

**The Mixtec Game of Kasia: Developing Conceptual Mathematics  
While Having Fun,  
Revitalizing Cultural Traditions in the Rio School District  
(A Paper in Process July 2014)  
Dr. Faviana Hirsch-Dubin & Dr. John Puglisi**

### **Overview & Context**

A traditional Mixtec game, known as "Kasia" has been played in Oaxaca for over two thousand years. Recently, however, it has been threatened with extinction due to few people playing it, knowing its rules, and children preferring other games such as yoyos, marbles, and tops (Cruz Bautista, MA at Mixtec.org). Fortunately, the Latin American Studies Program at San Diego State University and its Mixtec program, has communicated valuable information on its website (<http://www-rohan.sdsu.edu/~mixtec/kasia.html>), which enables us to learn about games like Kasia.

In the Rio School District in Oxnard, California we have had a program fostering ethnomathematics investigations of the ancient Maya and other Mesoamerican cultures for the last two years. This academic year we have begun to focus on Mixtec history, mathematics, and culture, which is very appropriate given that there is a significant percentage of Mixtec students and families within the Rio School District.

Working with two fifth grade classes, and a third grade class, at predominantly Latino and Mixtec elementary schools, which includes a Dual Immersion class, it has been exciting to discover information about the Kasia game. We had just begun to learn the Mixtec numbers from a young Mixtec promoter who works with the district in various capacities. The students were very responsive to his teaching them the numbers, interspersed with personal stories of family and community traditions he shared from Oaxaca.

Dr. Faviana was able to communicate with Marcos Cruz Bautista in Oaxaca about our interest in the Kasia game and our desire to learn more about it. We informed him that our students were excited about playing the game and that we wanted to have the strongest possible context for them to learn about it and from it. That led to scheduling a Skype session, in which both fifth grade classes participated. We elicited student questions beforehand, as well as had some of our own, as Marcos is a precious resource not only for us to learn about the game of Kasia but about Mixtec mathematics as practiced in rural communities of Oaxaca. We later

had a second opportunity to have a Skype session with Professor Marcos Cruz with a third grade class, asking questions based on collaboratively generated student interests. This exploration of the Kasia game and Mixtec numbers provides an excellent example of how culture and mathematics intersect in powerful ways that can impact student willingness to engage mathematics.

### **Where's the Math?**

Once some of the cultural, historical context had been set, we explained the parameters of the game Kasia. Students understood from the beginning that they were helping to keep this important tradition alive. We then drew a picture on the board of the rectangular playing field, explained its dimensions, as well as the various rules involved in playing the game. We divided the class up in teams and then headed out to a flat surface with chalk, tape measures, river stones, and goodies in hand.

We drew the first playing field, allowed two teams to practice, and then drew two more fields so that the entire class could participate. The students discerned how to play quickly and were anxious to win as many goodies as possible. A key rule was that the team must share goodies so that no individual student had more or less than others.

As students took turns throwing the disc-like stones, they realized that the process was not as simple as they thought. Those who become more proficient with practice realized that the angle of throw, speed, and other factors influenced their ability to target coveted goodies, such as shell nuts, raisins, and other items.

Even though not part of the traditional Kasia structure, we added having the students say a specific number in Mixtec in order to win a goodie. This gave them practice pronouncing and remembering Mixtec numbers and increased the value of the game in our context.

After the game was over, we constructed a T chart to uncover the mathematics as well as culture embedded in Kasia. A very interesting part of this process was having students consider what constitutes mathematics in this game, apart from some of the more typical mathematics such as measurement, multiples, counting (in Mixtec too), conversions and geometrical shapes. Students began to realize that strategic reasoning, decision-making (such as what goodies to aim for), as well as the mathematics and physics of how stones are thrown (angle and speed), were also involved. Concepts such as probability entered the picture, as we re-examined what

kinds of throws lead to what kinds of results and how often, as well as the percentages of successful versus zero hits. Order and sequencing were involved, fractions (2 hits out of three attempts) as was the scale of the playing field (would it be easier or harder if the field were larger or smaller?), and mathematical modeling.

On the cultural side, students had to stop and consider what constituted cultural aspects of the game, such as collectivity, team building, mutual respect, kinds of goodies, why stones were thrown, and more.

As our understanding of the game progressed, Dr. Puglisi introduced the concept and practice of collecting data on the game, using both written tallying and videos. What this produced was a body of data, which could then be analyzed by groups of fifth grade students. The process deepened understandings about key aspects of the game, such as components of a successful stone toss as well as reasons that team members might engage in a study of their own play. Students who made conjectures then had to ground them in evidence as they argued their positions to others. Students were in dynamic engagement with conceptual mathematics through this process.

### **What do Traditional Games Reveal?**

As Powell & Temple (2001) pointed out in analyzing a traditional African game called, "Oware", games reveal the thoughts and lives of those who invented them. This includes the physical structure, materials (such as sugar cane shoots for Kasia, that we could not access locally) which are often found in the natural environment, as well as the rules. Often the rules reflect how players respectfully treat each other in a cultural context, as well as guiding success in playing the game.

As Barta & Schaelling (1998) assert in an article called, "Games We Play: Connecting Mathematics and Culture in the Classroom", games help to build community, while practicing and enhancing skills, challenging our intellect and our ability to solve problems. Games involve so much mathematics that "play is considered one of the 'six mathematical activities' of all cultures (Bishop, 1991 as cited in Barta & Schaelling, 1998). Games often involve estimation, predictions, probability, operations and more.

Importantly, multiple concepts are explored at the same time that students develop strategies and create practices that help them to succeed in the game process. They become engaged in activities, which make them think and create

mathematically, but not in typical ways that students associate with learning mathematics.

### **Developing Cultural Pride While Engaging More Complex Mathematics**

We believe that an exciting aspect of our work on the traditional Mixtec game of Kasia, in the context of learning more about Mixtec mathematics, culture, and history, helps to develop cultural pride in our Mixtec student population. This is vital given the need to encourage success among Mixtec students and a strong sense that their culture and traditions are worth preserving. It also provides positive cultural awareness for non-Mixtec students who benefit from learning about the roots and practices of some of their classmates. It can also potentially promote greater curiosity and interest in exploring family origins and cultural practices of students whose families are from Mexico and other countries in Central and Latin America. Finally, this process provides an important academic resource for all students to draw upon in multiple arenas (Yeager & Cordova, 2009).

Perhaps other cultural games will emerge as our investigations into mathematics and culture continues, such as the ancient Mayan game called, "Bul" which is still played by contemporary Mayans in Honduras. Play will likely be an ongoing component of comparing number systems, since it is a rich resource.

We plan to spread the experience of playing Kasia and accompanying context of the Mixtecs to other schools and grade levels, which has already begun to happen. This will allow the Rio School District to help keep the Kasia tradition alive while deepening student conceptual understanding of mathematics as well as culture.

### **References**

Barta, J. & Schaelling, D. (1998). Games we play: Connecting mathematics and culture in the classroom. *Teaching Children Mathematics*, 4 (7).

Powell, A.B. & Temple, O.L. (2001). Seeding ethnomathematics with Oware: Sankofa *Teaching Children Mathematics*, 7 (6).

San Diego State University Mixtec Resources:  
<http://www-rohan.sdsu.edu/~mixtec/kasia.html>

Yeager, E. & Cordova, R. A. (2009). How knowledge counts: Talking family

knowledge and lived experience into being as resource for academic action. In M.L. Dantas & P. Manyak (Eds), *Home-School Connections as a Multicultural Society: Learning from and with Culturally and Linguistically Diverse Families*. (pp. 218-236). NY: Taylor and Francis.