

## **Math Enrichment Class in the Andes Mountains**

by Neal Koblitz

In the course of our visits to Latin America, Ann and I have had many opportunities to work with children in specially arranged math classes, using novel and entertaining enrichment material. One of our most interesting teaching experiences occurred this past June 6 during a trip to the beautiful Andean city of Ayacucho.

Our hosts, Norma Lagos Sáez and Aníbal Martínez of the “Friedrich Froebel School,” had organized a visit to the village of Pacaycasa, located about 25 kilometers (15 miles) from Ayacucho. Because of the bad condition of the road, with its steep curves and unpaved sections, the trip took almost an hour. Ayacucho and Pacaycasa are at an altitude of approximately 2500 meters (8000 feet), and most of the children with whom we worked had spent their entire lives high in the mountains.

About twenty children aged 9 to 11 and fifteen teacher-observers came to the class. We started by passing out “geo-boards” (a square board with a  $5 \times 5$  array of pegs) and rubber bands of different colors. These boards can be used to give concrete, physical explanations of the basic properties of geometrical shapes, such as the areas of various types of triangles, rectangles, and squares, and a purely visual proof of the Pythagorean Theorem. In many cases, children can discover geometrical principles on their own using the geo-boards.

I began by giving a careful, elementary introduction to the geometrical concepts, so that the youngsters could get used to my pronunciation and teaching style. This was the first time that a foreigner had taught a class in the school. Moreover, most of the children speak Spanish as a second language; their mother tongue — which they use at home and at play — is *quéchuá*, the most important indigenous language of the Andes.

After about 20 minutes, I felt that the students were beginning to understand me well. In fact, they were responding to my questions and carrying out the geometrical tasks with greater speed and accuracy than the children in Lima with whom we had previously worked with the same material. It is possible that the Andean children tend to have a better geometrical sense because of their daily experiences — or perhaps it is because something has remained of the traditions of their Inca ancestors, who developed relatively sophisticated mathematical techniques. Interestingly, while playing with the geo-boards and rubber bands, some of the children formed the shapes of the old Inca numbers for six (which looks like a rectangle with a slanted line across the right-most third) and ten (which looks like a Z with a double line at the top and bottom).

Teachers from the school observed that the geo-boards could easily be constructed at minimal cost with wood and nails rather than plastic. One child commented that little pieces of string could be used rather than rubber bands (which are not sold in the village and would have to be purchased in Ayacucho).

After the session with the geo-boards, Ann and I introduced a game with seven dice whose purpose is to practice arithmetic in a way that is creative and fun. The children rapidly caught on, and played well. But soon they started to have difficulty reading the

numbers on the blackboard. It was getting late, the sun was setting, and the school does not have electricity.

After our class with the children, which lasted 1 1/2 hours, we had a productive discussion with the teachers, one of whom made the point that when teaching mathematics it is very important to let the students experience the basic concepts in an active, physical way, using their hands as well as their minds.

For us, what has been most memorable about our visits to this and other impoverished schools in Peru is the children's level of enthusiasm and interest in education. We cannot help noticing the contrast with the situation in the United States, where most students have shorter attention spans and show less interest in their studies than the Peruvian youngsters.