Should Rey Mysterio Drink Gatorade?

Cultural Competence in Afterschool STEM Programming

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The afterschool hours offer children unscripted and flexible time to explore their spaces and interests so they can learn in and from their surroundings. They engage with the world, exploring natural environments and connecting with others through social relationships. For example, during informal fútbol games with friends, children learn how to position their bodies to block opponents and take shots on goal. At home, they view cartoons on television and delight in characters that float by escaping from gravity. With their families, they prepare the garden in spring by collecting earthworms and expelling slugs. While interacting with the world, they build relationships with family, friends, and community members to co-construct understanding and share knowledge.

Although teaching Western science gives children access to science professions, this education should take place in socioculturally relevant ways using the contexts of children's lives. According to the U.S. Department of Education, students of color comprised 42 percent of public school students in 2007; they are projected to reach majority status in the next few decades (National Center for Education Statistics,

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2007). Latino/as, the fastest-growing and youngest demographic group, will constitute nearly 30 percent of the entire U.S. population by 2040 (U.S. Census Bureau, 2008). However, the teaching force in the U.S. is predominantly white and middle class (Castro, 2010). Researchers have found that school educators are not fully prepared to meet the learning needs of culturally and linguistically diverse students (King, Shumow, & Lietz, 2001; Lee, Hart, Cuevas, & Enders, 2004).

Connections to children's lives and resources in children's communities can be used to foster science, technology, engineering, and math (STEM) learning when educators pause to notice children's ideas and questions. Families Involved in Education: Sociocultural Teaching and STEM (FIESTAS) creates space in which educators can look for and use these connections. FIESTAS is a model of collaboration between a teacher education unit and a STEM afterschool program. FIESTAS educators develop sociocultural competency that encourages them to position young people as experts and to ask questions to explore children's thinking. The afterschool program provides the opportunity to deepen how preservice teachers and afterschool staff explore children's funds of knowledge, notice children's thinking, and weave standards-based STEM content into rich learning environments for elementary-age youth.

Funds of Knowledge and Culturally Competent Approaches to STEM

Barton (2000) claims that "it is not enough to teach students rules for participation in science if those rules do not connect to the students' out-of-school lives" (p. 799). Sociocultural approaches to science intentionally notice children's ways of being and knowing (Rosaen, Lundeberg, Cooper, Fritzen, & Terpstra, 2008), such as telling stories, exploring their environment, or practicing *fútbol* moves—even when these actions are not obviously connected to science. Sociocultural approaches purposefully ask guided yet open-ended questions to nudge children to use their knowledge of the world to think deeply about scientific concepts and processes (Rosaen et al., 2010).

Sociocultural approaches also recommend that educators interrogate the ways in which societal inequalities are implicated in science education (Barton, 2000). Practitioners should question how traditional science education stifles children's voices, reproduces prejudice and inequity, and disempowers children and families. They can then actively reflect on ways to broaden children's opportunities and harness cultural resources to empower youth in science. Focusing on sociocultural processes, studies of effective afterschool programs demonstrate how children actively build relationships with adults and peers; co-construct knowledge in their experiences and networks of people; and live and play in culturally specific contexts (Honig & McDonald, 2005).

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When educators leverage sociocultural contexts, they become more culturally competent and responsive to children and families. According to Ladson-Billings (1995), culturally competent educators create learning environments that affirm students' identities and backgrounds, thereby providing "a way for students to maintain their cultural integrity while succeeding academically" (p. 476). Using *funds of knowledge* is one way to draw on communities' sociocultural assets as resources for teaching and learning. Moll, Amanti, Neff, and Gonzalez (1992) describe funds of knowledge as "historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being" (p. 133). Funds of knowledge in mathematics and science, for example, come from activities including farming, carpentry, automobile maintenance, and household budgeting. According to Moll and colleagues (1992), children are part of "flexible, adaptive, and active" networks in which they interact with people across multiple contexts to become known as whole persons.

Through careful listening and observation, educators can develop an understanding of children's knowledge and skills. They can then harness that understanding to connect deeply to children's worlds and to see families as valuable intellectual resources. Noticing and questioning strategies enable them to discover science- and math-related cultural practices and position children as experts in a co-learning process. This culturally competent approach enhances collaboration and participation on the part of children from many cultures.

Out-of-school time (OST) programs provide flexible and open-ended opportunities to notice children's observations and thinking, ask provocative questions about science, and focus on disciplinary practices in science while engaging youth (MacEwan, 2013). Bevan and Michalchik (2013) posit that OST programs give children opportunities to capitalize on their interests to learn STEM concepts and other enriching topics.

To build cultural competence and critical thinking, Van Sluys, Lewison, and Flint (2006) propose a four-part framework for use with educators. A key component is the idea of *disrupting the commonplace*. This disruption requires educators to critique the world and to interrogate everyday ways of seeing it. Practitioners develop ways of speaking and thinking that disrupt what is considered to be "normal," "dominant," or "common." The FIESTAS model takes up this concept to disrupt traditional definitions of teaching and learning.

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Implementing the FIESTAS Project

FIESTAS is a collaboration between Oregon State University's College of Education and 4-H Youth Development. The 4-H STEM program focuses on enhancing STEM knowledge, interest, and commitment in Latino/a and other youth in grades 3–5. This age range was chosen in an attempt to reach youth, especially those underrepresented in STEM fields, early in their schooling. Dropout rates for Latino/a children are the largest among underrepresented populations, especially in STEM careers (Litow, 2008). In keeping with these goals, the FIESTAS project has two primary purposes: to expose Latino/a youth to STEM-related programs and to engage preservice teachers in culturally and linguistically diverse settings.

Who Participated

Through courses in science methods, math methods, and multicultural and ESOL/bilingual education, faculty at the College of Education engage undergraduate and graduate preservice teachers in practicing STEM with Latino/a youth and families in local schools. The elementary preservice teachers are mostly from small towns in the Pacific Northwest; about 90 percent are white and middle class, and most are female.

The afterschool 4-H STEM program began in 2010 at two local elementary schools. Each school has approximately 400 children, high percentages of whom live in poverty, as indicated by provision of free and reduced-price lunch. Both serve culturally and linguistically diverse students, including speakers of English, Spanish, Arabic, and other languages; both offer schoolwide Spanish dual immersion programs. The afterschool STEM program is part of a 21st Century Community Learning Center program administered by the local Boys & Girls Club. The STEM club meets twice a week for 45 minutes, enrolling approximately 15 third through fifth graders at one site and 20 at the other. Most students are Latino/a or other underrepresented youth.

In 2011, the College of Education launched the FIESTAS project and partnered with 4-H to bring preservice teachers into the program. For the last three years, preservice teachers have worked with students in the 4-H STEM program in both schools during fall, winter, and spring terms, six to eight times per term. Each year, 56 preservice teachers worked with teams of youth to engage them with science and math concepts in classrooms, school playgrounds, neighborhood gardens, an aquatic center, a grocery store, and a movie theater. Activities included a variety of math, physics, nutrition, and technology projects. For example, during one school year, 4-H STEM program participants completed experiments and other experiential learning activities on forms of energy and energy use.

How Staff Were Prepared

MacEwan (2013) states that professional development for faculty and staff is essential for effective afterschool STEM programming, as many OST staff do not feel prepared to lead STEM activities. He suggests that professional development should engage afterschool staff in discussing curriculum and collaborating on pedagogy. This process allows faculty and staff to work through broad conceptual underpinnings and talk about successful engagement with STEM disciplines (MacEwan, 2013).

In keeping with that suggestion, 4-H afterschool staff became part of FIESTAS. They engaged in weekly meetings, conference presentations, curriculum design, and publications, all connected to the three-part framework outlined below. Weekly professional development meetings included professors, graduate students, and 4-H faculty and staff; quarterly meetings also included staff of the Boys & Girls Club. During these meetings, the team discussed program administration, budgets, short- and long-range planning, grant writing, data analysis, and theories. 4-H and education faculty have been redesigning the College of Education's science and math methods courses based on the three-part framework.

A Three-Part Framework for Cultural Competence

The FIESTAS three-part framework connects afterschool STEM programming to the school curriculum and standards while tapping the funds of knowledge children bring to science learning. OST staff and preservice teachers facilitate learning in three intentional ways:

- Intentional noticing of what children are saying and doing
- Intentional questioning practices
- Intentional connection to STEM standards

The flexible and informal environment of the afterschool program enabled FIESTAS preservice teachers to focus on child-centered interactions and the engaging nature of science. Rather than emphasizing the authority of the standards, they learned how to use standards in authentic and stimulating ways.

Rosaen and colleagues (2008) describe methods for *noticing* children's thinking and interactions with natural phenomena. Noticing shifts adults' focus from their own behavior and classroom management to children's words and actions. In FIESTAS, *noticing* involved focus on the nuances of discussion-based teaching, using notes and technological tools such as digital video or photography. Preservice teachers recorded their own interactions with children, and the children used digital video and photography to document their thinking about STEM topics. Reflecting on these two sets of digital recordings enabled preservice teachers to note *what* children were thinking in regard to content and *how* they were thinking about it. Educators could also see whether and how they were attending to children's own thoughts on science concepts and approximations of science processes.

As they notice, educators use *questioning* strategies to facilitate discussion about important science concepts (Rosaen et al., 2010). Questions also give children a model of how to pay attention to their own noticing, so that they can develop questioning as a practice of their own. In FIESTAS, questioning strategies included asking about content in open-ended ways that required the children, rather than the adult, to do the thinking. Preservice teachers and staff used questioning strategies (Elsteeg, 1985) to get at children's thinking about specific science ideas or concepts. Questioning strategies develop scientific thinking by shifting the focus from the adult's preconceived notions of how the activity should go to the children's connections and ideas.

Afterschool programs can *connect to standards* without becoming simply extensions of the school. For years, state and national standards have focused on an inquiry approach to science—an approach that many afterschool programs have long emphasized. Now *A Framework for K–12 Science* (National Research Council, 2011) and the Next Generation Science Standards (NGSS, National Research Council, 2014) continue this effort by linking knowledge development and scientific and engineering practices with children's interests and experiences. The focus on practices purposefully shifts the focus from what adults say to what children do. Educators can target NGSS by planning problem-based inquiry lessons based on children's thinking about science. While children bring their funds of knowledge from their families and communities, learning remains grounded in practices, vocabulary, skills, and concepts that are essential in school and disciplinary science. The flexible and informal environment of the afterschool program enabled FIESTAS preservice teachers to focus on child-centered interactions and the engaging nature of science. Rather than emphasizing the authority of the standards, they learned how to use standards in authentic and stimulating ways.

Rey Mysterio, Gatorade, and Culturally Competent STEM Learning

An incident that took place in winter 2013 demonstrates the use of the three-part framework to bring together children's funds of knowledge and STEM learning. This case demonstrates how *noticing* and *questioning* can turn a potentially chaotic scene into one focused on valuable science ideas.

Intentional Noticing and Questioning

On this winter day, fourth graders went outside with digital cameras in hand to explore science in their neighborhood. "Bernardo" and "Julian" (all names are pseudonyms) decided that climbing on the playground equipment was their science lesson of the day. They brought a lot of unguided energy and movement to their activity. Demonstrating the action of a professional wrestler, Bernardo jumped off the slide. Julian, who stood alongside the slide, said that some wrestlers are smart because they "fake wrestle" and put on purple makeup to resemble bruises. It seemed impossible just then to teach the boys about science; they were engrossed in re-enacting moves of the popular wrestler Rey Mysterio.

However, Lea, the 4-H afterschool educator, was *noticing* what the boys were thinking about. Rather than adhering to preconceived notions of science and fixating on discipline, she noticed that the boys were thinking about physical activity and how to control body motions to avoid injury and subdue an opponent. With preservice teacher Sid looking on, she then used *questioning* to position the boys as competent experts. Her moves focused their attention and turned wrestling into a resource for learning science.

> Lea: Can I ask you something? Can you come a little bit [closer]? Imagine that I'm a wrestler. Bernardo, come. I need your expertise on this topic because I truly don't know. So if you're a wrestler and I'm a wrestler, and I am like this, my feet are like this, and yours too, and I push you, could I throw you?

Instead of climbing the slide, Julian stood attentively before Lea and Sid, looked them in the eyes, and confidently answered "yes," explaining how he would position his body to avoid getting toppled. He explained wrestlers need to take a wide stance for balance and to bend their knees to keep their weight close to the ground. He had informal everyday knowledge that could meaningfully be connected to science. By referring to his expertise and saying "I truly don't know," Lea positioned herself as learner and Julian as a holder of valuable knowledge. Rather than trying to redirect the boys, she showed that she cared about what they cared about and allowed Julian to show what he knew.

It would have been easy to dismiss the boys' captivation with wrestling as off-task and to classify their behavior as an infraction. A single-minded focus on a pre-scripted lesson would have blinded the educator to what these boys knew. In his journal reflection, Sid, the preservice teacher, wrote:

> In my experience with the boys at [school name], I would not have discovered their fascination with Rey Mysterio had I shown up with certain curriculum I wanted to teach them about science. It is entirely too easy to have an agenda and be so focused on it ... that you fail to listen to what your students are telling you. Had it not been for the lack of focus Bernardo and Julian had that day, we would not have been willing to try anything, and we would have failed to listen to their ranting and raving about Rey Mysterio. Had we missed it, we would have missed an opportunity to teach.

By noticing, listening, and asking appropriate questions, Lea and Sid tapped the sociocultural resources their students brought to science learning. The questions were an appropriate way to stimulate STEM learning because they were open-ended, interrogated the boys' science understanding, and positioned them as experts. Using information garnered from intentional noticing, the educators could then craft science activities that would interest Bernardo and Julian (and others) and transform their knowledge into a STEM learning opportunity.

PROMPTS THAT POSITION CHILDREN AS COMPETENT

- I need your expertise on….
- I truly don't know about…. Can I ask you?
- What do you think? Why do you think that?
- How would you do it?
- What does that do? Why is it better?
- What would happen if…?
- `What do you know about this topic?
- Have you ever seen something like that in your life? Where?

Connecting Cultural Competence and Science Standards

The idea of connecting wrestling and science standards was new to everyone. In fact, Lea and Sid had never heard of Rey Mysterio. So their next step positioned them as lifelong learners: They used the Internet to learn about this area of popular culture. At www.reymysterio.com, they learned that Rey, a wrestling superstar, had been around for 20 years. His uncle Rey Misterio was famous on the Mexican wrestling scene; the younger Rey made his wrestling appearance at 14 under his uncle's guidance. Rey Mysterio thus connected the boys not only to peer and popular culture but also to their national and ethnic identity, as the boys' families were from Mexico.

The concept of body functions in sports resonated for Lea and Sid. They realized that the children's preference for the sports drink Gatorade provided the basis for an engaging project in chemistry and nutrition. The focus on Gatorade tied in to Julian's intuitive understanding of body processes during physical activity. It also engaged more children, including two girls who chose to join this group.

Sid planned an investigation into the differences in ingredients between sports drinks and water. Questions included: What happens when you do exercise such as wrestling? Why would a drink like Gatorade help when doing physical activity? He posed an inquiry problem in a video he made for the children.

> *[Video begins with Rey Mysterio photos and music. Sid uses an animated voice and facial features and then gets a serious look when questioned.]*
>
> **Sid:** So where does Rey Mysterio go when he needs some liquid? Gatorade. Why? Because Gatorade is the best. Whenever you're drinking something, you need to be drinking Gatorade because it rejuvenates everything you need.
>
> **Assistant:** What's so great about Gatorade?
>
> **Sid:** Well, uh, it's Gatorade. It's got everything you need.
>
> **Assistant:** So what's good about it?
>
> **Sid:** I don't know. I don't even know what's in this stuff. I have no clue. I guess you guys are going to have to tell me. Bernardo and Julian, that's your goal. You've got to tell me, what's in this stuff? And what's so good about it? I'm going to give you the ingredients, and you've got to find out.

Having watched the video, the children pondered the questions on their own before science class. At lesson time, they bounded into the classroom with enthusiasm, carrying their own bottles of Gatorade and heading straight for the activity table. (See "Activity Design" on page 35.)

Engaging Children Through Meaningful Cultural Practices

Several features of the investigation kept children interested and conceptually engaged. Their funds of knowledge were the basis of an inquiry-based activity in which they linked everyday language to disciplinary terminology and used scientific tools and processes to investigate a culturally relevant topic. The educators used multiple strategies particularly effective with English language learners. They repeatedly linked their lesson to an identity children valued by referencing Rey Mysterio. Throughout, they were guided by the three-part framework for cultural competence.

Noticing

The first step of the framework for culturally competent education is to notice how children interact with their environment, looking for ways in which they experience science in everyday life. Children's everyday cultural practices—their funds of knowledge—can be leveraged for science learning when educators pay attention to the ways in which children act on the world. In our example, Lea and Sid could have dismissed the wrestling moves of Bernardo and Julian as inconsequential, but instead the educators' asset-focused mindset oriented them toward the usefulness of the behaviors. Emdin (2008) claims that "the powerful connection students have with their peers and their distinct cultural understandings … are points of entry that educators and researchers must use to engage students in science" (p. 773). While Bernardo and Julian were oriented toward each other and toward Rey Mysterio, they were also embodying scientific concepts in their physical positions and movements. This connection became a point of entry to science learning because the educators noticed and used it.

Questioning

After noticing children's cultural practices, educators may use questioning strategies to expand on these cultural connections and to tap children's funds of knowledge. When Lea said, "I need your expertise on this topic, because I truly don't know," she opened an opportunity not only to assess Bernardo and Julian's knowledge of physics but also to empower the boys as holders of valuable knowledge. In addition, she drew out the boys' use of everyday language to explain a scientific concept. When she asked why a wide-legged position was better, Julian replied, "because it's wider, and they might only push over one leg." In everyday language, he demonstrated an understanding of how a wider stance lowers the center of gravity.

ACTIVITY DESIGN

MATERIALS

- Sports drink, paper cups, water, food coloring, salt, sugar, orange juice, paper towels, index cards with vocabulary words
- Children also need access to a science expert on an Internet site, by telephone, or in person.

VOCABULARY

dye, sodium, sugar, citric acid

PURPOSES

1. Students will be able to define vocabulary in their own words and use the words to ask questions about these ingredients' effects on the body during exercise.
2. Students will be able to read the ingredients in a sports drink, discuss the importance of each ingredient and its effect on the body of an athlete like Rey Mysterio, and understand approximately how much of each ingredient is in the sports drink as they formulate their own drink.

PROCEDURES

1. Show photos or video footage of a famous athlete like Rey Mysterio, especially images of the athlete drinking a sports drink.
2. Have children read the ingredients in Gatorade.
3. Provide vocabulary cards of the focal ingredients: dye, sodium, sugar, citric acid.
4. Ask children to define the ingredients in their own words. For example, "What is dye?" Show each item.
5. Lead a discussion of the question, "Is the ingredient good for our body?"
6. Suggest that now children will need to call on a science expert. Have available an Internet site, a nonfiction book, the phone number of an expert, or a volunteer visitor. Ask children how they might ask the question, for example, "Is dye good for our body?" or "What does dye do to the body?"
7. Select a student or groups of students to gather information from the expert. As a whole group, discuss the findings.
8. Pour water for each child in a cup. Have children choose how much food color to add and then try the drink to see if it tastes like Gatorade. Discuss whether it is a sports drink yet.
9. Repeat steps 4–8 with each ingredient: salt (sodium), sugar, orange juice (citric acid).
10. At the end, discuss what it tastes like. Is it like Gatorade? What went wrong? How much is needed of each ingredient?

INFORMAL ASSESSMENT

Review each major vocabulary word and ask students to give thumbs up or down: Is this ingredient good for the body of an athlete like Rey Mysterio?

STRATEGIES TO SCAFFOLD LANGUAGE LEARNING

This activity enhances language learning in several ways:

- Inquiry project around a larger question
- Collaborative group work
- Word cards for vocabulary
- Informal assessment: Thumbs up or down
- Use of real ingredients for hands-on experience
- Oral practice of asking an expert for information

Instead of overlooking the potential of informal talk, educators can use questions to intentionally tease out the richness of children's understanding of natural phenomena. After tapping children's funds of knowledge, they can introduce disciplinary ways of talking about scientific phenomena.

Connecting to Standards

The third part of the framework involves relating children's funds of knowledge to content standards by designing culturally relevant lessons. In our example, Sid related children's passion about the famous wrestler to the science of dietary minerals and electrolytes in Gatorade. The sports drink connected to the children's daily life not only because they saw Rey Mysterio and other sports heroes drinking it but also because they brought bottles to school to drink themselves. The educators designed an investigation that provided opportunities for children to apply concepts, show what they knew, and get continual feedback.

The Gatorade activity connects to the National Science Education Standards (National Research Council, 1996), covering two key goals of Content Standard A: Scientific Inquiry, Grades K–4.

- **Abilities necessary to do scientific inquiry.** Students investigated Gatorade's ingredients by learning about ingredients and then actually using them to construct their own sports drink. They used simple tools such as the nutrition label on a sports drink bottle and a measuring spoon. They practiced inquiry skills by calling a science expert for help with their inquiry question.

- **Understanding about scientific inquiry.** Students asked and answered questions together, supported each other in talking to the science expert, and explored ideas about whether to add more or less of each ingredient.

The activity also focuses on the practices highlighted in the NGSS (National Research Council, 2014):

1. Asking questions: What is the ingredient? What is its effect on the body? How much of it is needed?
2. Planning and carrying out investigations: identifying ingredients, deciding on amounts, measuring ingredients, using sensory data (taste) as evidence
3. Analyzing and interpreting data: analyzing the taste of their sports drink
4. Using mathematics and computational thinking: deciding on amounts of ingredients, exploring ratios for each ingredient
5. Constructing explanations: explaining what each ingredient does; explaining how ingredient amounts affect taste
6. Obtaining, evaluating, and communicating information: communicating with a science expert to gather information

Finally, this activity used both the children's language and the language of nutrition science. Both kinds of language were involved as children read Gatorade ingredient labels, used vocabulary cards, worded questions for the science expert, received responses, and summarized those responses. The activity was both standards-based and culturally competent because it engaged children in listening, talking, and reading as they investigated a question connected to their cultural passions.

Harmonizing the Parts: Interconnecting for Cultural Competence

Creating a space for learning science outside the traditional classroom shifts the expectations for both educators and children. In the classroom, both groups have preconceived notions of their roles and of what classroom science looks like. In the hybrid space of afterschool, students and educators are free to explore alternative ways of teaching and learning science. In the co-constructed learning environment of FIESTAS, afterschool and preservice educators created new expectations of what it means to study STEM content and of the roles of educators and students in that process. Our three-part framework creates an expectation for cultural competence, making children's cultural practices the basis of science learning when educators intentionally notice, ask questions, and connect cultural practices to science education standards.

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