> Human beings are the only beings that have to go to school to know who they are. Plants, animals, rocks, etc. know what they are from the beginning. Human beings must constantly search for who they are and work hard to stay right with who they were meant to be. It is becoming harder for our students to know who they are as they are pulled to what contemporary society prizes: things like big houses and nice cars. It is easy for our young ones to forget the ways of their people, which have sustained the people through centuries of hardship and challenge. (Personal communication, November 20, 1997)

Dancing Numbers offer teachers opportunities for adapting their instruction to align with a Native-way of knowing. As such, students learn important mathematical concepts and principles while also learning critical aspects of what it means to be a member of a Native community. The dance will begin for students when they are guided to making their own personal and spiritual meanings of numbers and mathematical concepts embedded in instruction that includes connections to who they are as Native people. We must seek to build bridges of understanding that connect from the students' worlds to the concepts we teach. Native cultures and traditions provide countless opportunities.

Native Elders must play a significant role in this education process as they share their wisdom concerning traditional activities, beliefs, and values. Culturally situated instruction connects not only with the activities and traditions of the people for whom it is designed but also reflects community values and beliefs. Dancing Numbers focus on allowing us to see the mathematics that lives within an activity or action. It illustrates multiple connections between mathematics and the world in which the child lives. Our Native students should not, in fact they must not, be asked to forget who they are as Native people to be successful in the world at large. The students' greatest contributions to society will occur not in spite of their Native identities and wisdom, but because of them.

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The Ethnomathematics of Vietnamese Algorithms

by Daniel C. Orey and Kieu T. Nguyen, CSU Sacramento

Many foreign countries have influenced the Vietnamese educational system, with the Chinese and the French making the greatest impact. Initially, Vietnam adapted a model rooted in the Chinese schooling based on Confucian philosophy, emphasizing educational attainments and ritual performance. During the years the French colonized Indochina, they laid a foundation for the current structure of the Vietnamese education system by developing a preschool to higher education system. Before this time, elementary schools in Vietnam consisted of only one or two grades of primary education.

At the current time, the Vietnamese government is committed to required and free primary education for all children in the country. All children begin school at the age of six. In the primary classroom the majority of teachers use a very rigid or standardized teaching style. Concepts are taught first, followed by a great deal of practice, much of it

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in assigned homework.

Typically the mathematics lesson time consists of 90% of whole class teaching, 8% devoted to individual work, and 2% to group work. Students are required to solve basic algorithms through the use of mental mathematics strategies.

Calculation and Algorithms

The process of learning mathematics is different from that found in the United States. In the United States, one is taught to write out most steps of the algorithm on paper. However, Vietnamese students are required to rely upon mental calculation. Examples include the basic Vietnamese algorithms of addition, subtraction, multiplication, and division.

Addition

```
 287      a. 7 + 3 = 10
+473       b. 8 + 7 + 1 = 16
 760       c. 2 + 4 + 1 = 7
```

In the Vietnamese method, the carrying over is not written down. Students are taught to remember that a number was carried over to the next column and was added in when calculating that column.

Subtraction

```
 427      a. 17 – 9 = 8
–189       b. 12 – 9 = 3
 238       c. 4 – 2 = 2
```

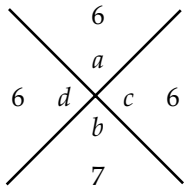
In Vietnam, students are taught to borrow ten from the 2 in the tens column in order to subtract 9 from 17. They then return 1 to the 8 in the tens column to get 9 and mentally subtract 9 from 2. Again 2 is too small to subtract 9, so by borrowing ten from the hundreds column, they subtract 9 from 12 to get 3. They return 1 to the 1 in the hundreds column to get 2 and mentally subtract 2 from 4 and get 2, for a final answer of 238.

Multiplication

```
 123      a. 3 x 7 = 21
x  7       b. 7 x 2 + 2 = 16
 861       c. 7 x 1 + 1 = 8
```

The Vietnamese process of multiplying is similar to that of addition and subtraction, as students are still required to do mental math. They are taught to record the first digit of each step in the process without recording the number to be carried into the next column.

In order to make sure the answer is correct, students check their multiplication as follows:



Draw an X as shown, and:

- ✔ in position (a), enter the sum of the digits of the top factor (1 + 2 + 3 = 6),
- ✔ in position (b), enter the sum of the digits in the bottom factor (7),
- ✔ in position (c), enter the sum of the digits of the product (a)(b); [(6)(7) = 42; 4 + 2 = 6]
- ✔ in position (d), enter the sum of the digits in the product of the problem (8 + 6 + 1 = 15; 1 + 5 = 6)

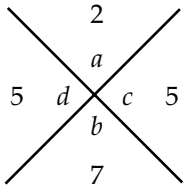
If (c) = (d), then the answer to the multiplication problem is correct.

Division

```
6 8 | 2
0 8   3 4
  0
```

In Vietnam, the division bar is drawn differently from that used in the United States. The Vietnamese adopted this symbol from the French. In the example shown, 2 is the divisor, and 68 is the dividend. The student divides 2 into the 6 of the dividend and records the answer (3) underneath the 2 (divisor.) They mentally multiply 3 times 2 to get 6 and subtract this from the 6 in the dividend, recording 0, as shown. They then divide 2 into the 8 of the dividend to get 4 and record the 4 next to the 3 under the divisor. Multiplying 4 times 2 gives 8, and subtracted from the 8 in the dividend gives 0.

As in multiplication, students are expected to check their work.



Draw an X as shown, and:

- ✔ in position (a), enter the sum of the digits in the divisor (2);
- ✔ in position (b), enter the sum of the digits in the quotient (3 + 4 = 7);
- ✔ in position (c) enter the sum of the digits in the dividend (6 + 8 = 14; 1 + 4 = 5);
- ✔ in position (d) enter (a)(b), [(2)(7) = 14; 1 + 4 = 5]

If (c) = (d), then the answer to the division problem is correct.

Conclusion

Mrs. Nguyen, A Vietnamese-American, grew up in the United States and had mostly negative perceptions of Vietnamese educational practices until she began this investigation. She heard numerous stories about people in Vietnam who quit school because they could not afford the fees or who were kept at home by their parents to help at home. She has learned that this was the case demonstrated by poor village residents when her parents were still in Vietnam, more than twenty years ago.

The authors of this paper have learned that there is now an increased value on education, both in Vietnam and by those of Vietnamese heritage now living in the United States. There is an increasing number of people attending school in Vietnam and going on to the university. They are constructing numerous colleges and universities for specific professions and trades.

Through a study of the basic algorithms and procedures used in Vietnam, the authors have come to realize that their emphasis on a strong repertoire of mental mathematics encourages students to learn and rely on their memory. Children in Vietnam are taught two-digit multiplication as early as second grade. They are expected to retain all concepts learned from grade one and on in preparation for comprehensive examinations that allow students to move to the next grade. This may contribute to the ability to develop rigorous mathematics in Vietnam today.

Yute: A Traditional Korean Game of Probability

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The Yute game is enjoyed by Koreans of all ages and is traditionally played during the Lunar New Year holiday season from the first to the fifteenth of January. This game, one of the oldest games played in Korea, is from ancient divination rituals used by farmers in the ninth century during the Paekche dynasty and is based on probability theory.

Wooden stick

The Yute game utilizes four wooden sticks. Each stick has one flat side, and one round side, and measures about six inches long and one half inch in diameter. Other commonly found objects such as round pencils split into two halves lengthwise can be used as Yute sticks.

You can draw the game board on paper or on the ground. The object of the game is to move one's four pawns, or markers, completely around a circular or square diagram of twenty dots before the opponent is able to do the same. An interior cross of nine dots that intersects the diagram provides short cuts toward the end dot from which the pawns can exit the diagram. A sample of the game board is shown on page 40.

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