Mr. Miller & Mr. Marzouk

Simple Swift Water Bin

Grade 6 DT Wheel

Project Journal of:

Design Brief

In refugee camps around the world, one of the most basic needs is to have an easy container in which to carry water.

Many refugee families arrive at camps with few or no supplies nor equipment of their own. They need a way to build a water carrier that is inexpensive, easy, and quick to make for when they first arrive.

Task

Design a water carrier that is easy to make using inexpensive materials.

Requirements

- Newsprint paper, masking tape, and craft sticks are very inexpensive,. These will be the supplies used to build a water bin. You are allowed:
  - A half-sheet of newsprint paper (29 x 22cm, 6.1 g) OR designers at home who do not have newsprint may use 2 sheets of regular copier/printer paper (A4/letter)
  - 4 wooden craft sticks (4.4 g) - eg Popsicle™ sticks OR designers at home who do not have craft sticks may use 8 toothpicks
  - 80cm of masking tape (1.5g), 2 cm (1 inch) wide
- The bin you design must **hold 200mL** of water for **at least 3 minutes**.
- Bin must stand on its own on a flat surface.

Constraints

- Bin designs will be judged by the ***engineering efficiency ratio***. This is the ratio of the amount of water retained at the 3 minute mark to the mass of materials used.

$$\frac{\textit{volume of water}}{\textit{mass of materials used}}$$

volume of water ← *total left in your water bin after 3 minutes*

mass of materials used ← *mass of newsprint, tape + craft sticks used in your bin*

- Bin may not be taped to any surface nor supported by anything but the materials in the list above.
- Should be easy to fill using a stream of water from a dispenser.

Workbook inspired by https://www.vistathink.com/water-tank-engineering-from-newspaper-part-2/

Picture from The Israeli Times

Questions

Reflect and Record

Now that you've read through the Design Brief, what questions do you have?

ASSIGNMENTS

Check off when you've completed in G-Classroom

☐❑ Most restrictive requirement

In Google Classroom, identify which *requirement* or *constraint* will be the most restrictive and explain why.

You may complete this via text, audio, or video.

☐❑ Half-scale model

Build a one-half-scale model of your first idea for how to solve the problem in the Design Brief. Record your results on the next page. Add any new questions that occurred to you, above.

If you can't think of any questions, consider:

1. What do I need to know, that I don't already know, in order to work on this challenge?
2. What information is missing from the Design Brief?
3. How can I find out what I don't even know that I don't know about this?!?!

First Idea

Record your first idea for how to solve the problem described in the Design Brief.

1. Draw a sketch
2. Add *annotations* -
   notes with arrows to describe & point out key aspects of your idea

3. Test Result - Water Held @ 1.5 min _____mL

4. When you tested it, what went well? What could be improved?

Learning resources

Media Options	I learned.../This made me think...
Which shapes are good ideas for water tanks? OR http://tiny.cc/o507tz	
Why are water tanks round? OR http://tiny.cc/p507tz	
Easy origami box (1:28 min) OR https://youtu.be/JK5Ni5_WEM4	
Water tank definition on Wikipedia OR http://tiny.cc/w507tz	
Paper water bomb video (4:33 min) OR https://youtu.be/bzdHmBSd5TU	
Video of newsprint water bin test (3:43 min) OR https://youtu.be/PLyx9sDAonc	

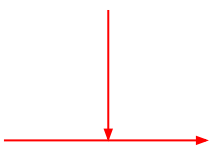
Which design ideas seem helpful to solve the problem? Why?

Which design ideas will probably not work to solve the problem? Why?

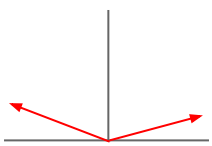
3D Drawing Practice

Practice drawing a crate, then using it to draw your idea *within it*.

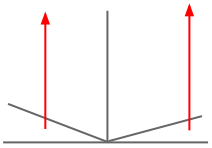
1. Draw upside down "T"



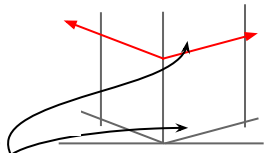
2. Add lines at about 30°



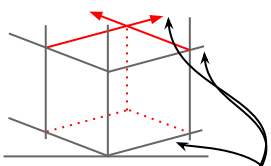
3. Add verticals parallel to middle



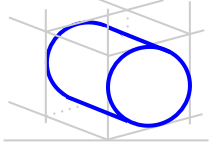
4. Add top lines



5. Add back lines parallel to others

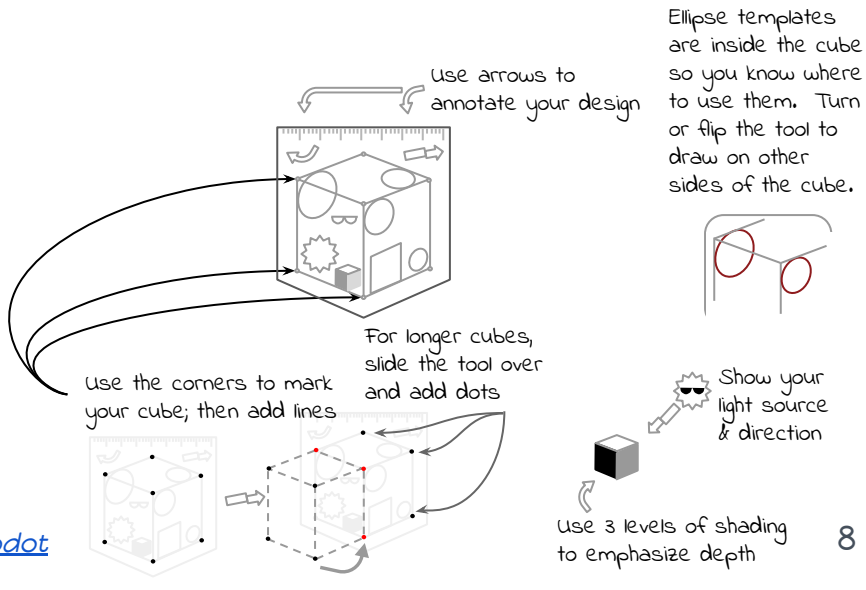


6. Use crate to guide your design



MicroDOT 3D Practice

Practice drawing crates using the MicroDOT tool. Try cubes & rectangular prisms. Then try drawing cylinders, other prism shapes, and other items within crates.



MicroDOT tool from DTResources:
https://dtresources.co.uk/collections/microdot

Ideation

Sketch 3 *different* ideas for your water bin solution, in 3D.

E.E.R

Engineering Efficiency Ratio Calculations

$$EER = \frac{\textit{volume of water}}{\textit{mass of materials used}}$$

← *total left in your water bin after 3 minutes*

←*mass of newsprint, tape + craft sticks used in your bin*

Here is some data from previous designers' water bins. Calculate the engineering efficiency ratio for each of their results. Do you find any surprises? What do these E.E. ratios mean for your design?

Designer	Water retained after 3 minutes	Mass (by weight) of bin materials	E.E.Ratio
Mark	171 mL	20.95 g	
Gehan	160 mL	17.8 g	
Janet	50 mL	4.3 g	
Hyu bin	180 mL	12.5 g	
Marco	100 mL	15.4 g	
Elena	120 mL	16.2 g	

Based on my results, to improve the E.E.Ratio of my design, I should:

ACCESS-FM

A esthetics
- What does it look like?
- What shape is it?
- Do you like it? Why?

C ost
- How much does this cost?
- Why is it a good value (or not)?

C ustomer
- At whom is this product aimed?
- At what age range?
- How will they use it / re-use it?

E nvironment
- Does it produce any waste?
- If so, what kind? How much?
- Could it make other people uncomfortable?
- Did its manufacture cause pollution? If so, what kind?

S afety
- Are there any ways the user could hurt themselves? Eg: cut, pinch, pierce,
- Is there anything that could come off or harm a child?

S ize
- What are the key dimensions?
- Is it suitable for its task?
- What makes it suitable (or not)?

F unction
- What does it do?
- How does it work?
- Is it easy to use?

M aterial
- From what is it made?
- Are the materials appropriate? Why?
- How is it made?
- Is it well made?

Design Specification

Use each of heading to choose one or more questions to answer in detail. Try to fully describe your design. Write each point as a complete sentence:

"My design is/should be ... because ... "

Product Analysis

You can also use this list to analyze existing products. This can help you understand what is commercially successful. Answer the questions with your personal opinions. Compare notes with other designers for additional perspective.

Presentation Sketch

Review your 3 ideas and choose the one you think is most *feasible*. Sketch a clean, annotated 3D version to turn in. **Review the rubric** on the next page!

Sketch Rubric

Green = all students; work on these first

Blue = most students; work on these after you complete all green items

Black = stretch! Choose one (or more) of these if you complete all blue items

- ➔ I included a lightly drawn crate
  (the crate may show signs of redrawing to find the most effective line)
- ➔ The design is drawn a bit heavier (2 line weights: crate + design)
- ➔ I've included details in my sketch showing some hidden items, using dotted or dashed lines (2-3 of: tape, craft sticks, hidden lines, folds, cut-lines, etc.)
- ➔ All design edges were drawn clean and smooth, not artistic sketchy
- ➔ I've annotated up to three details of my design (eg: part locations, construction aspects like folds or cuts, and so on)

- ➔ I clearly used a lightly drawn crate to *guide* the sketch of my design
- ➔ I added a darker/thicker outline around the outside edge of my design
- ➔ My sketch included more than 3 detail elements (see list above)
- ➔ Behind my design I placed a colored box (this touches but doesn't overlap past the edges of my design - it may cover some of the crate)
- ➔ I've annotated more than 3 aspects of my design; it could be built by someone else without any help from me

- ➔ My design has a shadow
- ➔ The object is shaded
- ➔ I've used 4 or more different line weights to show various aspects of the design:
  - construction guides / crate
  - interior lines
  - exterior lines / edges
  - contour/detail lines
  - shadow edges
- ➔ I've included a size reference (a human, a body part) at accurate scale
- ➔ My design is drawn to scale and I've indicated the scale

My Test Results

Use this table to record the results of your water bin model tests.

Remember:

$$\text{EER} = \frac{\textit{volume of water}}{\textit{mass of materials used}}$$

Design (# or name)	Water retained after 3 minutes (mL)	Mass of bin materials (g)	Engineering Efficiency Ratio

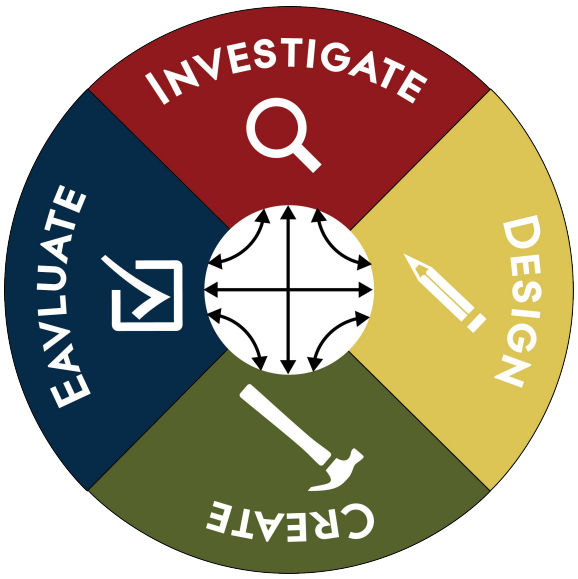
Final Reflection

On the left, please write a reflection about your project and your process of using our MS Design Cycle.

1. Use proper paragraph format, as you have practiced in Language Arts classes.
   a. **This includes using punctuation and capitalization.**
   b. Be sure to use transitions between sentences.

2. Your paragraph should include:
   a. **Topic sentence** - one sentence summarizing the success of your process & product
   b. **Evidence** - results of your product **and** aspects of your process to support your topic sentence
   c. **Explanation & Analysis** - why the evidence you chose supports your topic sentence
   d. **Conclusion** - wrap up or finish the paragraph; summarize or connect back to your topic sentence

(note: you don't need to color code your sentences)



See the next page for sentence starters, useful phrases and word bank

Writing in Design Technology

Writing about your design project

Write about your own ideas and process.

- I am really pleased with _____ because _____
- I had difficulty with _____. However, _____ went well.
- The part of my project that worked well was _____
- Initially I found _____ then I discovered that _____

I think that...	Another idea would be to....	
...reminds me of...	...reflects....	I like ... because ...
...suggests that...	...next time...	...makes me feel...
...reinforces...	...this particular idea....	

Introducing Evidence

Add evidence to support your main point.

for instance	meanwhile	as shown by
in the case of	because	this was because
for example	illustrated by	
such as	this can be backed up by	
clearly shown	the evidence to support this is	

Explanation and Analysis

Compare, contrast, or emphasize ideas. Explain the details of a statement you've made or a question you've posed.

although	likewise	however
nevertheless	as long as	but
unlike	just like	whereas
by comparison	instead	yet
in spite of	despite	similarly
because of this	still	unless
even so	except	in contrast
while	on the other hand	
otherwise	apart from	alternatively
equally	surely	obviously
significantly	especially	least of all
it would	clearly	in particular as
well as	above all	therefore
notably	too	this meant
I noticed	observing that	

Linking ideas together

Example: I started by drawing my design on the paper. **In addition**, I highlighted the parts I think are most important.

in addition	in spite of	next
also	it would	then
previously	besides	moreover
as well as	because	so that
and	this meant	
furthermore		

Linking ideas through time

Example: **At first** I used a ruler to measure and mark out all the lines, **next** I checked the angles using a tri-square.

at first	firstly	at length
eventually	later	until
after	ultimately	next
soon	earlier	meanwhile
lastly	finally	secondly
before	from that point	

Based on " Water Tank Engineering from Newspaper" at VistaThink