Cartoons in Middle School Classrooms

Hoyun Cho and Gary D. Lawrence

Middle school mathematics teachers try all kinds of strategies to increase student motivation and interest and to reduce anxiety. They work to find authentic ways to involve students in the important things that mathematicians do, such as ask questions, clarify problems, collaborate, observe patterns, and so on. We decided to experiment with the use of cartoons over a five-month period with a group of seventh-grade and eighth-grade mathematics students as a strategy for building intrinsic motivation and interest in the course content.

A cartoon is a visual medium with humor. It can be a single picture or a series of pictures—captioned or noncaptioned—that are printed in magazines, newspapers, and books. Selected humor not only is healthy, friendly, and attention grabbing but also increases students' interest and reduces students' tension and anxiety (Torok, McMorris, and Lin 2004; Cho 2012). Visualization based on pictures and text helps build student understanding of mathematics, creativity, and engagement in mathematical thinking (Cunningham 1991; Tall 1991). According to Cleaver (2008), cartoons have traditionally been viewed as "enemies" of the school. Today, however, some teachers view cartoons as potential educational tools, particularly as a way to arouse students' interest in academic subjects. Wright and Sherman (2006) state that cartoons have a particular attraction among school-age children.

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HOW DID WE USE CARTOONS IN CLASS?

We used cartoons in a northern New Jersey seventh-grade prealgebra class and an eighth-grade algebra class. We identified cartoon materials with high mathematics content and chose examples that would draw students' attention by visual interest and the posing of interesting situations. We found many good examples in NCTM materials. Specifically, we found the "Cartoon Corner," which appears monthly in *Mathematics Teaching in the Middle School,* to be helpful, as well as the publications *Cartoon Corner 1* (Reeves 2007) and *Cartoon Corner 2* (House 2013). We also drew from *Concept Cartoons* (Dabell, Keogh, and Naylor 2008), which focuses on mathematical misconceptions.

We followed the usual course curriculum for the first term and selected appropriate cartoons that would support the lessons. Some cartoons were selected to introduce a new topic. Others were chosen to reinforce concepts with which students were struggling. Some were chosen as a review or reteaching opportunity. We used cartoons about two times per week, with each cartoon activity involving a 20- to 25-minute time commitment. In each lesson, we normally gave students 2–3 minutes to read and understand the cartoon and the problems related to the cartoon. We then asked for clarifying questions to ensure that students were clear on the information provided in the cartoon and that they understood what they were being asked to do. Students usually worked individually for about 7–8 minutes, recording their thinking and their work in a journal. Then we encouraged them to work with a partner for 6–9 minutes to discuss their thinking about the cartoon and the given problems.

These discussions allowed students to clarify their thinking and get help if needed. Students could compare solutions and were encouraged to defend their approaches and calculations. Finally, students were given 5 minutes to refine their work, bring the problem to a conclusion, and write about whether they liked the cartoon. Sometimes students were unsure how to write about their feelings, so we gave them guiding questions:

- Describe what you found interesting about this activity.
- Was the problem associated with the cartoon too hard? Too easy? Just right? Explain.
- Did you like the cartoon? Was it fun? Explain.
- In what ways was the cartoon an effective activity to reflect on this mathematical topic?
- Describe a different activity you might have preferred to do to study this mathematical topic.

Students' feelings about each cartoon helped us see which cartoons worked well and why.

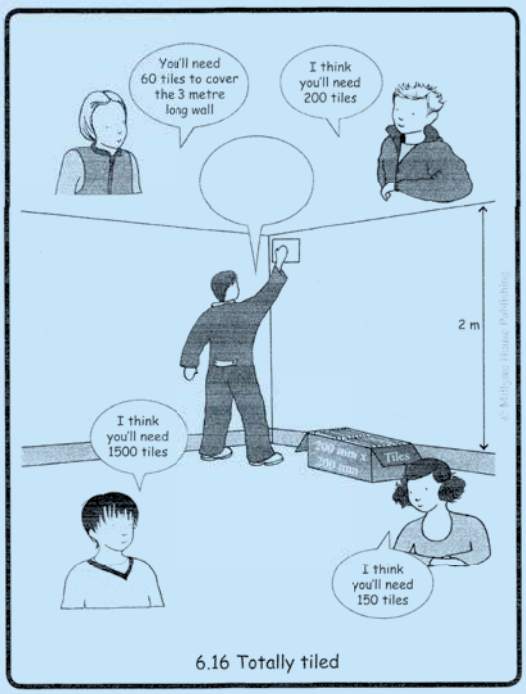
WHAT DID OUR EARLY EXPERIENCE REVEAL?

We were surprised at how quickly students entered into this kind of work. Some of the best cartoons elicited significant mathematical thinking and dialogue among the students. We noticed that mathematical vocabulary improved, and math topics became part of everyday conversations before, during, and after school. Our favorable impressions from the earliest classes only became stronger as the experiment continued. The best cartoon choices generated considerable energy and interest. Students quickly buckled down to do quiet or silent individual work in their journals.

Although some problems posed by the cartoons required calculations, others prompted the writing of thoughtful prose. We were especially pleased when students developed perceptive insights on the nature of multiplication and division, the idea of reciprocals, or different ways to visualize negative numbers. Finding words to convey their thinking brought a new dimension to our math classes.

"Totally Tiled" from *Concept Cartoons* (Dabell, Keogh, and Naylor 2008) is an example of what worked well with students on many levels (see **fig. 1**). It first required that students clarify the problem: "What wall are we trying to tile? What are its dimensions? Is it a rectangle?" Clarifying problems is one of the most important habits of a good mathematician. Students had to consider which units of measure would be most helpful to them: "Do I want to work in millimeters, centimeters, or meters? Would it be more efficient to work with square millimeters, square centimeters, or square meters?" Some thoughtful students asked, "What is area anyway?" "How do I visualize it?" "Can I think of each tile as its own unit of area?" Other students struggled with the questions, "How many square millimeters are in a square meter? Wait a minute, why isn't it 1000?" The cartoon design also encouraged students

Fig. 1 "Totally Tiled" (a) is an example of a cartoon activity from *Concept Cartoon* (Dabell, Keogh, and Naylor 2008); (b) represents students' work.



(a)

The wall is 2 meters by 3 meters.
There are 1000 millimeters in a meter.
The wall is 2000 mm x 3000 mm.

The tiles are 200 mm long.
2000 ÷ 200 = 10
10 tiles would fit along the short edge of the wall.

The tiles are 200 mm long.
3000 ÷ 200 = 15
15 tiles would fit along the long edge of the wall.

10 tiles would fit along the short edge of the wall.
15 tiles would fit along the long edge of the wall.
15 x 10 = 150.

150 tiles would be needed to cover the wall.

(b)

Fig. 2 This cartoon activity (a) from *Cartoon Corner* (Reeves 2007) was examined in the student's work shown in (b).

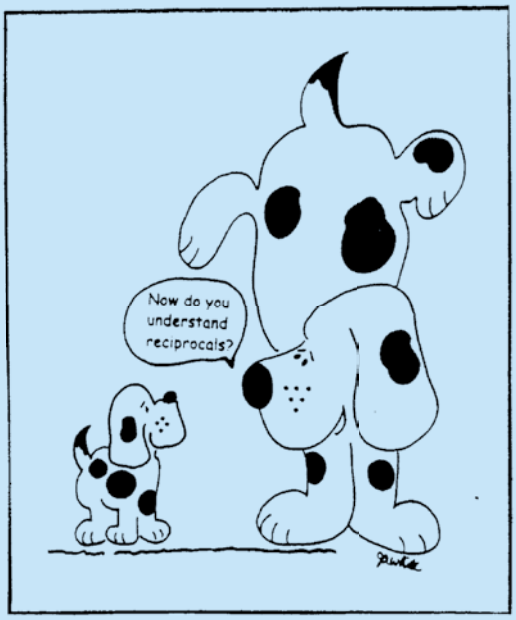
Reciprocal Agreement

1. Why is Bark doing a handstand to explain *reciprocal* to Bite? Explain below.

2. What operation is associated with reciprocals?

3. What is the definition of the reciprocal of a number x?

Bark and Bite *by Judy White*



4. Give the reciprocal of each number below, if possible:

2/3: ____ 4: ____ 2½: ____ 1: ____

−1/5: ____ 3/8: ____ 3¾: ____ −3/5: ____

7/12: ____ −10: ____ 0.5: ____ 0: ____

5. What whole number does not have a reciprocal? ____
Explain why not below.

(a)

I think that having math problems in cartoons is smart because when you look at a complicated math problem in a text book, you are a lot less relaxed about solving the problem than you are when you look at an equally complicated problem, presented for you to solve in the form of a cartoon.

(b)

to analyze errors: "What was the girl thinking who calculated 60 tiles?"

Pair and small-group conversations strengthened the social dynamic of the class. Verbal students suddenly had a more important role to play than ever before. Classroom artists were increasingly valued because they helped to envision important ideas by drawing pictures and cartoons of their own. Gifted writers enjoyed the journaling work and for the first time found uses for their writing skills in math class.

One thing that we learned was the importance of saving time at the end of each cartoon activity to hold a whole-class discussion, which was a satisfying way to conclude the work. Often, the students wrapped up by using their own words and arguments, and they accomplished exactly what the teachers had planned for that lesson. The teacher would then simply add a final exclamation point to the discussion and lead into the next class activity. For example, in the Bark and Bite (see **fig. 2**) from *Cartoon Corner* (Reeves 2007) on reciprocals, students did an excellent job of defining the concept of reciprocal and explaining why zero has no reciprocal. That left the teacher to conclude, "Wow! I am very impressed with the powerful words you have found to summarize your work on this cartoon. The rest of today's class will be spent reviewing the idea of division, especially division by fractions. Let's see what connections you can make between this cartoon discussion and what we are about to do now."

WOULD WE DO IT AGAIN?

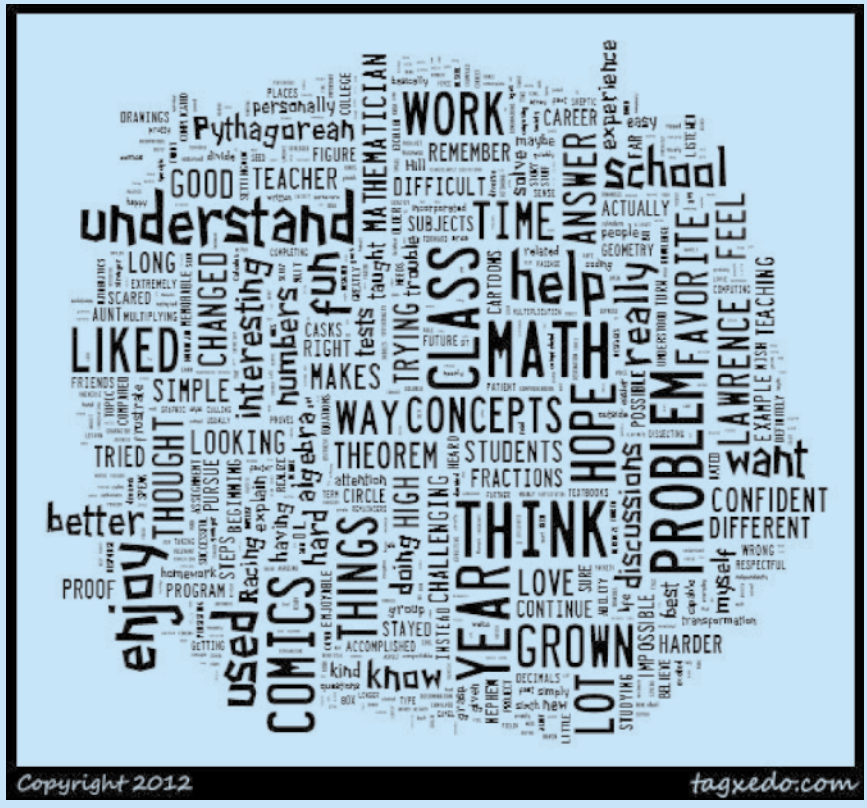
Indeed. We already have. For any math teacher, time allocation is a critical issue. Did the investment of time pay off? Absolutely. A careful choice of materials meant that students focused on the precise content the class was working to master. The cartoons added dimensions to their progress that could not be duplicated in any other way.

In the future, we hope to experiment with more student-created cartoons. Students doodle and draw cartoons all the time, so we will encourage them to create their own math cartoons. When we have an interesting word problem, we will challenge our students to create a graphic illustration to accompany it, perhaps with dialogue balloons to generate conceptual thinking. In these seventh-grade and eighth-grade classes, we have no shortage of volunteers!

At the end of the school year, we asked students to write reflections about the math class and the cartoon activities. Using their reflections, we created a word cloud (see **fig. 3**). The words most frequently used appear as the biggest and boldest. It is gratifying when words like *problem* and *work* are accompanied by *enjoy*, *liked*, and *understand*. The word *hope* also appears. At some level, students comprehend that we hope they will become "confident mathematicians," and that such activities as comics are part of the process.

Best of all, cartoons give students the chance to truly "be mathematicians." They ask questions, clarify problems, collaborate with classmates, draw pictures, observe patterns, solve problems, and do all the things mathematicians do.

Fig. 3 Teachers made a word cloud from students' end-of-year reflections.



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