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# Beyond Access: Girls And School Science

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## **Beyond Access: Girls and School Science**

*Rachel: I'm not a scientist yet because you study things like animals and you go out in rain or snow. (She pauses) But Jerry, he's a scientist.*

### **Introduction**

In the United States, a gender gap both in achievement and retention in science continues to plague science educators. Over the last decade, a variety of strategies to close this gap have been proposed—encouraging girls to take more science classes, providing scholarship programs, mentoring promising students, and designing special programs for girls. These strategies have defined the problem as increasing girls' interest and survival in science classes and careers. Although the achievement gap between boys and girls has narrowed, simply improving access girls' access to science has not solved the problem totally (Shaw, 1995; Walkerdine, 1998).

By focusing specifically on girls these initiatives perpetuate the myth that girls are less capable of doing “real” science and require special programs designed for them. For example, the science education research literature has determined that girls do not use tools exactly the same way that boys do and concludes that to be successful in science girls should have more opportunities to tinker with tools like boys. I suggest that it would be more fruitful to look at the multiple ways that boys and girls do science. Focusing on the differences between girls and boys does not take into consideration that children engage in science in multiple and context dependent ways. Researchers must develop a deeper understanding of why girls are resistant to science by seeing it as a cultural phenomenon and creating a climate in the classroom where gender relations can be equalized for girls and boys.

In my research, I ask a different question: how do girls and boys interact with each other around science? I analyze their discourse—words and actions—in the school context. Their social discourse provides clues to cultural meaning in the stories the children tell, the metaphors they use and the objects they employ in “doing science.” Seven- & eight-year old children’s study of live hermit crabs and snails provided an opportunity to analyze discourse for cultural meaning. Emilie and Lizzie talked about how they needed to keep the animals “wet.” They took a plastic container, filled it with salt water from the aquarium and placed two animals in the container, telling me that they were “making a little ocean so the animals will feel comfortable.” The girls not only used words to express a concept of “care” for animals but they physically acted out “caring” by creating a place the animals would “feel comfortable.”

Emilie and Lizzie showed me by their words and actions what they mean by “caring.” In one sense they were *performing* gender by their conversations and behavior. Their actions were also *performative* of larger Western cultural ideas of how one cares for animals. Analyzing social discourse in this way shifts the responsibility for social change from a focus on the individual’s behavior to the social and cultural institutional structures that create, replicate, or constrain individual behavior.

I spent one school year interviewing, observing, and conducting my own science research sessions with eighteen 7 and 8 year olds (eleven girls and seven boys) as they engaged in “hands-on science” in a suburban classroom north of Boston. In this classroom the children “did science” by sorting and classifying objects, measuring with available tools, identifying and accurately naming animal behavior; and experimenting with water, sand, and small animals. The pedagogy in this science classroom represents the best practices for teaching. Science educators believe that science knowledge does not

come from the objects themselves but from the ideas generated by the student's manipulation of objects. This way of teaching science encourages interaction and conversation between the teacher and the students and among the boys and the girls. Researchers of gender equity believe this pedagogy allows the classroom teacher to hear the boys' and the girls' emerging science ideas. In my observations I heard the student's ideas, which often included gendered responses to the science activity that were not usually expressed in front of the teacher.

For example, one day I observed Jessica and Howard looking at two tadpoles to decide if they were the same or not. I noticed how the teacher directed the children to see subtle difference. The children responded to her in kind, using a language of difference to describe the tadpoles. However, when the teacher left the two children alone, Jessica added an interpretation of the tadpole behavior as "hugging," which is a human activity. The children seemed to be aware of language appropriate for science, or at least language the classroom teacher preferred.

Teacher: I don't know if they are the same or different. You guys are the scientists here. Because we don't get the time to notice them closely so I'm curious to know what you think.  
Jessica: That one is like light and that one is dark.  
Teacher: So, even those two might be different?

*The teacher leaves the children to continue their observations.*

Jessica: Howard, they're hugging.  
Howard: I think one's a female and one's a male.

Howard also saw the tadpoles in human terms after Jessica brought it up. Jessica's use of the domestic discourse enabled Howard to see the tadpoles in a deeper way.

### **Discourse as Resistance**

My observation of the boys and the girls working together is that some girls actively negotiated for more powerful positions. When a boy tried to dominate a science activity, I

saw girls resist the requests to do things the boys' way. The girls' resistance took on a number of forms. Some chose not to engage with boys at all, especially if there was another girl in the group. For example, Kendra and Jessica were assigned to study hermit crabs and snails with Brian and Sheen. The girls brought their hermit crabs and snails to the rug to act out a school scene and left the boys at the table to race their snails. The boys eventually moved to the rug to watch the girls. The boys didn't participate with the girls, they just sat and watched and finally returned to the table to continue racing snails.

Other girls initially followed the boys' lead but changed the science activity by shifting the discourse with references to domesticity and by appropriating teacher authority. For example—Jerry often tried to dominate the science activity by asking the girls to assist him, but the girls actively resisted his directions. One day Jerry tried to enlist Jessica's aid to sort a collection of natural objects by size. At first Jessica resisted by saying she was busy but she gave in and assisted Jerry with lining up the objects.

Jerry: Jessica, help me line them up smallest to biggest.

Jessica: I'm looking at stuff.

Jerry: When they're lined up you be able to find what you need better.  
*Jessica agrees and helps him lay out the objects from big to small.*

*Here Jessica uses a teacher authority discourse.*

Jessica: Stop making them perfect.

Jessica: Don't touch. If you touch you'll be in big trouble. I'll tell the principal and you'll have to stay after school for the whole night.

In saying she will tell the principal, Jessica used teacher authority as a way to resist Jerry's desire to make the objects line up perfectly. When that did not work Jessica picked up an antler and used a domestic scene to change the focus. In doing so, she managed to silence Jerry.

*Jessica picks up the antler.*

Jessica: The antler needs a wife.

What is important to notice in this interaction is the gender dynamics between the Jessica and Jerry and how discourses drawn from home and school function. At first she resisted Jerry's directions to her telling him she's busy looking at other things. Only a domestic scene effectively silenced Jerry. Although Jessica used these discourses to reject Jerry's positioning of her as his assistant and his organizing structure, this does not mean that Jessica could not or would not choose to do science by sorting objects by their size in another context. We don't know that. What it does mean is that in this particular context and in this particular social interaction with Jerry, she rejected his way of doing science in order to reject his assumption of superior status. I found this pattern repeated in my observations.

It is likely that the domestic discourse succeeded in shifting the power balance between the children because domestic life in Western culture is still viewed as a site of power for women. Women remain the primary caretakers responsible for organizing the house and nurturing of the children, although that is changing as men and women begin to share those responsibilities. Throughout my observations, I never heard or saw boys use a domestic discourse in their unstructured play or in their science activities. It belonged exclusively to girls. Unfortunately sometimes classroom teachers have misinterpreted these domestic discourses as a girls' way of doing science. However, I suggest girls might be using this discourse in a context where they feel powerful.

### **Beyond Access in Tool Use**

Science researchers have focused on the use of tools by girls, arguing because young boys have more opportunity to tinker with tools, they are better equipped to use scientific tools such as thermometers, hand lenses, and microscopes.

In this a science activity involving Marissa and Brian, Marissa, positions herself as less competent than Brian in using a microscope despite her growing confidence and competence with the science tool. Brian for his part positions Marissa as less than competent by wanting to focus it for her and blames her for moving the focus button. When she resists his help, he complains to me, (acting in a role of a teacher) about how he will never get a turn if Marissa learns how to use the microscope.

*Marissa is trying to focus the microscope because she is having trouble seeing her object under the scope.*

*Marissa directing Brian who is helping her:* No, down.

Brian to me: Marissa will never let me have the microscope again.

C: Of course she will. Take turns. She's just trying to get it into focus.

Brian: I was trying to get it into focus and she was like- 'No!'

C: She wanted to do it herself?

Brian: I was teaching her how to do it.

C: Oh. I guess she didn't want to be taught how to do it, Brian.

*Marissa is still having trouble:* I can't see it.

Brian: Marissa, I'll do it.

*Brian goes over to the microscope and focuses it.*

Brian: I think Marissa hit the button by accident. I was trying to get that one in focus.

C: So, now you got it to work, Brian?

Brian: Oh yeah, in a big way.

Brian: I made it so good. I told you I was good at it.

Brian: I told them I'm the best person to make it focus.

*Marissa then goes over to the microscope that Brian has now focused for her.*

Marissa: Really cool, really good focus, maybe I'm not the worst focuser.

C: You thought you were the worst focuser?

Marissa: Brian said he was the best; maybe he's not the best in the class. I'm second best, I think.

Marissa initially resisted Brian's help and expressed her desire to learn how to focus the microscope herself. However, even though she learned to focus the microscope, she still deferred to Brian as the best focuser in the class. Yet in another context, Marissa exerted leadership and confidence when she and Matthew read a thermometer. This reminds us how important it is to see children doing science in multiple contexts.

As Marissa and Matthew looked through a tub of pond water for animals, Matthew placed a number of thermometers in the tub. Marissa asked Matthew to remove them because she thought they would hurt the animals.

*Marissa to Matthew:* Matthew, you're going to kill the animals.  
*She takes out all the thermometers and bug boxes that Matthew had placed in the tub.* So we don't kill any organisms.

In this next exchange Matthew is reading one of the thermometers.

*Matthew reads the thermometer:* Sixty degrees.  
*Marissa:* Degrees what? I'm going to be nudgy like Ms. A. (the teacher)

Context makes the difference thus there is no need to provide girls with their own form of science activities i.e. kitchen science such as some have suggested.

Tool use itself sometimes presented a moral and ethical dilemma for some girls. For example, Jessica explained to me that she wasn't very good with tools, not because some of the boys were better but she was afraid she might hurt the tadpole she tried to pick up with tweezers. It wasn't that Jessica doesn't know how to use tools as the science community might suggest; one feminist reading would suggest this illustrates girls have a different orientation to science, a moral and ethical orientation. I suggest instead that the girls' gendered orientations towards science emerge and develop in multiple ways depending upon the context.

## Gender Equity and School Science

Solving the gender equity problem in science education is much more complex than just providing access for girls. The science classroom is a particular social context with interactions between boys and girls, students and teacher, and in the case of science, with materials and objects. The girls take up different subject positions in these social interactions. Their discourses are contextual, often gendered, and grounded in Western, white, middle class, cultural metaphors such as *care*, *domesticity* and *teacher-authority*. These discourses also present a dilemma for the girls. Response to different contexts is mediated by their cultural images of femininity. As girls negotiate both their individual conceptions of femininity along with other people's (the classroom teacher, their parents, their peers), they develop a coherent gender identity. The girls struggle with wanting to be competent in science while boys often position them as weak and incompetent.

Studies in science education in the last two decades have often examined gender differences as if there were a girls' way of doing science (i.e. cooperative and caring) and a boy's way of doing science (i.e. competitive and fact-based). My research demonstrates that constructing knowledge in science as a set of dualisms, *subjective or objective*, *masculine or feminine*, *girls' way or boys' way* has outlived its usefulness. It is more fruitful to analyze the multiple, continuous set of orientations that both boys and girls use in "doing science," recognizing that these orientations shift with context and are gendered and culture-bound. Thinking of science knowledge in this way, as "situated" or as a "view from somewhere," (as theorist Donna Haraway describes it) acknowledges that children bring individual experiences to their science learning which are shaped by context and culture [race, class, and gender]—that are part of one's identity. A more rigorous look at children's own understanding of what science is and how they negotiate

their gender identities as part of doing science, provides better understanding of the definition of science, which some have argued is too narrow.

National standards and testing have left little room for creativity and expansion of the science curriculum. Even within these constraints, it is possible for classroom teachers to plan instruction and to create a classroom climate where they can encourage interactions between boys and girls in science and pay attention to the discourse. Using a variety of strategies such as cooperative groups and individual projects, writing assignments, and media presentations help give children multiple ways to tell the teacher what they know and how they know it. Teachers would benefit from reflecting on their own relationship with science exploring their feelings and biases. They have the opportunity to help girls and boys challenge, re-negotiate, and transform science knowledge.

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