

# Invert the Divisor & Multiply

An arts educator explores ideas for teaching math and science through stories and drama.

By Barry Stewart Mann

**M**y good friend Tom Wartelle never has trouble remembering how to divide by a fraction. When he was in fourth grade, his teacher, Mrs. Ording, explained to the class that to divide by a fraction, you simply invert the divisor, then multiply. Thus,  $2 \div \frac{1}{2} = 2 \times \frac{2}{1} = 2 \times 2 = 4$ .

But Mrs. Ording was concerned that the students might not really remember it. So she called Danny Devine to the front of the room. Danny Devine was the smallest student in the class. Of course, everyone, Danny included, wondered if he had done something wrong to be summoned suddenly to the front of the room. Mrs. Ording took Danny to the corner and spoke with him privately. She then attached something to his shirt and brought him to the center of the room. A paper was pinned to his shirt that had a single one word written on it: "Divisor."

Mrs. Ording said, "Okay, class, how do we divide by a fraction?"

A tentative chorus came forth, "Invert the divisor and multiply."

"That's right," she said, then she reached over and got a firm grip on Danny, lifted him up, and turned him upside down. "Invert the divisor and multiply."

The class, of course, gasped; Danny registered the shock of motion then grinned devilishly. Mrs. Ording gazed upon the students and let the image set in before returning the youngster to his upright position.

A better word might be imprint: The image and, therefore, the lesson were imprinted on the minds of those students because the teaching engaged their senses and emotions. That's why my friend Tom knows how to divide by fractions.

## Nouns and Verbs

His story, in my mind, was high drama. It contained a sympathetic protagonist, a sudden change in fortune, a moment of danger and suspense, then the world returned to calm. It was a new world, recognizable but somehow changed.

Tom told me this story as I was preparing to present a drama-storytelling workshop for elementary level teachers as part of a project called The Art of Teaching Through the Arts, part of ongoing research into arts education being conducted by Mary Ann Martini at Boise State University.

Because I was searching for ways to use the elements of drama and storytelling to embellish and illustrate typical elementary level lessons across the curriculum, I had gathered sample lessons for second through fifth grade in language arts, social studies, math, and science. Obviously the first two subjects easily lent themselves to dramatization and creative interpretation, but what do you do about math and science—with concepts such as simple machines and multiplying by zero or one?

How do you infuse dry concepts with the human values so necessary to story and drama?

I reflected on what Mrs. Ording had done and why that example still seems so fresh and compelling. She had turned a child upside down

(something you may not want to try), but, more important, she had turned expectations upside down by infusing that very conceptual phrase—"invert

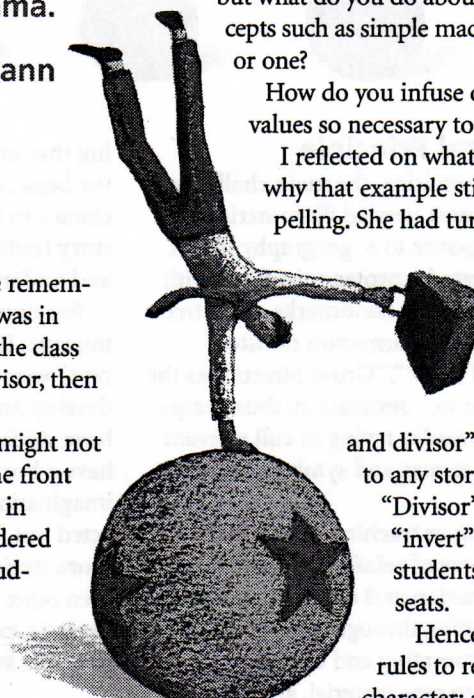
and divisor"—with two elements essential to any story: a character and an event.

"Divisor" became a character, and "invert" became an event. And the students were on the edge of their seats.

Hence, I thought of two simple rules to remember: Any noun can be a character; any verb can be an event.

Everyone knows that you need a noun and a verb for a story. Adverbs just don't do it. "Violently" is not a story. "Susie fell" is. Math and science are as full of nouns and verbs as any other area, so these rules render the playing field much more fertile. From here, of course, we want to add elements that we as storytellers already know and use. Characters should be likable, sympathetic, complex, and comically or tragically flawed. Events that befall them should be plausible, comprehensible, and serious but not insurmountable. Characters should change, grow, learn, even become better.

In the workshops, we started with these rules and concepts then turned to the sample lessons to choose a concept. The lesson we selected was "Multiplying by Zero or One." The first page of the lesson pictured three open boxes with nothing inside them; the opposite page showed three identical boxes, each with a pencil inside. Explanatory text was in the middle of the page. I asked for ideas.

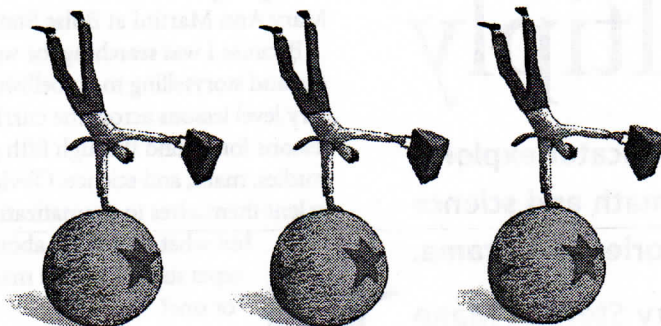




One teacher suggested, "You have a character who comes into a room with two tables, with three boxes on each, and she looks for pencils in the boxes. She needs pencils for some reason."

We discussed the suggestion: Was it dramatic? Did it illustrate the concept of the lesson, or was it just a situation in which a person learns the lesson? We decided to seek something less literal, less wedded to the text.

Instead of creating an external character and situation, we looked within the lesson for nouns and verbs to turn into characters and events. Hmm-mm ... One, Zero, Multiply. We thought about the nature of numbers and mathematical functions for further characterization and plot ideas and came up with a scenario that a group of five teachers acted out using assorted costumes and props.



## Illuminating the Central Principle

As we created the stories and scenarios, the main challenge was to find the principle that most needed illuminating in the lesson. For example, in response to a geography lesson on map reading, the group created a protagonist faced with three talkative characters: Directions, Landmarks, and Street Names. The characters called out information nonstop ("Southeast!", "Woodland Golf Club!", "Grove Street!") as the protagonist attempted to locate her destination, thus dramatizing the experience of a map reader trying to cull relevant information from a myriad of names and symbols found on a map.

I wouldn't suggest introducing or teaching lessons exclusively in this way. But it is one way of reinforcing the basic lesson, of exploring new information and concepts, of clarifying details, of testing understanding through its application on metaphorical levels, of incorporating and utilizing students' own native responses to new material, and, perhaps most important, of offering alternative channels to students who may learn more effectively through other than literal and rational modes.

With a lesson about right, obtuse, and acute angles, a group built characters based on alternate or homonymous meanings: One character thought he was always right, a second was known for her girlish good looks, and a third was mentally rather dense. A group dealing with a page about simple machines sought to physically portray the various machines as dramatic characters. Once they thought of transforming the human body to look and move like a wedge or a double pulley in a literal way, they explored the personality of each machine in terms of complexity, the function it serves, specific applications, and so on. The double pulley character was moody—up and down all the time—while the wedge was nosy and divisive, always trying to get between the others. The wheel was always on the go.

Personifying machines offers a different way of looking at them, of interpreting them, and of seeking out and becoming familiar with their attributes.

Another lesson dealt with completing a current of electricity. Students were shown several configured circuits and asked which ones would light the attached light bulb. The group tackled this first by playing with the vocabulary and dynamics of electricity, then developed a medieval legend using the information. The story dealt with a powerful queen who sent out two knights on separate circuits to tame a nefarious dragon, whose conquest would be signified by the enforced breathing of fire. One knight was Sir Positive and the other Sir Negative, and they both rode heavily-insulated chargers. They went on many unsuccessful journeys before learn-

ing that only through teamwork and timing could they tame the beast. As a group effort, this story gave everyone the chance to offer a pun or a twist in the tale. Built on a known story tradition, it engaged everyone in really investigating and understanding the details of the lesson.

You don't have to weave a lesson into a rich tale of intrigue. It can be as simple as asking: If this (object or concept) were a person, what would he or she be like? You can develop and tell stories from the subject material yourself or have students do it as an individual or group exercise. If you have a box of scrap costume pieces and props, the collective imagination will do the rest, and simple stories can easily be acted out. The key is: Once the lessons have been taught in a more straightforward fashion—then relax some of the rules and begin to explore, interpret, and have fun. ■

*Barry Stewart Mann of Atlanta, Ga., has been an actor since the late 1970s and a storyteller since 1991, when he began touring through the Lincoln Center Institute with David Novak. As an arts educator, Mann has served as Master Teaching Artist in Drama with the San Diego Institute for Arts Education and has worked extensively with the California Playwrights Project and the Old Globe Theatre. A member of the Southern Order of Storytellers, he is currently on the teaching faculty of Atlanta's Alliance Theatre, on the residency and touring rosters of the Georgia Council for the Arts, and on the performing roster of Young Audiences of Atlanta.*

CONTACT Barry Stewart Mann at 404-371-8759.

