socially. In our confusion, we are tempted to follow the child's question with another question, such as, "Do you mean why do we *need* the rain?" And we have all watched the child leave the scene on that one.

So how do we help the child think about his/her thinking without sounding too technical? We can ask the child to draw the event. Drawings allow us to look with the child at the child's understanding. Here are some real examples from the preschools in Reggio Emilia, a small town in Northern Italy. Children from four to six years old were asked to walk through the city streets as it rained. They took photos of the rain and made audio recordings of the sound of the rain falling on the ground or on the metal hood of a car, and the sounds of a child splashing through the puddles. Upon their return to school, they were asked to draw their understanding of the rain: its source, where it goes as it falls and thereafter, how the rain is used. They were also asked to listen to the audiotapes and draw the sounds of the rain. They drew curves and spots to represent these sounds, widening circles for thunder, jagged lines for the pitter pat of rain on the hood of a car. But as you will see, the broader objective remains: to help them think about their own understanding of the rain.



Look at this drawing by Matano, age five and a half years. He has drawn a set of pipes that circulate the water from cloud to cloud. He explains: " In the sky there are some kinds of machines that never end ... if one gets emptied there's another one ready right away. They have sort of pipes, the pipes goes into the middle of the clouds; there's water inside the clouds, the water inside the clouds never ends, if it ends it's no good, because then it wouldn't rain anymore. Then the pipe full of water goes back into the machines, where there's a sort of lever and when the machine is full of the water that the pipes brought, it switches on and it starts raining."

Matano, with obvious diligence, has represented his understanding of the rain. It is not important whether Matano believes that pipes are actually in the sky. What does matter is that Matano is trying to understand how water moves around in the sky. His best guess is that the water is forced through some conduit that is itself a rigid support. The idea that water might move airborne, without a rigid conduit, most likely violates his well held belief that water is heavy and would fall without support. A teacher who sees this drawing can be impressed with Matano's inventiveness within his own belief system and also acknowledge the incomplete nature of his understanding.

He has a budding notion of an eco-cycle, "some kinds of machines that never end," and of circulation of water. But his eco-cycle is an infinite linear chain rather than a cycle of reconstituted water; and his construction of circulation omits the lighter than air properties of water vapor. How do we help Matano ask the questions that will move him toward a more complete understanding of the rain? By the phrase, "ask the questions," I mean, how do we help Matano ask questions from the facts of which he is aware, which is not asking the teacher. How do we help him question his own understanding? To answer this, we need to make a shift in what we believe a question to be.

The child's answer can be treated as a question. That is, an answer that comes from a child's reflection on a previous answer is, in most cases, a type of rhetorical guess. Let's listen. The teacher follows up on Matano's drawing - first comes general praise, then a specific question: ""This is interesting (affirming the child's thoughtfulness). I am curious about the pipes. Tell me why we need the pipes in the sky." The child might say, "So the rain can get from cloud to cloud. The clouds have to get rain from some place." Teacher: "And from where do the pipes get the rain?" Child: "From the machines." Teacher: "And the machines, from where do they get the water? Child: (hesitates) "That's a good one!"

[Special Note: The teacher changed the word "rain" to the word "water" so as not to assume that the water always deserves the child's name "rain". The name shift also could sensitize the child to the underlying question of when in the process does water become rain.]

The teacher has used Matano's own construction of the event to address his incomplete knowledge and hopefully have helped him re-question his answers. Herein, the teacher's dialogue serves as a model for a cognitive strategy that the child will internalize in time as he/she matures as a thinker. We can call these cognitive strategies metacognition because they are strategies for thinking about thinking, e.g. meta-thinking.

One might ask, reasonably so, what is the difference in asking children, "Tell me why we need these pipes" in the above example versus, "Do you mean why do we need the rain?" (our follow up question when the child had asked, "Why does it rain?"). At one level, both teachers are asking the child to reflect on his/her thinking. The difference is in the directness. The question about the pipes allows the child to remain within the system that the child is trying to understand. To review, "What do you mean by your question?" versus "What do you mean by your answer (the drawn pipes)?" The latter is within the system that the child has invented. The question about the question makes the child think

about the difference between an intended message and the message received by the listener.

This latter case (What do you mean by your question) creates a feeling in the child that he has failed to communicate. Such a path in the dialog would lead the child away from his theory about the rain in his attempts to clarify his question. While these little side trips on message-repair or message clarification are occasionally necessary, we need to be careful not to get caught in a meta-linguistic loop that cases the child, again, to leave the scene.

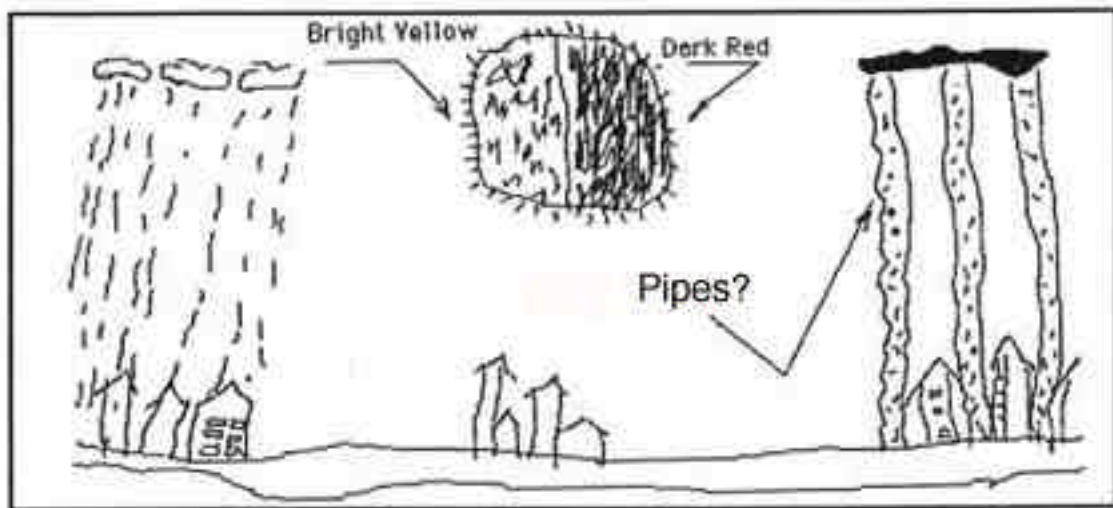
Now lets compare, "I am curious about these pipes" versus "Do you really think that there are pipes in the sky?" In the first, the teacher honors the child's theory, in the second the teacher is indirectly trying to dissuade the child from his theory. Even the teacher's tone of voice expresses her incredulity. The teacher intention may be to have the child think about what he really thinks, but the effect will be for the child to think about what the teacher thinks of what he thinks. Where are the clouds and water in this? The teacher has caused the child to leave the system of events that he is trying to understand. Thus, it is better to ask, "Tell me why you need the pipes." This form of the question takes for granted that the pipes are there for a reason (i.e. the reasoning is honored), only this reason needs to be given to the teacher. The child's construction is honored at the same time that it is questioned. But the honoring of the child's reasoning is not done to make the child feel good (even though it might). The honoring is done so that the child will take a non-defensive look at his reason, make the reason more explicit in the process of explaining it to the teacher, and thereby have the comfort of revising it or amending it in the presence of an interested adult.

The teacher tries to stay within the system of events that the child wants to understand. Thus, the way to help children ask good questions is to help children reflect on the facts until the child discovers something new to question. In this manner, the question that the child creates will emerge from his/her own construction of the system. The teacher is not literally teaching the child to ask the teacher better questions, but to ask better question of the set of facts. And, since these sets of facts are representations held by the child, the child is actually asking him/herself better questions.

The dialogue with the teacher may sound like the child is giving answers; but as the child relates the answers to each other, a new question will emerge from the child to him/herself. We can surmise that Matano now questions his facts - Where does the machine get its water? He said, "Now that's a good one!" Perhaps he realizes that he has a system that contains a bit of magic, i.e. something comes from nothing. He could have

easily accepted the magic by dismissing the teacher's last question with the conclusion: "The machines make the rain," thereby obviating the confrontation with magical thinking. Such an answer could indicate that Matano has gone about as far as he can go, at least for the day. But he will chew on this question and continue to wonder about the relevance of other facts, such as his knowledge that the cloud-like mist over his pond is gone by noon.

There are additional reasons why we want children to represent as much of the facts as they can - say through drawings, an extended description, or any other symbolic medium. It helps the teacher see more context of the child's theories. The teacher is aided greatly by the richness of an extended representation by the child him/herself. Let's take a look at another child's representation of the rain.



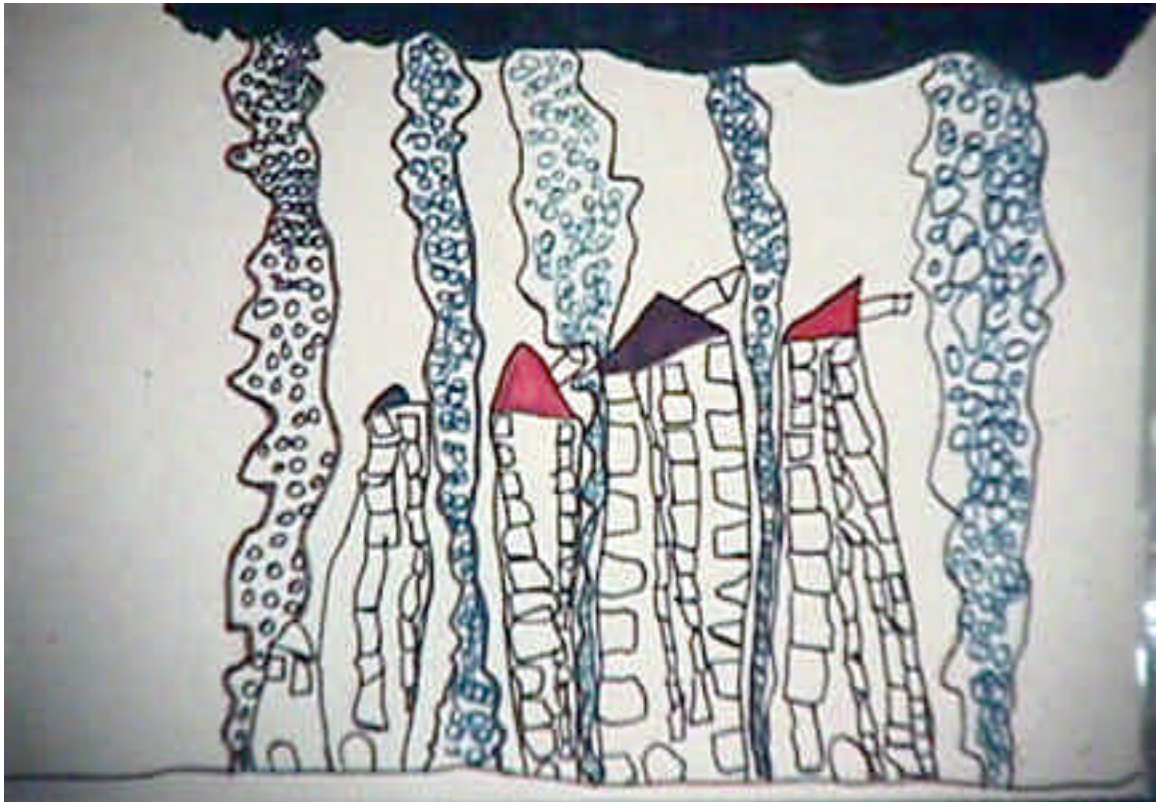
Here is what Simone (age five and a half years) says about the rain as represented in the above drawing. (The words were not printed by the child, but are placed there just to facilitate our discussion of the drawing).

"The rain falls on the houses, on the umbrellas and on the trees, then it goes on the earth, in the courtyards. Then things dry up when it's sunny. Instead of continuing to go around the houses, the rain dries up, it heats the rain that has fallen and that's how it goes away afterwards, it goes back in the clouds and then it starts to rain again."

Simone's verbal explanation sounds complete. Unlike Matano's linear pipes, Simone's eco-system is circular. The rain falls, it (the sun) heats the rain that has fallen, the rain goes back in the clouds, and then it starts to rain again. But since the teacher had asked her to draw this system, as well as describe it, we notice some interesting gaps in her

understanding. Notice that the return of the rain (right side of drawing) portrays the rain flowing up inside bounded channels. Might we have here another version of Matano's pipes based on an incomplete understanding that water can exist as vapor? In both children, the transport of water from place to place requires some sort of solid conduit. Is it possible that Simone's phrase "dries up" simply means "moves up?" Does "the rain goes up" mean rain as liquid instead of vapor?

Lets presume that the teacher on deck speculates that these marks have a reason, that they look like pipes. Why pipes? the teacher has trained herself to think. Well, in order to get liquid water to move upward, the water has to be inside pipes with pressure from below. Now how does the teacher open this discussion? Here the entry is a bit more delicate. Simone has not call these marks "pipes." We might want to hold off naming these marks "pipes" just yet. Here is a close-up of the right side of Simone's drawing.



Now lets listen to a conversation that might have happened.

Teacher: "Wow, this is quiet a drawing. I see the sun, the houses, the rain.
Could you help me understand this part over here. I notice here (teacher points),

these marks here. You have drawn two lines with these dots inside. Could you tell me about the marks."

Child: Oh, that's water going back into the cloud."

Teacher: So what is the water, these marks (points to dots) or these marks (the parallel lines).

Child: These (points to the dots)

Teacher: And these marks, what are they?

Child: You need those. That's how the water gets up.

Teacher: Hmm, the water goes up here. How does that work?

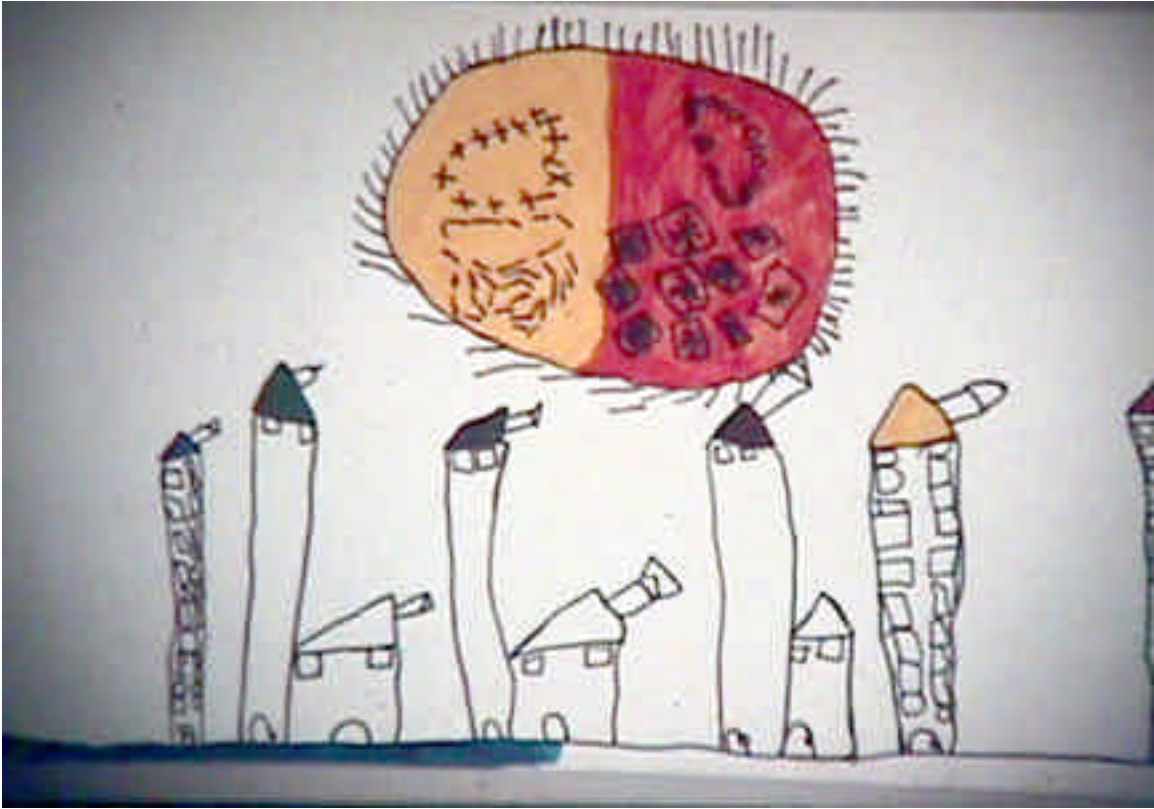
Child: Well, the water just goes up in these pipes.

Teacher: And without the pipes, the water would not go up.

Child: You got it!

There are several things interesting about this dialogue. For one, the teacher calls the elements "marks" and did not call them "pipes." Furthermore, the teacher encourage the child to think of the relation between form and function, i.e. "And without the pipes, the water would not go up?" This last comment also addresses the issue of necessary conditions for an effect to occur, which means that at some point you can question the logic of that assumption. But first, the teacher must help the child become explicitly aware of these conditions that the drawing presumes to be necessary.

The teacher has many things to revisit in this replete drawing. The teacher could say, "I see that you have drawn the rain between the buildings here (on the right) but all around the building here (on the left). Or: "I see that your sun is half bright and half dark. What's happening here?" (See blow up of the middle part of Simone's drawing below).

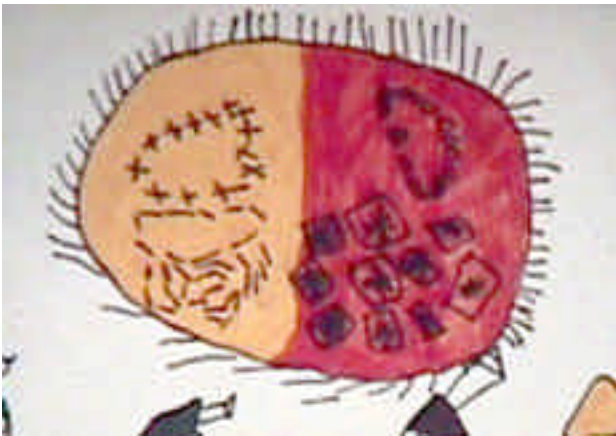


In this last question, the teacher wonders if Simone will comment on why evaporation is happening on the dark side of the sun. There is also the possibility that Simone has confused a whole earth symbol for night and day with a more suitable representation for sunny and shade in a given city. This is a subtle confusion between the shadow of the earth itself versus the shadow of clouds in the ground. We should not expect too much progress on this distinction at age five.

Nevertheless, the teacher can help Simone begin to consider the differences between night (the dark side of the earth) versus shade (the shadow cast on the ground by an object in front of the sun). Eventually, a more complete understanding of these distinctions will dawn (sic) on the child.

In each case, the teacher tries to understand the child's understanding and then gingerly asks the child to tell more about an aspect of the drawing. In order to be effective, the teacher needs to select a specific aspect of the drawing that has the potential to lead the child to discover gaps in his/her understanding. The teacher needs to have a theory about the child's theory. The conversation is less likely to build if the teacher fishes without a guess about a theory, such as "Why does the sun have those little lines all around it."

The child would say, "That's the fire." and that would be the end of the construction of new knowledge. Consider this alternative question, "I notice that the water is on the ground here (the dark shading under that houses on the left), but then here (to the right) there is no water. Why not?" The teacher has referred to a change, from water to no water. This difference was intentional. The teacher has an idea that the missing water on the ground means that the rain water pools on the ground immediately after falling, but with time and with the presence of the sun, it is not there. So here we have a process that can be discussed.



The little hair marks around the sun do not have this potential, at least not the way the teacher called attention to them. Of course, she could have said, "I notice that the marks on top of the sun are straight but the ones on the bottom are at an angle. Could you tell me about that?" While these elements have been made differently and the difference was no doubt intentional, the difference was probably not representational. That is, the difference had more to do with crowding the flame marks without hitting the marks for the houses. Or perhaps the child had difficulty holding the marker as she proceeded around the circle of the sun. Some element differences denote a theory about the referent (how it rains). Other element differences are due to constraints of the medium or the technical skills of the child. It is best to call attention to those elements that you feel are representative of how the referential system (the real sun, rain, and clouds) work. Many marks are shaped the way they are because of their relation to other marks and carry no particular indication of the child's theory about the system under study.

When a teacher has practiced this art of revisiting, the children will learn to reflect and to re-construct their understandings. They may struggle a bit, but the teacher supports this struggle by referring to their own documentation of their theories. At the same time, the teacher allows the children to experience the personal satisfaction that comes when they first discover the gap and subsequently when they reconstruct their understanding of the event (Footnote 1).

1. For a wonderful example of a 7-year-old child using drawing to reconstruct his theory of how a bicycle works, see the video titled Jed Draws His Bicycle, A Case of Drawing to Learn. Go to <http://www.learningmaterialswork.com> and click on the Reggio Emilia button and scroll all the way to the bottom of the page.