

National Association of Special Education Teachers (NASET)

THE PRACTICAL TEACHER

This Month's Topic:

A Proper (Fraction) Museum

Karen Hazlett & Joanne Caniglia

Students with intellectual disabilities often experience difficulty with the concept of fractions. The Final Report of the National Mathematics Advisory Panel noted “Difficulty with fractions is pervasive and is a major obstacle to further progress in mathematics, including algebra” (NMAP, 2008, p. xvi). The Panel recommends that a major goal for K–8 mathematics proficiency with fractions should “simultaneously develop conceptual understanding, computational fluency, and problem-solving skills”. (NMAP Final Report 2008, p. xvi). There are many reasons why students with disabilities struggle with fractions. Among them is the presentation of procedures without enough attention to the concepts and the various models that are involved in the understanding of fractions—the set (discrete), area, linear, and symbolic representations.

Creating a Museum is a means of making fractions concrete and relevant to students’ lives while developing the concept of the set model (often termed discrete). My students planned, designed, and built their own museum exhibits as an introduction to a unit on fractions. In the process of collecting materials that represented fractional parts, they sharpened their organizational and problem-solving skills. By creating signage and other documentation for the objects in the exhibit they were more aware of the academic language associated with rational numbers. Finally by inviting guests to view their exhibits, students (docents) communicated their number sense through providing tours and composing promotional brochures for the display.

This activity originated from the text, *Collecting Their Thoughts: Using Museums as Resources for Student Writing* (2008). Following field trips to the local art museum, this text offered the authors practical ways to use museums in the works, artifacts, collections, and other materials they contain as a foundation of learning. By announcing to students that they would be collecting items to form a museum before they participated in an art museum field trip, they were more aware of the design, construction, signage, and displays. By consulting with the museum staff and sharing our class project description, docents gave background information that helped students to make their own displays.

The following steps will serve as a guide to setting up your own fraction museum (or any other mathematical theme) and explain how the activity supported students understanding of fractions.

Preparing the Exhibits

Students were asked to think about objects they could bring from home that would support the concept of fractions using various representations (area, set, symbolic, or linear model). Such objects should be capable of conveying information about the theme to the audience. I explained that students could bring in many different kinds of objects, such as books, photographs, cassette tapes, clothing, letters, or any other items that represent fractions.

Creating and Revising Signage

I next gave students time to create signs or labels for their exhibit (see Photo 1). The following guidelines assisted students in this process.

- Identify the object with a creative and inviting title.
- Explain what items are contained in your exhibit.
- State who owns the object. (You can also include why the object is important to the owner or to other people.)
- Point out any particular parts that the viewer should pay attention to and explain why they matter.
- Keep your label short. Keep in mind that exhibition space is limited.
- Can your exhibit be interactive? Can you ask visitors to find equivalent fractions? Can students rearrange the items and create other fractions?

After the students finish writing, I divide them into pairs or small groups and have them exchange the labels they've written. By telling them to read each others' work from the point of view of someone visiting the future exhibition and, if necessary, to comment on how the labels could be made clearer, more informative, and livelier. Then I have the students revise their labels and copy them onto poster board for the exhibition. Remind the students to write neatly or, if they are using computer-generated labels, to use clear fonts. Have them make their type large enough to be seen from several feet away.

An essential component of the signage is the symbolic representation of the fraction. Students are to symbolize the parts of the collection, for example: $\frac{1}{2}$ of the Lego's are red, $\frac{1}{4}$ are blue, $\frac{1}{8}$ are green, and $\frac{1}{8}$ are yellow. Students are to check if the entire collection totals one whole.

Identifying Rare Collections

As students visit each other's collections, they are asked to observe similarities and differences. They are also encouraged to ask questions about the background of the exhibits. For example, a student who loves to draw brought in pictures of her artwork—a fraction of them decorated while others were plain and stark. Students noted that most of the exhibits used sets of objects to represent fractions. Only one student used an area model of fractions along with her set of nutcracker statues (see Photo 2). Fractions are a rich theme for a museum because of the many models that one can use.

Students were then asked to rearrange the displays and explain why they would place some exhibits together or apart. Common denominators were most often cited as reasons for arrangements. But the rare collection was the fraction that spoke of area models. The nutcracker collection (see Photo 3 and 4) not only is the set model but also students noted that that stocking in the same collection represents an area representation.

Developing a Floor Plan

After the fraction museum was complete, children were asked to construct a floor plan for visitors. A paper was folded into 16 different sections. Each section represented a particular collection. Students were to find two equivalent fractions for each display and place them in one of the 16 squares. Below the title of the exhibit, students were to find equivalent fractions.

After identifying the exhibits from the floor plan, students then were able to discuss and ask questions of the collectors. Examples of questions were: Why this set of objects? Why do you think that so many students had 12 or 24 objects (the most frequent denominator)? What if we needed more room and asked to cut each exhibit by $\frac{1}{2}$ or $\frac{1}{3}$? How would you solve this problem?

Visitors! Visitors!

In addition to parents, school staff, and other students, you might want to consider inviting staff from a local museum or historical society. Also consider having the students give tours of the exhibition, using narrations they've written themselves. One of the key visitors is the classroom teacher. The full impact of this activity as a formative assessment dawned when I asked questions. This was an excellent opportunity to hear student discuss fractions. Students' knowledge of vocabulary and equivalent fractions became evident (or not!).

More than a Collection of Objects

Research suggests that students should explore a variety of models to develop fraction concepts (Behr, et al., 1992). Because students are bringing in collections of objects, the fraction museum is a concrete expression of the set model (often termed, discrete). Other types of fraction models include region or area models, length or measurement models and symbolic models. The museum also allows students to see the relationship and equivalent forms. When students develop this relationship, they are able to convert, order, and compare fractions, whole numbers, and mixed numbers.

Evaluating the Exhibits

Give students time to observe visitors in the exhibition. Explain that, while they're observing, they should try to keep in mind whether the exhibition seems to be serving visitors' needs and getting across the information students intended. For example, can visitors easily see displayed objects and recognize the fractions? Are labels positioned so that, to the extent possible, people who are reading them aren't obstructing other people's views? Suggest that students ask visitors for their feedback on the exhibition, and then have the students work in groups to come up with any recommendations for improving the exhibition.

The students were delighted with their fraction museum. The assignment to bring in items to represent a fraction produced many more concepts than ever expected, from set, area, and symbolic models to equivalent fractions. The results were creative and allowed the authors to assess student understanding of various models of fractions while students found equivalent fractions from visiting other exhibits.

References

Behr, M., G. Harel, T Post, & R. Lesh, “Rational number, ratio and proportion.” In *Handbook of Research on Mathematics Teaching and Learning* edited by Douglas Grouws, 296-333. New York: Macmillan Publishing, 1992.

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