

Multicultural Mathematics: Revelations from an Exploratory Assignment

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Introduction

One semester while attempting to help pre-service teachers learn how to make mathematics relevant to the lives of young children, it occurred to me that many pre-service teachers in our teacher education program were uncomfortable outside of their own personal cultural experiences. It wasn't any one thing that caused me to develop this perception, but a collection of conversations I had with pre-service teachers enrolled in the elementary mathematics methods courses, examination of their writings when I asked them to build contexts for teaching mathematics (see sample lesson, Appendix A), and reflections on the challenges they had with discussing mathematics through the lens of real-life.

I had recently read some work of Claudia Zavslavsky (1996), who is considered to be the "mother of multicultural mathematics," and decided to develop a course related to the topic. My aim in developing the course was to focus the future teachers' attention on the development of mathematics, the ways various groups of people have contributed to or interacted with mathematics, and how applicable mathematics was or is in the real, daily lives of people.

I knew this to be important given that many of our future teachers would have the opportunity and responsibility to teach mathematics to children from a variety of races, backgrounds, ethnic groups, social groups, etc. The presentation of mathematics from a cultural, historical, humanistic point of view could help anchor children to mathematics by presenting mathematics that was interesting and reflective of their own cultures.

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Exploratory Assignment

To either support or refute my hypothesis that the pre-service teachers really needed such a focused course, I asked some of them to develop mathematics lessons plans that reflected their understanding and value of different cultures and the way people in those cultures contributed to and participated in mathematics. I decided that if the pre-service teachers were on the right track after all, well, celebration would be in order. If they were not, then I knew that I had to make a concerted effort to help them develop a more healthy perspective and knowledge base of multicultural mathematics.

I gave the pre-service teachers the option of using resources (e.g., library, Internet, etc.) for completing the task, although surprisingly, none of them took advantage of these options. They appeared confident that they knew just what to do. Following, I share several snap shots of lesson plans from this exploratory assignment, some of my initial responses to the pre-service teachers' position on the topic of multicultural mathematics as reflected in their lesson plans, and activities I have since used to support pre-service teachers' experience with teaching mathematics from a multicultural perspective.

Lesson Summary #1

A pre-service teacher developed an interactive bulletin board to match numerals (e.g., "1") with number words (e.g., "one"). The numerals 1-10 were placed on construction paper cut-outs that had the form of people. The pre-service teacher designated these cut-outs as "Indians." The words were placed on construction paper cut-outs that were designated as "canoes." The children participating in the lesson would be instructed to go to the "Ten Little Indians" bulletin board and match the Indian figures with canoes, that is, match the numeral with the correct number word.

Upon review of the lesson, I realized that the pre-service teacher needed to be challenged with her misconceptions about the use of a group of people outside of any real context and acknowledgement of their contributions to and participation in mathematics. I figured that if this was not an issue with the pre-service teacher, then it would not matter what group of people she chose as a context for the lesson.

Hence, I asked her if she would ever make a "Ten Little Blacks" bulletin board. Her response was, "Of course not. That would be offensive to Black people." Then I asked her why she didn't think that a Native American would be offended by her current display. She said that she had never considered that point, but on reflection would most likely change the context of the lesson if she were to use it with children.

An activity I now employ to help pre-service teachers develop respect for other cultures is to ask them to complete an assignment called "*Defining Your Cultural Self*." I share with the pre-service teachers that each person is cultural and a reflection of their "cultural self" will assist them in their interactions with and study of other persons, particularly the children they will eventually teach.

I simply request the pre-service teachers to each define his/her cultural self, to discuss what they see about themselves that makes them similar to or different than other people. Then we share the writings across the whole class and discuss the important ways they see themselves and how we can exhibit respect for their conceptions when we attempt to use this insight for mathematics instruction. I try to guide the pre-service teachers to a place of supposing how children define themselves and how teachers can use this information beneficially to support mathematics instruction.

Lesson Summary #2

For a lesson centered on the celebration of Thanksgiving, a pre-service teacher included a “Ten Little Indian” song: “Ten little Indians in a bed; one said, ‘Roll over. Roll over.’ One rolled over; one fell out. Nine little Indians in a bed; one said, ‘Roll over. Roll over.’ One rolled over; one fell out. . . .” The mathematics focus was on counting backwards and subtraction.

Certainly, it has been common for teachers to include Native Americans in a classroom activity related to Thanksgiving. However, the pre-service teacher mentions Indian in the lesson by way of a song that is questionable along the same lines as presented and discussed in Lesson Summary #1. The pre-service teacher neglected to include the people, their heritage, and their contributions in a way that was meaningful and that would help children develop an appreciation for Native Americans’ contributions to and participation in mathematics (e.g., the strong presentation of patterns in Native American designs of cloth).

As previously, I asked the pre-service teacher several questions about the use of the song and the “Indian” context. She, similar to the other pre-service teacher, responded that she really hadn’t thought about the context, but just wanted to find a song that would match her idea for the mathematics content of the lesson.

This is in fact a familiar song to many people and the context of who is in the bed can change according to the person singing the song. This made it easy for the student to adjust the song to something she thought would constitute an acceptable cultural relevance. So while the intent of the mathematics was worthwhile, the lesson lacked integrity with respect to the cultural context.

Multicultural Mathematics Game Day

I know that pre-service teachers are hoping to teach in fun ways and support children’s learning of mathematics in similarly fun ways. The goal is to address these aims but to also model for pre-service teachers how we should to attend to integrity related to multiculturalism. To those ends, I host a “*Multicultural Mathematics Game Day*” as part of the course. Here are the guidelines for the event as given to the pre-service teachers:

- ◆ You are to bring in a game for the class to experience (and enjoy) that

directs our attention to multicultural mathematics.

- ◆ No typical commercial games are allowed unless you make the case that they support multicultural mathematics. That is, the game must lend itself to discussion about people who developed or play it, and the game must require explicit mathematical concepts and skills. A commercial game of Mancala could be allowed since it represents a particular culture’s way of recreation. However, we have seen or heard about this game on several occasions, so it will not be allowed.

- ◆ We will also read the multicultural mathematics game chapter in Zaslavsky (1996). You are not allowed to present any game found in the chapter or any game we’ve already explored in class.

- ◆ So that we do not have duplications of games, let me know at least three days prior to game day what game you want to present.

- ◆ Make sure you have all of the necessary materials for playing the game.

- ◆ Write a “About This Game and the People Who Designed/Play It” description (including any pertinent references) on a 4x6 index card—this card is to be displayed with the game.

- ◆ Write a “How to Play This Game” description on the other side of the “About this Game” index card. If you have a commercial game, you may omit duplicating instructions *if* the original instructions are clear and straightforward. List the mathematics that is present in the process of playing the game.

- ◆ If you share a game that requires construction (by the teacher or students), be sure to provide directions for making the game (e.g., game board, etc.).

- ◆ Set up your game, then rotate around the room playing and discussing the games.

- ◆ Submit the index card and the game at the end of class.

The pre-service teachers delight in the game day experience. My observations each time I have hosted a game day is that the students engage deeply about the games, the mathematics need to play the games, and the people who designed/play the game around the world.

Lesson Summary #3

Another pre-service teacher included a format for a discussion in a lesson on American Indians. The mathematics focus of the lesson was on building categories from information. She was going to initiate the discussion by asking kindergarten children what they knew about “Indians.” I responded to the lesson by asking the pre-service teacher what she thought five- and six-year-old children knew about American Indians that would be accurate, to say the least, and positive to support the learning context.

She admitted that she did not think children this age would really know much. I asked her to consider that the media forms many people’s perceptions about Native Americans, and that much of this information is most often based on incorrect assumptions. In light of this, she reconsidered her approach to the lesson and decided to provide some guided information that would help the children “find” accurate information, even though this was not related to her original goals for the lesson. Interestingly enough, the pre-service teacher had not conducted enough of her own research on Native Americans to speak confidently on the subject though she intended to enter a lesson with this cultural context.

I want the pre-service teachers to gain experience in finding information that will be helpful for them as they teach multicultural mathematics. One activity that I engage them in is the development of a “*Multicultural Mathematics Teaching Resource File*.” I request that the pre-service teachers review a minimum of 10 multicultural mathematics resources that will support teaching of the topic. They must include at least one book (not the course text), seven web-sites, and two other resources of their choosing. At a designated time, we bring all of the files to class (hard copy or electronic) for a whole-class peer review. This allows pre-service teachers to take note of findings from their peers and opens up their awareness to the importance of gathering authentic information rather than depending on perceptions developed from exposure to media.

Lesson Summary #4

Yet another pre-service teacher used American Indians as a context for a lesson. She proposed that for the mathematics lesson, children would sit “Indian-style” on the floor. Nothing else was mentioned

about the people nor their culture, as if all they contributed to our world was a way of sitting, an image mainly emphasized by Western movies. In addition, the sitting posture was not at all related to the mathematics content of the lesson.

I asked the pre-service teacher to re-evaluate her selection of context for the lesson so that at the least (1) she considered the cultural authenticity of the context and (2) she considered the integrity of the mathematics of the lesson in light of the cultural context. I imposed upon her the responsibility of measuring the meaningfulness and “worthwhileness” of not only the mathematical content of the lesson but also the context that she selected to support the lesson. In addition, this provided an opportunity for me to build into the course the responsibility for the teacher to insure that respect to cultural context is a priority.

Journal Article Readings

I see it as my duty to help the pre-service teachers and expose them to resources that prepare them for teaching mathematics from a multicultural perspective. One of the assignments for the course that helps with this is “*Journal Article Readings*.” The pre-service teachers search for, read, write a review and reflection on, and present to the class a journal article related to multicultural mathematics.

When students present their journal articles to the class, we engage in discussion about the content and I try to find ways to raise issues of concern that might help all of the pre-service teachers’ understandings regarding the topic at hand. I give the following information to the students to get them started in finding an appropriate article for the assignment:

Sample Journals:

Action in Teacher Education
Arithmetic Teacher
Australian Mathematics Teacher
Black Issues in Higher Education
Educational Studies in Mathematics
For the Learning of Mathematics
Journal of Negro Education
Mathematics in School
Mathematics Teaching
Multicultural Teaching
Social Studies and the Young Learner
Teaching Children Mathematics
Teaching Mathematics in the Middle School
The Journal of Educational Issues
of Language Minority Students

Sample Key Words:

Cultural
 Diversity
 Ethnicity
 Ethnomathematics
 Equity
 Mathematics
 Global
 Historical
 Multicultural

Lesson Summary #5

The Hanukkah holiday was used in several lesson plans. Most often pre-service teachers wanted to include Christmas in a lesson plan, and thus felt the need to include Hanukkah as a way of appeasing Jewish students and parents. Unfortunately, they did not consider several things:

1. Christmas and Hanukkah are not related holidays. Christmas is the Christian’s celebration of their savior’s birth, while Hanukkah is a historical celebration of victory of the Jews to regain Jerusalem from the Syrians.
2. Secondly, Christmas and Hanukkah do not always occur close together on the calendar. In that particular year, Hanukkah began on November 30. As usual, Christmas was December 25.
3. There are often more than two religions or celebratory practices represented by the children in a any given classroom.

I therefore asked the pre-service teachers:

1. How they would include the religious holiday celebrations of students who were not Christian or Jewish?
2. How would they accommodate a child who was not religiously engaged?
3. How would they accommodate children who celebrated non-mainstream holidays (e.g., Kwanzaa)?
4. How would they accommodate children who were religiously engaged but did not celebrate Christmas (e.g., Jehovah’s Witness)?

The most common response from pre-service teachers in the course was that they just hadn’t given any thought to the bigger picture of using holidays or developing lessons from cultural events that truly supported the mathematics being taught.

An important resource for the course

is the group of students themselves. One of the ways I use the pre-service teachers themselves to inform the entire class is to share “*Tips for Teaching Multicultural Mathematics*.” The pre-service teachers provide a list and description of at least 10 tips for teaching mathematics from a cultural perspective to support all students’ learning of mathematics.

Some of the tips focus on content (e.g., always make sure the mathematics is clearly seen in the lesson.) and some of the tips relate to students’ knowledge about their own cultures (e.g., some people consider the number 7 lucky, while other people have a religious concept of 7 meaning completion; this is important to keep in mind when asking children what numbers mean to them). With an average of 25 pre-service teachers and deleting redundancy, we usually have about 220 tips to consider, discuss, and refine for application.

Lesson Summary #6

A pre-service teacher wanted the children participating in her lesson to copy her artwork. She drew bells and balls on a felt cut-out Christmas tree. She also drew bells and balls on a drawing of the Star of David. This was her way of including the culture of Christians and Jews in the lesson. Her premise was that these would be the two dominant religious cultures represented by the children. I informed the pre-service teacher that the Christmas tree and the Star of David are not parallel in meaning. In addition just as the cross is a symbol of the Christian faith, the Star of David is a symbol of the Jewish faith.

In fact, several pre-service teachers indicated that they were planning to just celebrate what the majority of children represented and would include other days so children would not feel left out. However, the notion of including other things so children won’t feel left out does not necessarily acknowledge the value of those things, especially if their inclusion is forced as in the case of this example.

One of the things I hope to accomplish in the course is to encourage the pre-service teachers to be courageous in learning about people (particularly their students) and interacting with different people. This will provide them an opportunity to learn things that will help them in mathematics instruction that is intended to reflect multicultural emphasis.

To help them begin this journey, I guide them in developing an interactive “*Public Awareness Poster Presentation*”

Promising Practices

about multicultural mathematics. Then the pre-service teachers (in small groups) must leave the classroom building and go to some other part of campus to set up their posters and engage the public in conversation and activities regarding multicultural mathematics.

The goal of this assignment is to assess:

1. what they have learned about multicultural mathematics;
2. their strategies for presenting the information to other people, and
3. their development and/or collection of materials for promoting multicultural mathematics.

After presenting, the group submits a written reflection paper about the experience.

Revelations

I learned a great deal from facilitating the exploratory assignment (and subsequent course activities) with these pre-service teachers. I realized that teaching mathematics from a multicultural perspective needed to be included in the agenda for elementary mathematics pre-service teachers. The pre-service teachers were clearly not equipped to teach about the various contributions that other cultures had made to mathematics, to use available information to develop lesson plans that reflected these cultures' contributions to the use and study of mathematics, or to develop plans that reflected attention to the cultural representations in current classrooms.

I also learned that the pre-service teachers were not aware of the myriad of ways people around the world participate in mathematics. The first step in empowering teachers to teach mathematics from a multicultural perspective is to equip these

teachers with information about the many cultures that have contributed to the field of mathematics and the way many cultures use mathematics for working, problem solving, recreation, etc., with the use of culture in the broadest sense.

The pre-service teachers had many misconceptions and misunderstandings of people of various cultures. A second implication from this exploration is that educators should use whatever opportunities there are to help pre-service teachers come face-to-face about their misconceptions and misunderstandings about people who are different from themselves. I found that when I asked pre-service teachers questions that really made them think about their positions, they were very willing to reconsider their thoughts and actions and make attempts to find their own errors in their thoughts and actions. I am now more at ease and believe that when these pre-service teachers attempt to teach mathematics from a multicultural approach they will at least give some thought to the way they treat peoples and cultures in their lessons.

My review of the lessons revealed that the majority of the pre-service teachers concluded that multicultural mathematics was made multicultural just by the mere mentioning of a group of people from some cultural group or just by using a contextual situation from a cultural group. In fact, the overuse of some cultural groups or concepts (e.g., Native Americans, Hannakuh) indicated that pre-service teachers were grasping at the familiar even if they did not have proper understanding or background to use the familiar wisely. The pre-service teachers definitely needed to be enlightened on what is meant by multicultural education and what is needed to give a real cultural context to a mathematics lesson.

In light of this experience, I am more convinced than ever that mathematics

educators who are proponents of teaching mathematics from a multicultural perspective must provide ample support and information to future teachers so that those teachers are prepared to implement multicultural mathematics lessons in an appropriate manner. This experience changed the way I teach the elementary mathematics methods course, and it was the impetus for the development of a multicultural mathematics course for the graduate level of our program, "Methods of Multicultural Mathematics."

I no longer use the phrase "multicultural mathematics" with the assumption that pre-service teachers can automatically address the concept appropriately, but I recognize that the pre-service teachers need empowerment in regards to the content of mathematics as well as in regards to the concepts of culture, multiculturalism and multicultural education. I designed the course to interweave these concepts so that the pre-service teachers will be more equipped to teach mathematics in the climate of diversity present in today's schools.

Reference

Zaslavsky, C. (1996). *The multicultural math classroom: Bringing in the world*. Portsmouth, NH: Heinemann.

Appendix

See Appendix on next page.

Appendix

Tower of Hanoi

Cultural Context

The Tower of Hanoi was invented by the French mathematician, Edouard Lucas, in 1883. He was inspired by a legend that tells of a Hindu temple where the pyramid puzzle might have been used for the mental discipline of young priests. Legend says that at the beginning of time, the priests in the temple were given a stack of 64 gold disks, each one a little smaller than the one beneath it. Their assignment was to transfer the 64 disks from one of the three poles to another, with one important proviso—a large disk could never be placed on top of a smaller one. The priests worked very efficiently, day and night. When they finished their work, the myth said, the temple would crumble into dust and the world would vanish."

Mathematics Content

Patterns, problem solving, geometry.

Materials Needed

Construction paper, scissors, compass/ruler.

Exploration

1. Make a model of the Tower of Hanoi (if you don't have a commercial version). Cut out the following objects from construction paper, each on a different color of paper. If two objects have the same color it is ok: (a) rectangle, 2.5" x 9", make three dots with an equal amount of space on each end and between each dot; (b) circle, 2.75" diameter; (c) circle, 2" diameter; (d) circle, 1.75" diameter; (e) circle, 1.5" diameter; (f) circle, .1.25" diameter; (g) circle, 1" diameter. (An envelope is provided in which you are to keep your model when explorations are complete.)

2. With the Tower of Hanoi model you've just made, simulate the actions the priests might have taken to transfer the disks from pole (place) to pole (place). Your goal is to move all the disks from pole (spot) #1 to pole (place) #3 with the guidelines given above.

- ◆ How many moves did it take you to complete the task?
- ◆ What problem solving strategy(ies) did you use?
- ◆ Complete the given chart regarding the minimum number of moves necessary to move the disks from pole (place) #1 to pole (place) #3:

Number of Disks	Minimum Moves
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

- ◆ What is the relationship between the number of disks and the minimum moves necessary to move the disks as instructed?
- ◆ Graph the data from the chart. The graph is a model of _____ growth.
- ◆ What hypotheses can you make regarding the minimum moves necessary to move 64 disks?
- ◆ If the priests made one move every second, how many years do you think it would take them to move the 64 disks?

One NCTM Standard Reflected in this Exploration

In grades 3-5, all students should describe, extend and make generalizations about geometric and numeric patterns.

References

<http://www.lhs.berkeley.edu/java/Tower/towerhistory.html>

Braxton, B., Gonsalves, P., Lipner, L., & Barber, J. (1995). *Math around the world*. Berkeley, CA: The Regents of the University of California.

Your Reflections/Extensions