Service Learning: Math curriculum that incorporates Native American Culture

Dr. Martha Gregg
LeAnn Severson
Augustana Academy for Seniors
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Motivation

- Academic success of Native American students still lags behind that of the general population

- 2009 South Dakota STEP test:
  52% of Native 11\textsuperscript{th} graders Proficient or Advanced
  80% of White 11\textsuperscript{th} graders Proficient or Advanced
The Course

• For pre-service teachers
• Mathematically rich problems
• Introduction to Native Culture and Issues in Native Education
• Course Project: classroom activity in math which is mathematically rich and incorporates some aspect of Native Culture
• Reflections
Mathematically Rich Problems

Example:

You have a 3-gallon bucket and a 5-gallon bucket, and are standing at the edge of a large lake. Can you get exactly 4 gallons of water in one of the buckets?
Solution

<table>
<thead>
<tr>
<th>Contents</th>
<th>Next step</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5-gal, 3-gal)</td>
<td>• Both buckets are empty</td>
</tr>
<tr>
<td></td>
<td>• Fill 5-gal bucket</td>
</tr>
<tr>
<td>(0,0)</td>
<td>• Fill 3-gal bucket from the 5-gal bucket</td>
</tr>
<tr>
<td>(5,0)</td>
<td>• Empty 3-gal bucket</td>
</tr>
<tr>
<td>(2,3)</td>
<td>• Empty 5-gal bucket into 3-gal bucket</td>
</tr>
<tr>
<td>(2, 0)</td>
<td>• Fill 5-gal bucket</td>
</tr>
<tr>
<td>(0,2)</td>
<td>• Fill 3-gal bucket from 5-gal bucket</td>
</tr>
<tr>
<td>(5,2)</td>
<td></td>
</tr>
<tr>
<td>(4,3)</td>
<td></td>
</tr>
</tbody>
</table>
Generalizing

• What amounts of water can we get using the 3- and 5-gallon buckets?

• What if we had 2- and 4-gallon buckets instead?

• What pairs of buckets allow us to get the most possible measurements?
Panel Discussions
The Meaning of the Star Quilt

• The Morning Star announces the coming of light and sun to the earth
  ▫ Start of each new day
• Morning star quilts are made with an 8-pointed star that fills most of the quilt top.
  ▫ Numerous small diamonds are pieced together to create this star.
• It represents the direction from which spirits travel to earth and it is a link between the living and the dead.
• Today, star quilts are one of the most valued gifts of the Lakota people
Example:
Lesson Plan:

• Geometry Lesson
  ▫ Reflections, Rotations, and Translations
• Relates to the 6\textsuperscript{th} Grade Curriculum
• Students will work in groups of two to create a star quilt
  ▫ Experimental
  ▫ Given directions based on the geometric terms
Mathematically Rich Questions:

- Reflections
  - How many reflections are possible?
- Rotations
  - How many degrees of rotation can you come up with?
- Translations
  - Which shapes can be translated?
Other Group Projects

• Symmetry
  ▫ Navajo Rugs

• Probability
  ▫ Traditional Lakota game of chance

• Polar Coordinates
  ▫ Lakota origin story (emergence from Wind Cave)
Dissemination

• Each student (or pair) left supplies for the teacher they visited

• Electronically available via the internet

• Possible presentations at summer workshop
Acknowledgements

- Augustana Service-Learning Grant Program
- Panel speakers:
  - Anna BrokenLeg-Hektner, Dan Howard, Anne Robertson, Tate Walker, Marcia Zephier, Stuart Zephier
- Cultural Consultants
  - Karla Abbott, Anna BrokenLeg-Hektner, Marcia Zephier
- Teachers
  - Ruth Johnson, Kelly Iverson