CITIZEN MATHEMATICS

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Introduction

The purpose of this paper is twofold:

1. To describe an innovative math citizenship teaching experience based on cross-age tutoring with Senior 2 and Senior 4 Consumer math students and Grade 3 to 6 students, and

2. To describe obstacles that may happen and that were not expected by a first time teacher-researcher. The following paper is based on my personal experiences and written while in the middle of my research.

In the past, mathematics facts were taught by memorization. Students either remembered them, or did not. They usually did not have any other methods for learning this mathematical concept. It is my belief like that of Buchholz (2004) that “students are not empty vessels into which information is poured, but rather, they are products of experiences on which knowledge and skills are built.” (p. 283). The first part of my action research project will try to use this foundation to assist students in grades 3-6 (middle-years students) to learn the 7’s multiplication facts and to build a rich collection of images to associate with multiplication as a concept. I will try to achieve this by having students engage in a range of activities that enable them to use dynamic hands on manipulation activities and games to build visual imagery for multiplication. By having the students see the activity, do the activity, make the activity, talk about the activity, draw the activity, and say what they did in words and in arithmetic, I hope to help students engage cognitively with their actions and the images they construct doing the activities while also building their mathematical communication and inquiry skills. Board games, card games, and dice games provide rich contexts for mathematical learning. (Fosnot & Dolk, 2001), and I hope that this will be the case in with these students. The activities that I hope to help do this were chosen by me and Dr. Ralph Mason, who is my research partner, and they are:

- *Penny Flowers*—creating flowers out of pennies;
- *Race to 50*—racing their partners to 50, one using dice and one counting by 7’s, to see who wins;
• *Calendar Sevens*—noticing the patterns of 7’s in calendars;
• *Hundred’s boards sevens*—noticing the patterns of 7’s on a hundred’s board;
• *Seventh Street Bus*—a wonderful story and activity that works with 7’s;
• *Multiplication Golf*—a game where students not only notice the 7’s times table, but also that of the 8 and 9’s time tables;
• *Dice Towers*—noticing the pattern on opposite sides of a die;
• *Accordions*—quick times 7 recall; and
• *Digit Sums*—noticing the patterns in the digits of multiples of 7.

Some of these activities bring real-world applications to the seven times table, and I am hoping that it will enable students to understand multiplication as having some significance by connecting it to the world around them (Willis & Johnson, 2001).

The second part of this research project has to do with citizenship of senior years students. The citizens in this project are my Consumer 20S and 40S students (grades 10 and 12, respectively), and I am planning to use them as cross-age tutors to introduce the above activities to the younger (grades 3-6) students and by doing this, I hope that my Consumer math students will, by learning the activities that they teach the middle-years students and teaching them to the students, achieve what we associate with being good citizens: i.e., forming a positive sense of social worth by making a significant contribution to others in one’s community (i.e., with the younger students in the school).

**Background**

My school is a small rural K-12 school, and its sense of community operates beyond classrooms. The school’s population is around 200. The elementary classrooms are all multi-aged, and the middle-years students with whom we are working come from a grade 2-3 split class, a grade 4-5-split class, and a grade 5-6 split class. My Consumer Math class is also a split class. In my class I teach Consumer 20S and 40S. The 20s Consumer Math class has seven students. In the 40S Consumer Math class, I have a wide range of students. I have seven 30S (grade 11) students who have just finished taking 30S Consumer Math and wanted to take their 40S (grade 12) credit this year, one mature student, and two students in
grade 12 who have never taken a Consumer Math class before. My Consumer Mathematics students are not very confident mathematically themselves, so working with the middle-years students will be a challenge to them because some of my Consumer students believe the middle-years students are smarter than they are.

The Project

The model that I am using for this project is in a number of phases:

Phase 1

In Phase 1 of the inquiry, a one-day workshop was held on March 9, to orient the Consumer Math students to the mathematical activities they will be sharing with the grade 3-6 students. They experienced all the activities themselves, and they were led to discuss the meanings of the activities as learning events. They were shown what being successful in mathematics looked like in a subject area where risks of making errors that others may notice have traditionally been damaging to students’ mathematical success and egos. They also had a chance to meet with their groups of middle-years students to get acquainted with them and to do an introductory activity as a warm up.

Phase 2

In this phase of the inquiry, two Consumer students work with four grade 3-6 students for twenty minutes at the beginning of my Consumer mathematics period, which is at 1:35. These sessions take place twice a week for up to five weeks.

Phase 2a. In the first session, which was 40 minutes long, the middle-years students got a chance to do collaborative timed skip-counting activities that were introduced by the Consumer students. They also collaborated with their partners to make concept webs showing as many meanings for $7 \times 7 = 49$ as they can. The results of these activities will provide a baseline of information about the elementary students’ recall of multiplication facts and the depth of their understanding of the concept of multiplication.
Phase 2b. In each session, the senior-years partners introduced middle-years students to a new activity. They explored the activity and practiced their mathematical communication with their partners. As the twenty-minute session closed, they made a one-page record (They drew the activity-put it into words-and put it into numbers.) Each day of a great example of the math they experienced. In the second session of the week, they played the activity expressly to develop accurate and rapid use of multiplication facts. At the end of that session, they wrote a math journal, describing to their senior years partners something about their learning that day. The senior year’s students replied back to their middle-years partners the next session with responses to their journals.

Phase 2c. In the last two sessions, the middle-years students got to repeat the activities they participated in for their baseline in the first session. This record gave them a chance to see how much progress they made in multiplication speed and accuracy on the one hand and in enriching and expressing their mathematical ideas for the concept of multiplication on the other.

Phase 2 for the consumer students. The Consumer students have led the middle-years students for 20 minutes, and, at the end of each 20-minute session, the Consumer students returned to my room to discuss what they experienced. They wrote a journal entry on what the learning (i.e., the students’ mathematical success) they saw that day looked like to them. I responded to all journal entries the next day.

Phase 3

The middle-years students represented their experiences in a manner of their own choosing under the leadership of their classroom teacher. The Consumer math students each prepared an element based on the experience to include in their portfolios for evaluation. The experience concluded in a class discussion so that the students can all share their “representation of experiences” with each other and with me.
Some Anecdotal Results

Phase 1 took place on March 9th and was a great success. While we did not get to show the citizens all of the activities that we had planned, they did get a large group of activities that they used to work with in their groups. The students were with us (Dr. Mason and myself) all day from 8:55 to 3:00, and all of my students were there except for two who were sick. Now that is a major accomplishment because I have not had a full class of students all semester. I feel they all showed up because they felt that it was an important learning experience for them. As I have mentioned before, some of these students are not very confident mathematically themselves. When Dr. Mason mentioned Mad Minutes to the class, everyone groaned, and one of my students said how much he hated them and that they still bother him even though he has not seen them for years. Another student was very frustrated with the math he was doing. He was working on the 7 by 10s activity and was asked how much do you add to 21 to get 70. He took his string off the board and did not answer. You could tell by his expression and his attitude that he was frustrated that he did not know the answer. He probably also took his string off the board because he was afraid of giving the wrong answer to the class.

Having the Consumer students meet with their middle year groups was an interesting and important event. Most of the Consumer students had a good time meeting their partners and did a good job of presenting the introductory activity, but some Consumer students realized that they did not listen to instructions in class or they did not do the activities enough times in class to be comfortable with the activity and had a difficult time working with their groups. After meeting with the middle-years students for about 30 minutes, we came back to my class and discussed what happened. We discussed what the middle-years students had done and went over procedures for what to do if the middle-years students became difficult to handle. All of the groups paid more attention to the activities afterward. Now when I chose the citizens who were to work with the middle-years students, I had no idea who the younger students were or what they were like, so I chose the groups at random. I would now like to speak about “poetic justice.” When we got back to class, only one pair of Consumer Math students complained about the group they had. They told all of us that their group was disruptive, took the manipulatives that they had brought, and would not listen to them. Well, these two boys are exactly like the group they were working with--disruptive, played with manipulatives and are not the best listeners--so that when they told everyone in the class what their group was like, everyone else in the class laughed and said.
that it served them right. The rest of the day went very well and as planned, but the end of
the day was a big surprise. The class ended at 3:00, and all of my students left except the
Senior 2 students who had a spare, so they helped me clean up my room. I then told them
they could go to the library, and they left, but came back very soon and started to talk to
Dr. Mason about what had gone on in class (I thought that aliens must have taken over my
students bodies.). They also came back to learn the dice towers game again, and the student
who was so frustrated with math actually worked with Dr. Mason on the 9 times table on
the hundred’s board. One of my students was so impressed with the dice tower game that
he stayed after to school to show all of his friends. I have never seen these students so ex-
cited before.

Obstacles

This is the first research project that I have ever been involved in, and I would like to
take some time to discuss some of the obstacles that I encountered in trying to set up my
research. This research is sponsored by an Imperial Oil Academy grant. I heard about the
grant from Dr. Mason, and, after talking with him about research that we could do, he
asked of I would like to participate in the workshop that the Academy was putting on about
how to write proposals for grants. I thought that this was a great idea, and I went to the
workshop. It was a great learning experience, and, from there, Dr. Mason and I worked on
our proposal.

Obstacle 1: The Imperial Oil Academy.

As stated, this was the first research that I had participated in, and I had never writ-
ten a proposal before. Our proposal was sent in on the date it was due, and, from my per-
spective, I assumed that it would either be accepted or rejected. I was prepared for either
result. I was surprised and mildly shocked when I received an e-mail that it needed to be
resubmitted with some changes. I was not prepared for some of the criticisms that the pro-
posal received. I was prepared for the type of feedback that I give my students or the type of
feedback that I received from my Masters professors, not the feedback I received. As a first
time researcher, some of the criticism was difficult to understand (i.e., the intentions of the
feedback), and a little hurtful to me personally. It made me consider not resubmitting my
proposal, but I felt that the research was very important to my students and me. The changes were made, and it was resubmitted to the Academy, and the Academy accepted the proposal, but to those people who are submitting a proposal for funding for the first time, one should be prepared that it might not be accepted the first time and that the criticism that one receives might be very critical and personal.

**Obstacle 2: Ethics Submission**

I was hoping to start my research by the beginning of the second semester and to be able to do this; we submitted our Ethics proposal before we found out whether or not we would receive the funding. I did not know that ethics holds proposals until they have received their funding, and I was becoming worried that the proposal was not accepted. I also did not expect for this proposal to go through two cycles of editing, so I was surprised again when we had to resubmit our ethics proposals with some changes. We resubmitted our proposal to ethics, and it was accepted, and it did not throw our timelines off by too much, but people applying to ethics should be prepared to have their proposal not be accepted the first time and to require some changes.

**Obstacle 3. The School**

As stated, I have never done research before, and I had no idea how to organize four classrooms, seven teachers, one administrator, one university professor, one superintendent, 75 students, and two researchers. But these obstacles were not difficult to work with, especially compared to the other ones that I encountered, and I had no difficulty getting the research done.

**Conclusion**

I have worked with Consumer students for many years now, and I really enjoy teaching them, but I have seen how bad their self-image is. Most feel that they are not smart and can hardly wait to get out of school because it has only bad memories for them. They enjoy Consumer Math because it tends to have some relevance to them, but other courses, especially math, from Grade 1 to Senior 1 were difficult and sometimes painful for them. I want
To try help them feels better about themselves, about school, and about math and try to help them to become better citizens. Now I would like to tell you about one special element of my research. It has to deal with one of my students. This student had not been to school to hear “O Canada” in the morning for more than two years, but he came to the all-day session that we had. This student participated and was active all day. He went from saying that he would not work with the middle-years students, to a maybe. He actually only missed one class with his middle-years group and interacted with them in all of the activities. This student has shown me a role that I had not seen before. I was extremely pleased that this student showed such a strong interest in the activities and working with the middle-years students. It will now be interesting to see how this person will fit into the research. This will be my challenge.
References

