# Fill It Up

**Background:** We have been counting and exploring numbers up to 15. Now, we are ready to use our knowledge!

**Design Challenge:** Design and create a container for a given number of balls. Estimate the size your container needs to be by sketching it out.

**Criteria:**

☐ Your container must hold the number of balls that are given to you.
☐ Your container must hold the balls securely.
☐ The shape and size of the balls cannot be changed.
☐ The number of balls must be written on the container.

| **Materials:** Select from the list below. | | **Tools:** Select from the list below. |
|---|---|---|
| • cardboard tubes<br>• cardstock<br>• craft sticks<br>• fabric scraps<br>• glue<br>• paper fasteners<br>• paper scraps | • ping-pong balls<br>• pipe cleaners<br>• straws<br>• tape (24-inch piece)<br>• tennis balls<br>• yarn | • scissors<br>• markers/crayons |

# Tips for Teachers

**Targeted Standard of Learning:**

Mathematics K.2    The student, given a set containing 15 or fewer concrete objects, will include
  a)   tell how many are in the set by counting the number of objects orally;
  b)   write the numeral to tell how many are in the set; and
  c)   select the corresponding numeral from a given set of numerals.

**Supporting SOL:**   Mathematics K.1, K.3, K.13, K.14; Science K.4; English K.1, K.2

**Targeted Standard for Technological Literacy:**

11    Students will develop the abilities to apply the design process.

**Supporting STL:**   8, 9

| Prior Knowledge & Skill | Materials & Preparation | Safety Issues | Class Management | Materials Provided | Design Process |
|---|---|---|---|---|---|
| • Container construction<br>• Counting to 15 | • Suggested balls: ping-pong balls, tennis balls<br>• Markers/crayons can be eliminated if children are able to display the numeral without them.<br>• Each group should be given a different number of balls. | • Use of scissors | • Partners or small groups | • Design Brief<br>• Guided Portfolio (adapt as appropriate/ optional)<br>• Rubric Assessments | Follow the Design Process:<br>• Restate the problem.<br>• Brainstorm solutions.<br>• Create the best solution.<br>• Test the solution.<br>• Evaluate the solution. |

**Extension Ideas:** Have students put containers in order by numbers of balls and graph results.

## Guided Portfolio

Name _____

Group Members _____

**1.   What is the problem?** State the problem in your own words.

_____

_____

_____

_____

_____

_____

_____

Name  _____

**2.** **Brainstorm solutions.** Sketch and/or describe some possible solutions.

|  |  |
|---|---|
|  |  |
|  |  |

Name _____

## 3.  Create the solution you think is best.
Keep notes about your problems and how you solve them. Make sketches if they help.



_____

_____

_____

_____

Name   _____

## 4.   Test your solution.

Was your estimate close to the size of the container you built?          YES          NO

- Was your estimate larger or smaller? _____

Does your container hold the balls securely?          YES          NO

How many balls does your container hold?  _____

_____

How did you show your number on the container?  _____

_____

Did you change the size or shape of your balls?          YES          NO

Name  _____

## 5.  **Evaluate your solution.**

Was it the best solution? Why or why not?

_____

_____

_____

What would you have done differently? Why?

_____

_____

_____

# Rubric for Fill It Up

Name _____     Date _____

0—no evidence; 1—limited understanding; 2—some understanding with room for improvement; 3—good understanding with room for improvement; 4—substantial understanding

| Student Evaluation | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| **Oral Presentation: The student** | | | | | |
| • used complete sentences | | | | | |
| • used descriptive words. | | | | | |
| **Guided Portfolio: The student participated in** | | | | | |
| • restating the problem | | | | | |
| • brainstorming solutions | | | | | |
| • creating a solution | | | | | |
| • testing the solution | | | | | |
| • evaluating the solution. | | | | | |
| **Team Skills: The student** | | | | | |
| • used appropriate voice | | | | | |
| • encouraged team members | | | | | |
| • listened to team members | | | | | |
| • was involved in all aspects of the project | | | | | |
| • respected team members. | | | | | |

| Tested Criteria | YES | NO |
|---|---|---|
| The student estimated the size the container needed to be. | | |
| The container held the balls securely. | | |
| The container held the correct number of balls. | | |
| The balls remained the same shape and size. | | |

# Standards of Learning

## English (2010)

*Oral Language*

K.1    The student will demonstrate growth in the use of oral language.
- a) Listen to a variety of literary forms, including stories and poems.
- b) Participate in a variety of oral language activities including choral and echo speaking and recitation of short poems, rhymes, songs, and stories with repeated word order patterns.
- c) Participate in oral generation of language experience narratives.
- d) Participate in creative dramatics.
- e) Use complete sentences that include subject, verb, and object.

K.2    The student will expand understanding and use of word meanings.
- a) Increase listening and speaking vocabularies.
- b) Use number words.
- c) Use words to describe/name people, places, and things.
- d) Use words to describe/name location, size, color, and shape.
- e) Use words to describe/name actions.
- f) Ask about words not understood.
- g) Use vocabulary from other content areas.

## Mathematics (2009)

*Number and Number Sense*

K.2    The student, given a set containing 15 or fewer concrete objects, will
- a) tell how many are in the set by counting the number of objects orally;
- b) write the numeral to tell how many are in the set; and
- c) select the corresponding numeral from a given set of numerals.

## Science (2010)

*Matter*

K.4    The student will investigate and understand that the position, motion, and physical properties of an object can be described. Key concepts include
a)   colors of objects;
b)   shapes and forms of objects;
c)   textures and feel of objects;
d)   relative sizes and weights of objects; and
e)   relative positions and speed of objects.

# Standards for Technological Literacy

Standard 8:    Students will develop an understanding of the attributes of design.

Standard 9:    Students will develop an understanding of engineering design.

Standard 11:   Students will develop the abilities to apply the design process.

# Please give us some feedback.

Complete the form below to let us know how this design brief worked for you and your students. Please be specific so that we might use your suggestions to improve the activity. *You can fill this out on your computer, or you can print it, fill it out manually, and scan it.*

Teacher:  _____

School:  _____

School division:  _____

Design brief title:  _____

| **Background**                                                                                                       *Put an X in the appropriate column:* | Needs to be rewritten | Needs minor adjustment | Is ready for classroom use |
|---|---|---|---|
| Does it set the context for the activity? | | | |
| Is it age-appropriate in language, length, and complexity? | | | |
| Does it reference prior learning and/or research that the students did that will facilitate designing a solution to a problem? | | | |
| Is it detailed enough that an adult will understand the purpose for the design brief? | | | |
| COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.* | | | |

| Design Challenge | Needs to be rewritten | Needs minor adjustment | Is ready for classroom use |
|---|---|---|---|
| Does the challenge support your curriculum? | | | |
| Is it age-appropriate in language, length, and complexity? | | | |
| Is it detailed enough that an adult will understand the purpose for the design brief? | | | |
| COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.* | | | |

| Criteria<br>Criteria are part of the challenge. They set the limitations for the design. They are not directions. | Needs to be rewritten | Needs minor adjustment | Is ready for classroom use | N/A |
|---|---|---|---|---|
| Are the limitations age-appropriate? | | | | |
| Do the limitations encourage critical thinking? | | | | |
| Is the application of mathematic knowledge/skills integrated into the criteria? If not, should the skill area be addressed? | | | | |
| Is the application of science knowledge/skills integrated into the criteria? If not, should the skill area be addressed? | | | | |
| Is the application of social studies knowledge/skills integrated into the criteria? If not, should the skill area be addressed? | | | | |
| Are language skills integrated into the criteria? If not, should the skill area be addressed? | | | | |
| COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.* | | | | |

| **Materials**<br>Materials help set the limitations for the design. The list should include materials that might work. | Needs to be rewritten | Needs minor adjustment | Is ready for classroom use | N/A |
|---|---|---|---|---|
| Does the materials list encourage a variety of design solutions? | | | | |
| Does the materials list include a variety of choices for joining items? | | | | |
| Does the materials list include materials that force students to make decisions? | | | | |
| COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.* | | | | |

| **Tools**<br>Tools can be used in the construction of the designed product. They are used to manipulate materials. They cannot become part of the product. | Needs to be rewritten | Needs minor adjustment | Is ready for classroom use |
|---|---|---|---|
| Are the tools listed age appropriate? | | | |
| Are all tools needed for the activity included? | | | |
| COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.* | | | |

| Standards of Learning | Yes | No |
|---|---|---|
| Does the design brief reinforce the targeted Standard of Learning(s)? | | |
| Are the supporting Standards of Learning appropriate? | | |
| What Standards of Learning would you add or remove? | | |

| Standards for Technological Literacy | Yes | No |
|---|---|---|
| Does the design brief reinforce the targeted Standard(s) for Technological Literacy? | | |
| Are the supporting Standards for Technological Literacy appropriate? | | |
| What Standards for Technological Literacy would you add or remove? | | |

| Tips for Teachers | Yes | No |
|---|---|---|
| Are the tips listed in the chart helpful for a first-time teacher? | | |
| What tips would you add? | | |

| Guided Portfolio | Needs to be rewritten | Needs minor adjustment | Is ready for classroom use |
|---|---|---|---|
| Are the instructions and questions age appropriate and clear? | | | |
| In the "Test your solution" section, do the questions force students to thoroughly test their solutions? | | | |
| In the "Evaluate your solution" section, do the questions force students to honestly evaluate their solutions | | | |
| COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.* | | | |

**Additional Comments**
Please use this area to provide general suggestions for improving this design brief.