Unleashing the Inner Math Monster: Counting and Cardinality in Kindergarten

Emily Borodkin, Katelyn Martin, Kellie Roy, & Emily Stapleton *Kent State University*

Abstract: *Allowing younger elementary school age children to learn mathematics in an imaginative and playful way can help promote engagement and lead to exploration of mathematical concepts on a deeper level. The authors describe an activity that encouraged kindergarten students to practice counting and cardinality skills with the game "Feed the Monster." They share experiences facilitating the activity and discuss the learning that resulted.*

Keywords: *Subitizing, ten frames, one-to-one correspondence, inequalities, counting, cardinality*

1 Introduction

"Feed the Monster" is an interactive and versatile mathematics game that focuses on building on multiple skills, including one-to-one correspondence, subitizing, and greater than and less than recognition. As preservice teachers, we used the game during our field experience with pairs of kindergartners.[1] The game begins with students using number cards or dice to determine how many counters to place on a ten frame (i.e., a mathematical manipulative that displays a 2×5 array). Next, students use the frame as a plate, feeding the counters to a "monster" by placing each one individually or dumping the plate into its mouth.

This activity is versatile and easy to modify based on a teachers resources, classroom limitations, and the needs and goals for the specific children participating. Since "the ability to identify numbers, 1discriminate between quantities, and identify missing numbers in sequences at the end of kindergarten is a strong predictor of mathematics outcomes at the end of first grade" (Jordan et al., 2009, para. 7), we believe that this activity is a great one to modify and use in any early elementary classroom.

2 Overview of the Activity

2.1 Connection to ODE Standards

Standards K.CC.4 and K.CC.5 focus on the relationship between counting (up to 20) and the numerals representing these quantities. In the activity, children are able to connect their knowledge of counting by using manipulatives, such as counting bears or unifix cubes, scaffolded through use of

[1]The authors extend a special thanks to Dr. Julie Stoll, a professor in the School of Teaching, Learning, and Curriculum Studies at Kent State University, for recommending the game for use with kindergarteners.

ten frames. This reinforces their one-to-one correspondence skills and can be done from numbers 1-20. To include numbers 11-20, just include a second ten-frame.

Standard K.CC.2 states that children will be able to count forward within 100 beginning from any given number other than 1. During this activity, children were able to use the ten frames as a placeholder when counting. For example, when they were using two ten frames, the children could start from ten and continue to count.

Standard K.CC.6 explains that children will be able to orally state whether the number of objects in one group is greater/more than, fewer/less than, or the same as the number of objects in another group, not to exceed 10 objects in each group.

2.2 Materials

The game requires a few simple materials: any type of item that could be used as a counter such as counting bears, little blocks, pebbles, etc.; 2 plates or pieces of paper that have ten frames drawn on them; number cards 1-20 (including numerical number and its corresponding dot pattern); 2 die (optional, substitute for number cards); and homemade monsters (see Figure 1). Monsters can be made out of most any material. For instance, three of us made the monsters out of an empty tissue box or small cardboard box; one of us used cups with wide openings. We also decorated our monsters to make them more appealing to the children. We used construction paper, cotton balls, cotton pads, stickers, and pipe cleaners for the decorations, but one could really use anything to decorate them, or even have the children decorate their monster themselves.

Fig. 1: *Two example math monsters.*

2.3 The Task

We recommend playing the game with small groups of up to 4 children. Provide students with the monster. Explain to the children that your monster friend is hungry and needs to be fed. Depending on the developmental level of the students, one could set a limit of how many counting manipulatives the monsters can eat. However, it is not a requirement for the activitys success. After this, have the children pick a number card or roll one to two die, depending on the ability level of students, and put the correct number of counting objects on the ten-frame plate. Again, for numbers larger than 10, use multiple ten frames. Using numbers over 10 connects to Ohio Math Standard K.CC.2. Have students' classmates check their work to make sure they've chosen the correct amount. This connects to Ohio Math Standard K.CC.4. Ask questions such as, "How many more counters

do you need to fill the frame? How do you know?" Asking these questions connects to Ohio Math Standard K.CC.5 and can help initiate a higher-demand task by "[requiring] students to access relative knowledge and experiences and make appropriate use of them in working through the task" (National Council of Teachers of Mathematics, 2014, p. 18). Once students have the correct number of counting manipulatives on the plate, have them "feed" the monster the counting manipulatives.

3 What to Expect from Students

Overall, this activity is very straightforward, and there are many ideal outcomes that can be expected when performing this task with children. First, students will be able to count the counting manipulatives to determine their answer to "how many?" Second, students will be able to point to each object as they count to show they understand one-to-one correspondence. If students are having difficulties with pointing to the objects, they will be able to pick each object up and put it in the monster's mouth as they count to help with one-to-one correspondence. Finally, students will be able to count from any number without restarting at one. We observed our students utilizing previous knowledge of ten frames in order to take shortcuts when counting, such as counting the top row as five or a full ten frame as ten and counting up from there. For example, Student A, "This row is full, that means 5, now 6, 7 , 8." This is evidence of the students ability to subitize as they were able to quickly recognize the amount of five.

Fig. 2: *Feeding the monster.*

During the activity, each of us noticed that imaginative play was an excellent vehicle for engaging children in mathematics (See Figure 2). The monsters kept children motivated as they continued to work on their math skills. One student who participated in this Feed the Monster math activity often had a difficult time staying on task. However, once the "monsters" were pulled out, his eyes lit up and he could not wait to participate. As a result, he was engaged for the duration of the activity and put more effort into his work.

4 Differentiation

The students we worked with had a wide range of mathematical backgrounds, and we found many ways to differentiate the activity. For example, if students are struggling to count, have them feed the monster one counter at a time to practice one-to-one correspondence skills. If this activity is too easy, encourage students to use multiple ten frames, as shown in Figure 3.

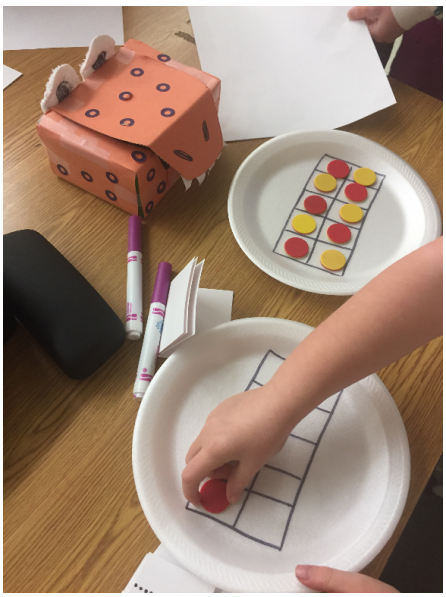


Fig. 3: *Using multiple ten frames.*

For English Language Learners (ELLs), count aloud with the child to scaffold the activity. Also, encourage ELLs to write the numbers because the numerals tend to be consistent throughout many languages. For students with mathematical learning disabilities, count aloud with the student and help point to each object to provide extra assistance during the task. For children who struggle to stay engaged, or who require more physical movement, one way to differentiate this activity is to have children work in pairs or groups of three and have them toss the counters into the monsters mouth one at a time. When not tossing the counters, the children can hold the monster or act as the "retriever" by collecting all of the counters that do not make it into the monster's mouth. By doing so, children are provided the opportunity to get up and move, the game is made more competitive, and children are kept engaged through the added role when it is not their turn.

5 Next Steps/Extensions

Once students have developed an understanding of the game, teachers can implement numerous extensions to enhance student learning. For instance, children can use two different sized monsters—Mega and Mini Monster. Mini Monster cannot eat more than Mega Monster so, if a child rolls a "six," Mini Monster can only eat six bears or less. This provokes the children to think of the concept of inequalities, which connects to the ODE Standard K.CC.6—*Orally identify (without using inequality symbols) whether the number of objects in one group is greater/more than, less/fewer than, or the same as the number of objects in another group, not to exceed 10 objects in each group*. Children have to decide which plate of bears will be fed to each monster based on their quantities. From our experience, students were receptive to this extension. They successfully decided which amount was greater and which was less. When presented with the amounts eight and four, Student B said, "this plate has more [counting bears] on it than the other one so I'll feed this to Mega Monster."

6 Recommendations

- Make sure children are comfortable with, and understand, ten frames before engaging in this exact activity (See Figure 3).
- Make sure children know the expectations of the activity before proceeding. Using the monsters can make the children very excited, so it is important to explain to them to respect the materials and play the game as explained. It may be helpful to let them play with the manipulatives for a few moments before beginning the activity to maintain their focus throughout.
- Try to adhere to the interests of each specific group of children. If they are not interested in monsters, you can perform this using other creatures such as fish or unicorns.

7 Conclusion

Our activity is useful because it incorporates multiple math standards. This activity is a higher-level demand task that encourages children to think critically. It is easy to differentiate to meet individual student needs, and the activity engages children in an exciting math activity through a constructivist approach. This activity also is very affordable for teachers and is easy to create. Feeding the monster instills multiple mathematical skills while also providing an interactive experience for the children and teachers.

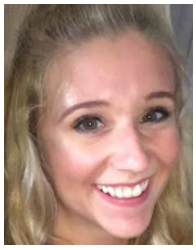
This task can be considered a higher-level demand task because it "[requires] students to access relative knowledge and experiences and make appropriate use of them in working through the task" (Leinwand, Brahier, and Huinker; 2014; p. 18). Students were able to draw information they already knew about ten frames. They also used the knowledge they knew about simple addition facts when filling the ten frames. The task "[demands] self-monitoring or self-regulation of ones own cognitive processes" (Leinwand, Brahier, and Huinker; 2014; p. 18). Students monitored their learning by ensuring that they were focused on using one-to-one correspondence and not skipping any counting manipulatives. On occasion, one child would skip a bear, but then self-correct immediately. Finally, the task elicits higher-level thinking by "Making connections among multiple representations [to help] develop meaning" (Leinwand, Brahier, and Huinker; 2014; p. 18). Providing multiple representations allows students to use the form that best suits their needs. Within our four groups, certain students responded better to the numerals while others preferred the manipulatives. By using the number cards and the counters to represent the numbers, children are able to see numbers portrayed in all three modes of representation (enactive, iconic, and symbolic modes) to better make connections and better comprehend their meaning.

References

Jordan, N.C., Kaplan, D., Ramineni, C. & Locuniak, M. N. (2009). Early math matters: Kindergarten number competence and later math outcomes. *Developmental Psychology, 45*(**3**), 850–867. `http://dx.doi.org/10.1037/a0014939`

Leinwand, S., D. Brahier, & D. Huinker (2014). *Principles to Action*. Reston, VA: National Council of Teachers of Mathematics.

Emily Borodkin is an undergraduate at Kent State University studying Early Childhood Education and minoring in mild to moderate special education. Her professional interests include global diversity and multiculturalism in the classroom as well as developmentally appropriate curriculum design. In her spare time Emily loves listening to Ingrid Michaelson and binge watching the latest show on Netflix.



Katelyn Martin is an undergraduate at Kent State University. She is currently a student teacher in a second grade in Westlake, Ohio. She is also a member of the Alpha Lambda Delta Honors Society. Katelyn loves to travel and expand her knowledge of other cultures. She is looking forward to having her own classroom in the near future.

Kellie Roy is an undergraduate at Kent State University studying Early Childhood Education and will graduate in the fall of 2019 after student teaching in a kindergarten classroom. She is the recipient of several scholarships, including the Lillian Pollack Cawley Early Childhood Scholarship. In her spare time, Kellie enjoys reading, boxing, and spending time with her family and friends.

Emily Stapleton is an undergraduate at Kent State University studying Early Childhood Education. She graduates with her Bachelor's degree in the fall of 2019 and is currently student teaching in a first grade classroom in Akron, Ohio. Emily currently works in a daycare center where she is able to work with young learners and help them develop their early learning skills. She enjoys to spend her free time watching movies and reading.