



The Role of Drawing in Kindergarteners' Science Observations

Jill E. Fox, Ph.D.

University of Texas at Arlington

ABSTRACT

Although some scientists believe that scientific observation skills are discipline-specific, public school science curricula for many American states require teachers to begin teaching children to observe scientific phenomena in kindergarten. This study examines the role that drawing played as 15 kindergarteners drew their observations of live animals in the classroom and then responded to an interviewer's questions about what they had observed. The findings indicate that drawing helps children to remain focused on what they are seeing and to respond factually to the interviewer's questions.

Introduction

Observation is a basic scientific skill. Scientists in all disciplines depend on observation throughout the inquiry process. In these endeavors "observation is a complex practice that requires the coordination of disciplinary knowledge, theory, and habits of attention" (Eberbach and Crowley, 2009, p. 60). Scientists who depend on skills of observation in research draw upon extensive knowledge in their fields, experience with the observed phenomenon, understanding of the environment, and their own adult attention spans to make sense of what they observe. The development of observation skills, however, begins long before scientists have reached levels of expertise in their fields. This paper will explore the role of drawing as young children participate in observation activities in the kindergarten science curriculum. Specifically, this paper will respond to the research question "What is the role of drawing in the science observations of kindergarten children?"

Literature Review

Within the field of science education, controversy exists around the teaching of observation skills. Elementary science curriculum too often limits observation to a simple task linked to basic sensory perception (Ford, 2005). Disciplinary specialists

state that meaningful observations can occur only within a disciplinary framework. "On the surface, observation appears to be a simple skill. Consequently, children may be directed to observe, compare, and describe phenomena without adequate disciplinary context or support, and so fail to gain deeper scientific understanding" (Eberbach & Crowley, 2009, p. 39). Ford (2005) recommends that students experience discipline-specific observation in which the theoretical constructs within a discipline provide a context for observation activities. Ford's research with third graders observing rock and mineral properties supported the use of disciplinary constructs as a framework, but little data on the development of observation skills in children younger than third grade is available.

Regardless of the approach to teaching observation skills recommended by disciplinary experts, science educators and advocates take a broader view. "Everyone should acquire the ability for...making careful observations and for handling observations" (American Association for the Advancement of Science, 1997, para 28). In America, the National Committee on Standards for Science Education (1996) identified observation as a key scientific skill that children should begin to develop during the early elementary grades (ages 6 through 9 years). The standards encourage teachers to provide for their students experiences in observing similarities and differences and in using the data collected through observation to answer specific questions. Children's "initial sketches and single-word descriptions lead to more detailed drawings, and richer verbal descriptions" (National Committee on Science Education Standards, 1996, para. 3) as they become experienced observers. Individual American states have also identified observation as a basic scientific skill to be introduced in the kindergarten science curriculum (California Department of Education, 1998; Connecticut State Department of Education, 2004; Texas Education Agency, 1998; Virginia Department of Education, 2009).

Teachers of young children recognize that most children begin school as experienced observers of their environments. Their informal observations go beyond merely looking at objects and events. According to Howes (2007), young children can act upon and transform the observational setting by recording what they observe; they take some control of their experience by changing the situation to explore further; they imitate and adapt what others have done in order to "see" or "feel" it for themselves (para. 27).

Careful observation of a phenomenon may be the stimulus needed to encourage a child's interest in a more detailed study. Thus, teachers of young children frequently use observation experiences to stimulate discussion of a new topic or to initiate a new unit of study. Recognizing the energy and interest that is often generated through observation activities, teachers help students develop incipient interests into something more in-depth, thoughtful, and on-going (Howes, 2007). Teachers of young children may also use observation experiences to support children's development of critical thinking skills. "Children who learn very early to note details within their context and to think about these in the structuring of something much greater are beginning to practice vital habits of mind" (Heath & Wolf, 2004, p. 10).

As Howes (2007) points out, however, scientific observations are meaningless for either young children or experienced scientists without "recording what one observes and/

or asking questions and following through on pertinent inquiries" (para. 35). For adults and older children, recording their observations is most often done in writing, often in a science journal. But for younger children, who have not yet developed their formal writing abilities enough to record their own thoughts and questions, writing in a journal may limit rather than enhance their observational experiences. Kepler (1998) states that drawing pictures in their science journals can also be a valuable way for children to express observations and abstract ideas.

Shephardson and Britsch (2001) suggest that children can connect their "experienced and imaginary worlds with the investigative world of the science experience" (p. 45) through either drawing or writing in science journals. The use of a drawing as a recording tool for science observations is common in classrooms for young children. Kaatz (2008) discusses the differences between scientific and artistic drawing and looking with her young students at examples of scientific and artistic illustrations. "Children seem to easily pick up on the term "scientific drawing" and are able to distinguish this kind of work from their more artistic pursuits" (p. 31).

As early as 1967, Merritt suggests that drawing from observation was much more meaningful to children than drawing from memory, but cautioned teachers that even the scientific drawings of young children are not likely to be exact replicas of what they have observed:

The small child, who is apparently expressing himself spontaneously, has definite felt knowledge of his environment, which he uses in his drawing. He expresses his knowledge in symbols, and it is the fact that he is comfortable with his symbols which enables him to draw freely. His symbols need not imitate reality (at least as seen by adults) to satisfy him, but they do need to conform to his own felt knowledge (p. 38).

Similarly, Shephardson and Britsch (2001), in their discussion of children's science journals, found that young children name and designate more than represent [in their drawings]. To put it simply, between the ages of four and seven years, children are much more likely to draw what they know how to make, rather than a detailed representation of what they are seeing (Beaty, 2002). When they draw their observations, children draw their own personal symbols of the objects they have seen, rather than objective reproductions.

If young children's drawings are not accurate representations of what they observe during science activities, teachers may legitimately question the rationale for encouraging children to record their observations through this medium. The purpose of the project described in this paper is to identify the role that drawing plays in the development of the observation skills in kindergarten children.

Method

Research Methods

An inductive research strategy was employed in this project with the goal of gaining intuitive understandings (Merriam, 1998) rather than testing existing theories of the role

of drawing in children's science observations. Data was collected through observation, interview and analysis of the children's drawings. Interview questions were developed collaboratively by the researcher and the classroom teacher. The questions were designed to reflect observation activities the children had previously experienced in their science curriculum. This study, with its small sample size and inductive approach, was designed to provide foundation and structure for a larger scale project around the topic of drawing and science observations.

Research Setting

The setting for this research was a public school kindergarten classroom. The school was located in a large suburban district in the southwestern United States. Approximately 97% of the children attending this school qualify for free and/or reduced lunch. There were 15 children enrolled in the class, eight boys and seven girls. All of the children were attending kindergarten for the first time and had turned five years of age on or before October 1 of the current school year. Their ethnicities were as follows: eight children identified as African-American; five children identified as Latino; one child identified as Asian-American and one child as Anglo. For the purpose of this research, the children were ability grouped according to their current placements in instructional reading groups. These placements were based on the children's scores on the school district's reading assessment that had been administered to each child three times during the school year, most recently approximately five weeks before the children were interviewed for this project. The teacher loosely identified the reading groups as low, medium low, medium, and high reading abilities.

Although the research was conducted during the last two weeks of the kindergarten year, the children as a class had participated in science observations and drawings throughout the year. The teacher described the class's early observation experiences as they might have occurred during the first weeks of school:

"I model it [observation] first. I look at something and try to think of everything I can to describe it. And I show another object—something similar but different in some way—to the children and ask them to begin describing it" (personal communication, September 2, 2009).

Drawing was integrated into science observations during science units on apples and pumpkins in October.

"As a group, we would try to predict what the inside of an apple, and later a pumpkin, would look like. We'd make a list of descriptors. Then we would cut the apple or pumpkin open and I asked the children to draw what they saw. When they finished their drawings, we'd come back together to talk about their drawings and see if the descriptors and predictions went with what they had drawn" (personal communication, September 2, 2009).

Observation and drawing continued to be a part of the science curriculum as the year progressed.

"In January, we made daily observations of the weather. And in the spring, we

planted seeds and recorded daily observations by drawing in our Plant Journals” (personal communication, September 2, 2009).

Although the children had previously observed plants and weather phenomena during class activities, they had an animal prior to this study. For this study, each child participated in two observations of live animals. The children were randomly divided into a drawing and a non-drawing group; children from each ability group were evenly distributed across the drawing and non-drawing groups. Interviews were conducted by the researcher, an early childhood professor and a former kindergarten teacher, who had been volunteering in the classroom daily for the two weeks prior to the interviews. For their first observation, individual children were asked to join the researcher at a table and to be a scientist, making “a careful observation” of a fire-bellied toad in a terrarium. When each child indicated that he/she had finished observing, each child in the non-drawing group was asked a series of questions (Appendix A) about what he/she had seen. Each child in the drawing group was given a sheet of paper and a set of markers and asked to draw what he/she had seen. When the child had completed his/her drawing, the same series of questions was asked by the researcher. For both groups of children, the toad and the terrarium remained in full view on the table so that the children could look again as needed. During the following week, the same process was repeated with a reversal of the drawing and non-drawing groups and a different animal for the children to observe: a beta fish in an aquarium.

An audio recording was made of each child’s responses to the series of interview questions. The recordings were transcribed each day after the interviews were concluded. The researcher reviewed the transcripts daily and began to identify patterns and categories in the children’s responses. The transcripts were also reviewed by the classroom teacher and a second early childhood professor to confirm the patterns and categories identified by the researcher. Data was triangulated by asking the classroom teacher and an early childhood professor to also review the transcripts.

Results

The primary question this study attempted to answer was “What is the role of drawing in the science observations of kindergarten children?” An analysis of the data collected through the transcribed interviews with the children yielded a point of significant interest to this question. When the children drew what they were observing before answering interview questions about their observation, they stayed on-topic in their verbal responses, answering the interviewer’s questions succinctly and accurately. When the children did not draw what they were observing prior to their interviews, two-thirds of them provided at least one response during the interview that was based in a hypothetical or imaginary situation.

When children drew.

Without exception, when the children were interviewed after drawing either the toad or the fish, they responded by providing factual accounts of what they had seen during their observations. Although answers may have reflected an individual child’s limited vocabulary or knowledge about the subject of the observation, the responses

supported a factual accounting of what the child was seeing. For example, Sabrina spoke of seeing “something on that big bump. It’s another snail.” Her pointing and gestures indicated that she was describing an isopod on top of a rock in the toad’s terrarium. Similarly, Gregory described a moving “tree up on the bowl” during his interview. Gregory’s shift in position to change his perspective of the aquarium led the interviewer to understand that Gregory was describing a plant whose image was distorted by the convex sides of the fish bowl.

A review of the children’s drawings of their observations supports the suppositions of Merritt (1967) and Shephardson and Britsch (2001) regarding children’s tendencies to draw the personal symbols of what they see, rather than the objects themselves. While the children’s choice of colors was always accurate, their drawings did not reflect the positions of the animals drawn or the size and placement relationships of the various objects in the animals’ habitats. In this study, drawing their observation supported children in making an accurate verbal, rather than graphic, record of what they saw.

When children were not drawing.

Two-thirds of these same children, however, veered away from their accurate verbal responses to interview questions when they did not draw what they saw in their observations. In the fifteen interviews in which children observed the toad and then the fish without drawing, ten children included at least one response based on a hypothetical “what if...?” or an imaginary characteristic of the animals. Four children had as many as eight of these comments during their interviews.

A review of the transcripts found a total of 38 hypothetical or imagination-based remarks in interviews with children who had not drawn their observations. The subjects of these off-topic remarks varied. Seventeen of the remarks were questions asked of the interviewer about potential activities of the animals. For example, Maggie asked, “What if it [the toad] jumped so high it went over the cage and over the wall and outside?” Nine of the children’s off-topic comments played with the idea of animism, the assignment of human attributes to animals or inanimate objects (Atwood & Donnelly, 2002). Osvaldo told the interviewer that the fish “looks like he’s sad,” while Sabrina insisted that she could “see the fish smile.” Six children included additional information about the animals in their interviews. Estancia described an isopod in the toad’s terrarium as a snail, saying, “a snail always moves by its neck. And they hide in their cave and they don’t let anything happen.” Three children also included animal noises in their interviews—either “bloop, bloop” for the fish or “ribbit, ribbit” for the toad.

Discussion

Divergent thinking and creativity are typically encouraged in the kindergarten classroom. Scientific observation, however, is dependent on literal thinking and logical reasoning. Accurate observations are those that carefully distinguish what was actually observed from ideas and speculations about what was observed (American Association for the Advancement of Science, 1997). Alden (2009) adds that “a related skill is economy: learning what to rule out when observing” (para 10). In this study, the act of drawing objects that were seen in the observation appears to have supported

the children's focus on what was actually there while restricting speculation or interpretation about the animals and their habitats. The children economized during their interviews in ways that the majority of the children could not when they did not draw. They left out hypothetical questions and imaginary interjections and focused their attention on what was there.

Drawing as an activity in the kindergarten curriculum is most often associated with creativity. Kindergarten teachers encourage children to use their imaginations when they draw and to include their thoughts and impressions in their artwork. Drawing is, after all, a means of communicating (Edwards, Gandini, and Forman, 1998). Just as children learn to write for different purposes, they can also learn to draw to communicate the literal as well as the imaginary.

Conclusion

Although additional study is needed to determine exactly why drawing helps to keep children focused during their observations, this paper suggests that drawing does play an important role in helping children to focus on their subjects during scientific observations. While professional scientists in all fields draw upon disciplinary knowledge and understanding of the environment to learn from their observations, observation, like any other working skill, must be learned and practiced (Alden, 2009). Focused observations in which children use drawing to record what they see provide the foundation upon the skills and abilities needed for scientific inquiry are built.

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APPENDIX A

Interview Questions

Child's Name:

Date of Interview:

DRA Group:

Drawing or No Drawing

Tell me what you see.

Where is it in the terrarium? [fish bowl?]

What is it doing?

What color is it?

How big it is?

What shape is it?

Is there anything else you'd like to tell me about what you are seeing?