

The Best 3D Printing Lesson Plans for the Classroom



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WELCOME!

1. Getting started
2. The Design Process
3. Lesson Ideas
4. Resources
5. Tools for 3D Modeling
6. Workshop Challenge
7. Closing & Reflection



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- Instructional Facilitator of Technology
- Educator for 8 years
- K, 4, 5
- 3D printing for 4 years
- with K-5 classes
- Content creation & the SMART Lab
- Makerbot Ambassador

Trials & Errors of 3D Printing

- It doesn't happen overnight
- Getting to know your printer
- Filament? PLA? ABS? Acronyms for days...
- Temperature, Supports & Sanity



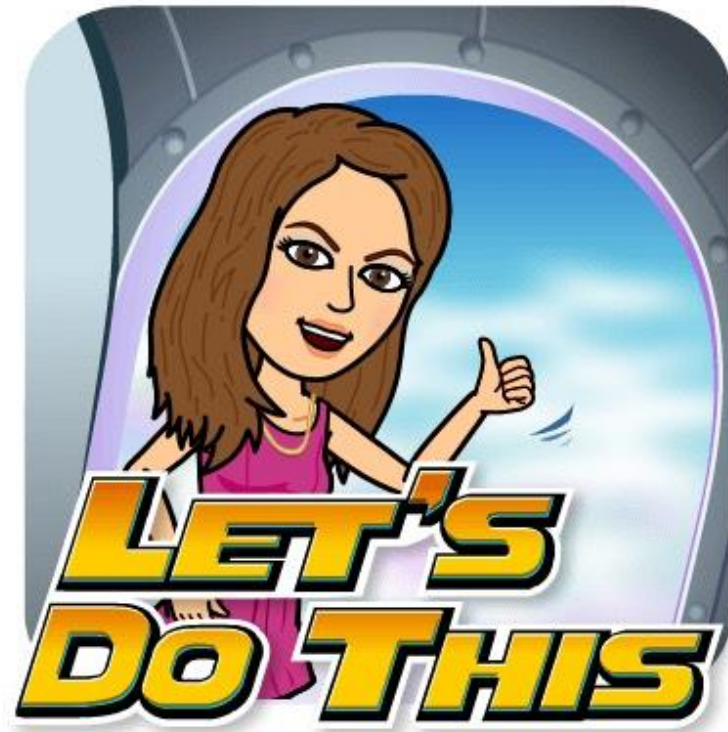
Trust the Process

3D isn't about having something,
it's about the process

- Critical thinking
- Learning in 3D
- How to manipulate an object
- Turning & movements
- Angles, lines, grids, measurement!
- Trial & error



Lessons!



Kindergarten:

Community Helpers – Part 1

Kindergarteners were asked to use Blokify or STEM objects & the 3D scanner to create a building in which a community helper would work.



Real world example: community helpers include jobs such as police, firefighters, doctors, sanitation workers, teachers, construction workers, etc. Students need to know about the people who make the community run effectively.

By creating these structures students were able to construct their own class community complete with all of the necessary buildings that help run our world.

Kindergarteners chose from a hat which community helper they were building and then created their part of the community. The finished project assembled and entire town.

Kindergarten:

Community Helpers – Part 2

Kindergarteners were asked to use Blokify or STEM objects & the 3D scanner to create a building in which a community helper would work.



Real world example: community helpers include jobs such as police, firefighters, doctors, sanitation workers, teachers, construction workers, etc. Students need to know about the people who make the community run effectively.

By creating these structures students were able to construct their own class community complete with all of the necessary tools & supplies that help our community's workers.

Kindergarteners continued working with their previous community helper create a tool that would be used by that job. (ie: a police officer might have handcuffs)

First Grade:

Describing words and attributes

First Graders were asked to use Selva 3D to create the face for Jack-O-Lanterns. The facial features needed to have a “tab” so they would accurately fit into the pumpkin.



Real world example: First graders needed to use descriptive words to explain their facial feature and then describe it in relation to the rest of the face.

By creating these piece of the Jack-O-Lantern students used vocabulary words like “next to”, “underneath”, “between”, etc. to describe the position of an object. They also had to use words to describe their shape: “round”, “bigger”, “smaller”, etc.

First graders were thrilled to actually create their Jack-O-Lantern face and then put them into a real pumpkin.

First Grade

Patterns

First Graders were asked to use Selva 3D to take their hand drawn patterns and turn them into 3D creations!

REAL WORLD EXAMPLE: PATTERNS CAN BE FOUND IN IDEAS, WORDS, SYMBOLS, NUMBERS, AND IMAGES. THEY CAN ALSO BE FOUND IN BEHAVIOR, ROUTINES, AND IN NATURE.

By understanding patterns, children are able to make predictions about what should come next.

FIRST GRADERS CREATED THEIR UNIQUE PATTERNS TO SHOW AN “A-B” OR AN “AA-BB” MATHEMATICAL SEQUENCE.



First Grade

Physical Adaptations

Lesson Plan: <https://www.thingiverse.com/thing:1695812>

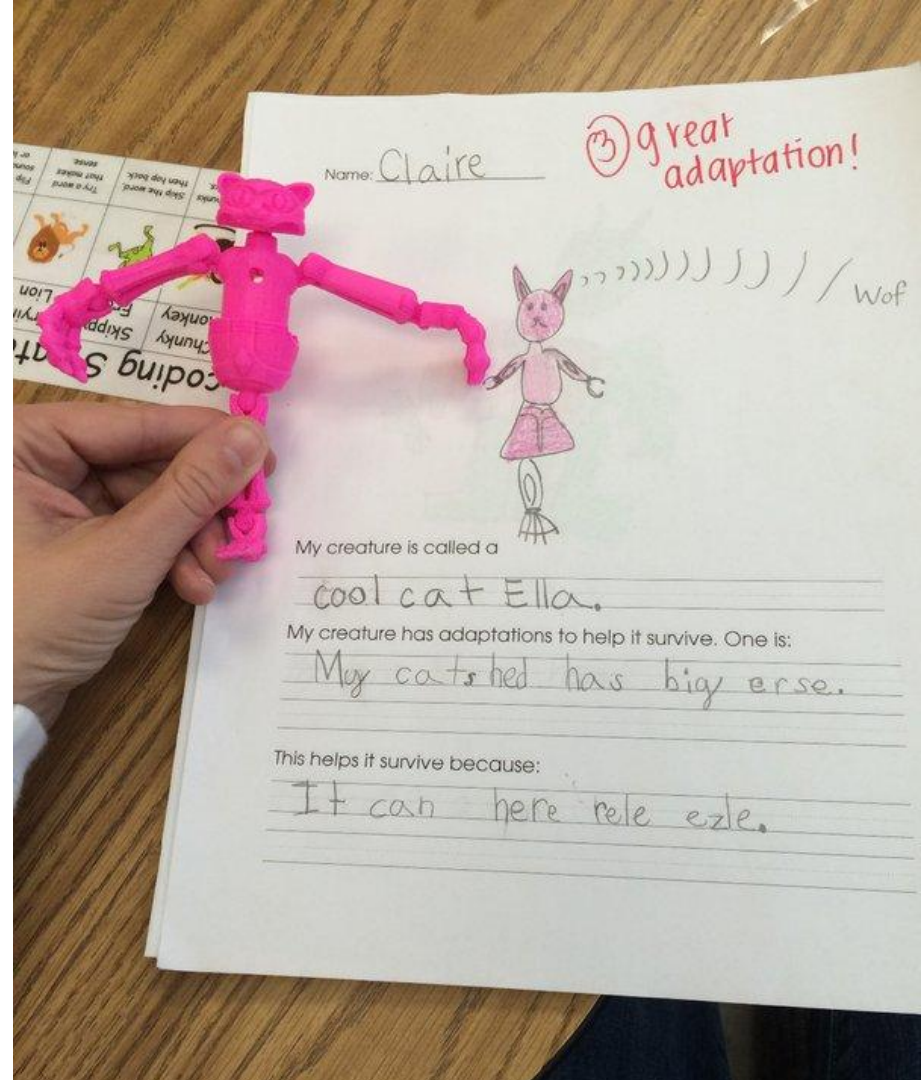
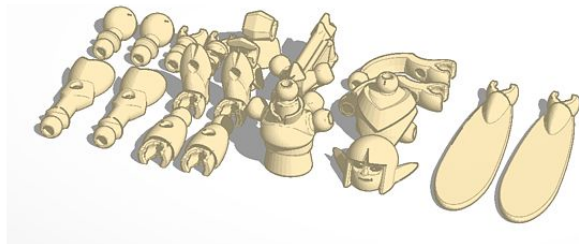
First Graders were asked to use Tinkerplay/TinkerCAD to develop an action figure with preset body parts to represent physical adaptations learned in class!

REAL WORLD EXAMPLE: THE FENNEC FOX OF NORTH AFRICA HAS LARGE EARS WHICH SERVE A DUAL PURPOSE.

- First, they are great for listening for bugs to eat that may be moving around underground.
- Second, they are loaded with blood vessels, allowing the animals to get rid of excess body heat.

FIRST GRADERS CREATED THEIR UNIQUE ANIMALS AND THEN HAD TO JUSTIFY HOW THEIR ADAPTATIONS HELPED THEM TO SURVIVE.





Second Grade:

Survive a Flood

Lesson Plan: <https://www.thingiverse.com/thing:1711704>

Second Grade's STEM challenge was to use TinkerCAD to design a structure that could survive a flood as part of their weather unit!

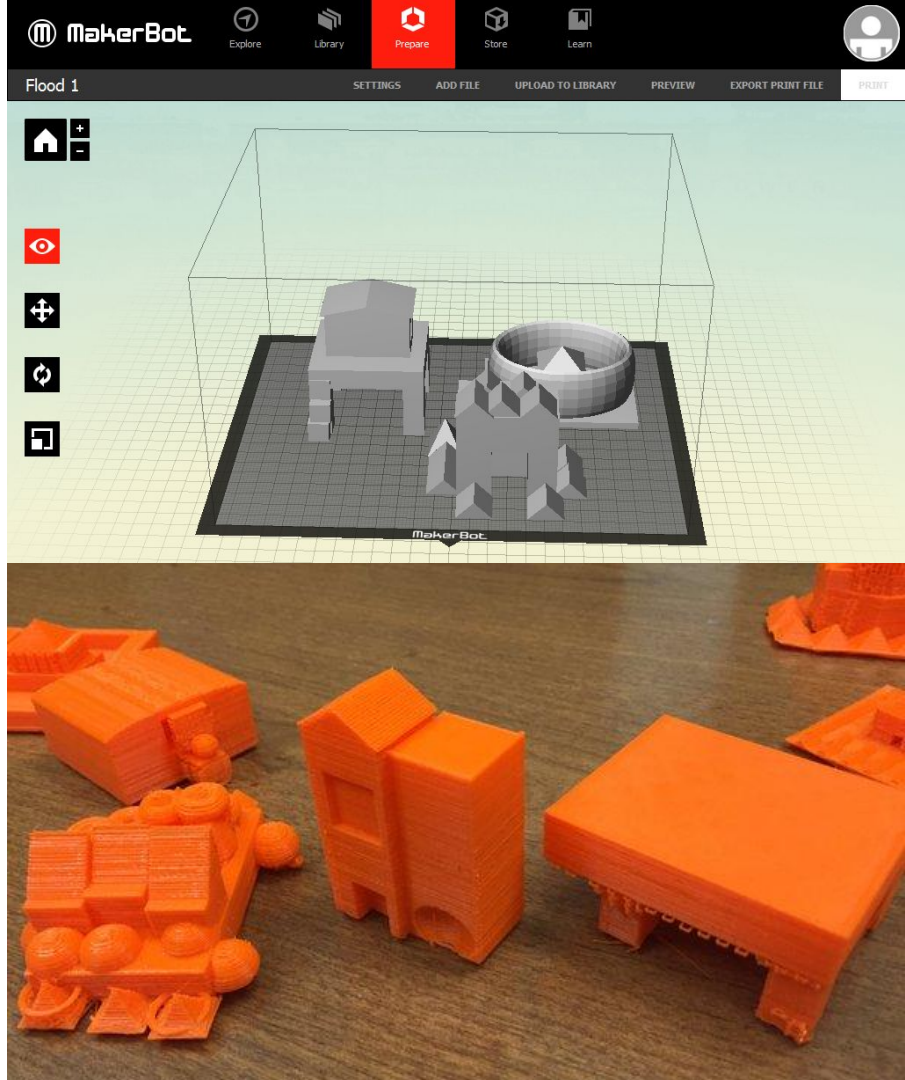
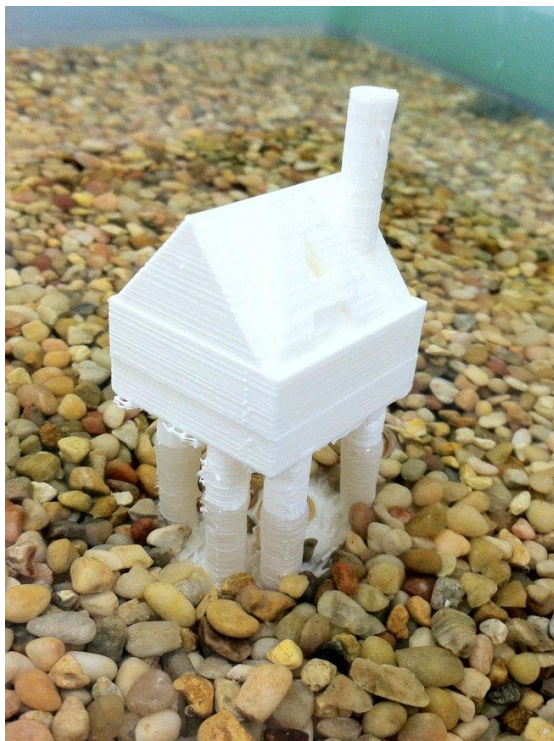


REAL WORLD EXAMPLE: BUILDINGS NEED TO HAVE A SOLID SHAPE AND BLUEPRINT WITH DETAILS SUCH AS DOORS, WINDOWS, CHIMNEYS, ETC.

The architecture must be designed to withstand large storms

ASK YOURSELF HOW DOES EROSION, MUDSLIDES, ETC. CONTRIBUTE TO YOUR DESIGNS?

SECOND GRADERS PLANNED, DESIGNED, AND PRINTED THEIR STRUCTURES TO WITHSTAND A FLOOD. THEIR STRUCTURES WERE THEN TESTED TO DETERMINE THE BEST ARCHITECTURE FOR THE JOB!



Second Grade:

Animal Habitats

Second Graders were asked to use TinkerCAD to create a habitat suitable for an animal that lives in an ecosystem of their choosing (forest, desert, tundra, etc.). The habitat must include shelter and a food source!



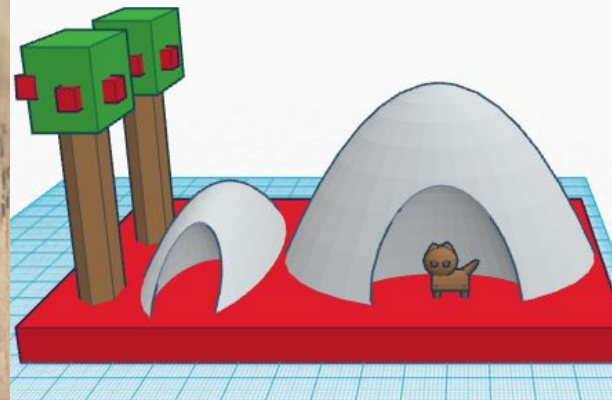
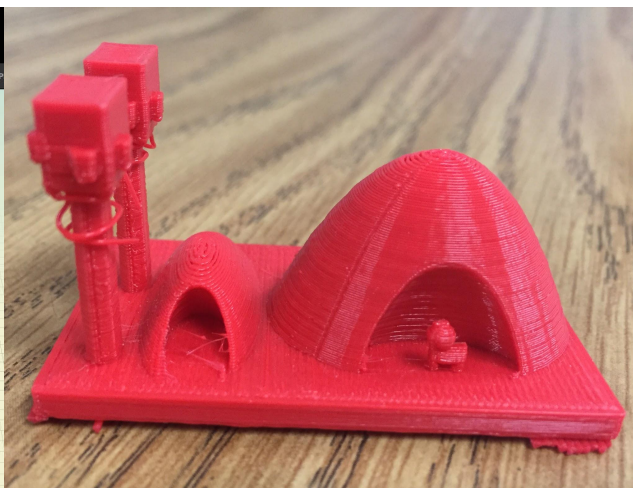
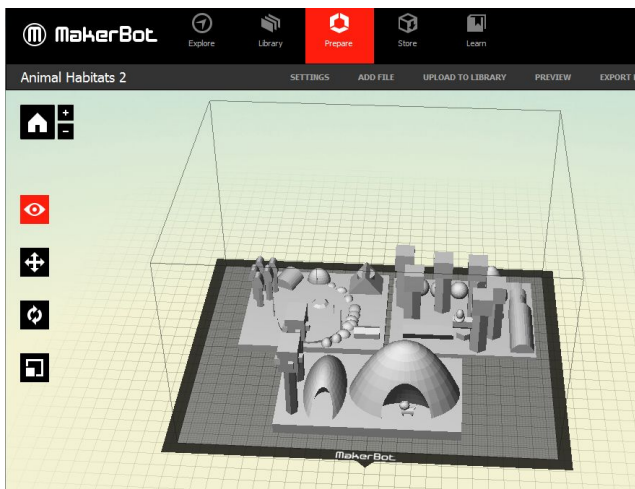
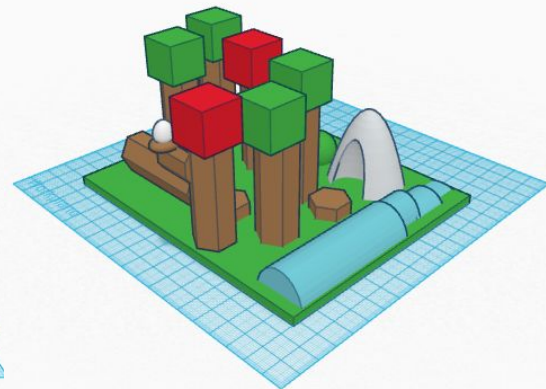
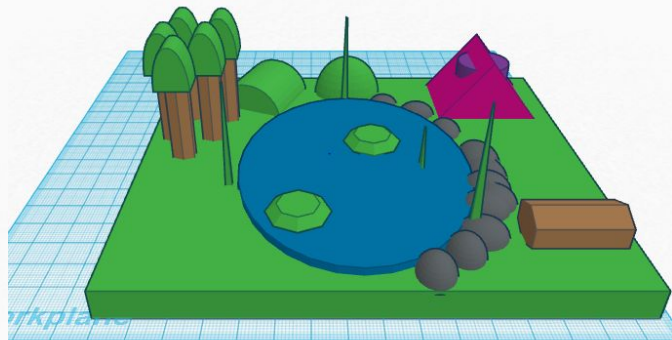
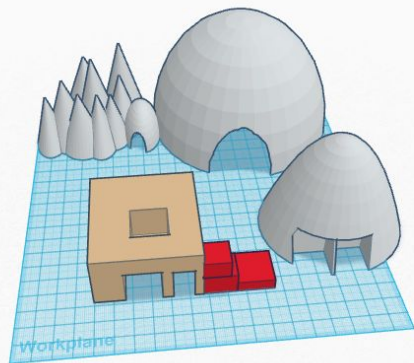
REAL WORLD EXAMPLE: EXPLORING THE NATURAL AND PHYSICAL ENVIRONMENT WHERE LIVING ORGANISMS CAN FIND:

Food, Shelter, Protection, and the ability to Reproduce.

EXAMPLES OF HABITATS INVESTIGATED ARE:

Desert, Tundra, Rainforest, Ocean, Savannah, Forest

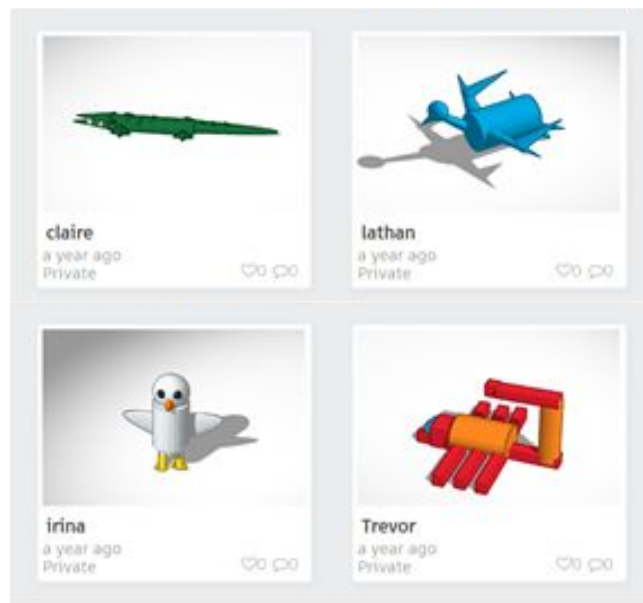
SECOND GRADERS NEEDED TO IDENTIFY THE HABITAT THEY WERE CREATING, INCLUDE THAT HABITAT'S FEATURES AND THEN MAKE IT SUITABLE FOR AN ANIMAL TO LIVE.



Second Grade:

Animals

Second Graders were asked to use TinkerCAD to create a wild animal that lives in a specific habitat.



REAL WORLD EXAMPLE: Second graders learn about 6 different types of habitats: Artic, Ocean, Glassland, Dessert, Forest, Wetlands

Students got to choose which habitat they wanted to focus on. Then they brainstormed animals that would live there. Students chose their animal and spent 3 class periods creating the animals and learning the design tools of TinkerCAD.

SECOND GRADERS then received their animals and made **STEM** habitats for them that contained their basic needs (food, water, shelter, space). Once their **STEM** habitats were complete they were able to place their animal & habitat on a large world map to demonstrate where these habitats exist.

Second Grade:

Native American Homes

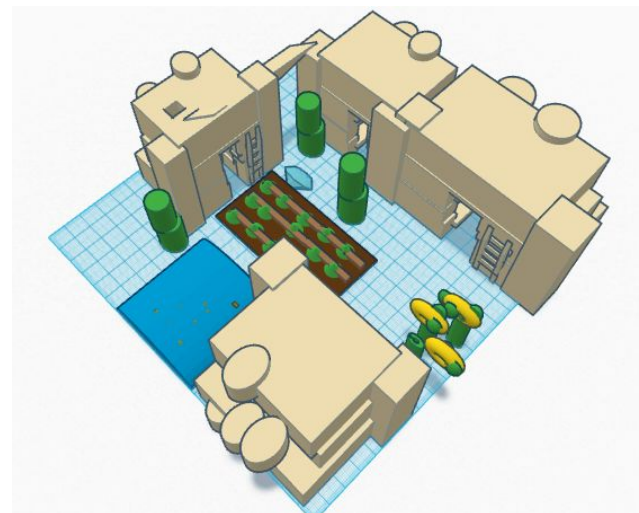
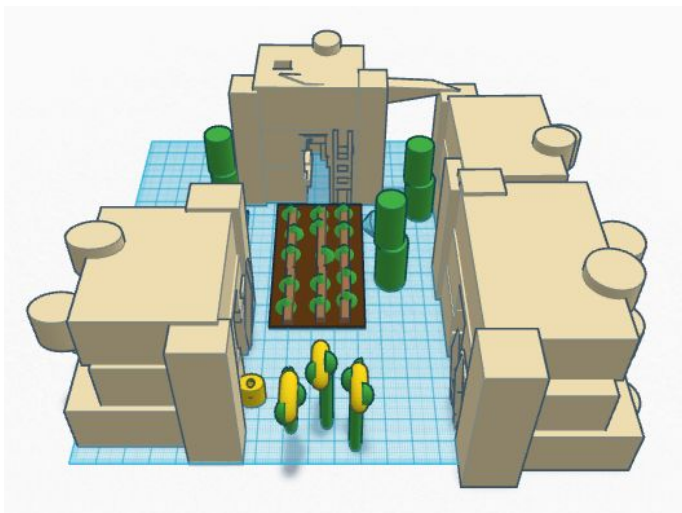
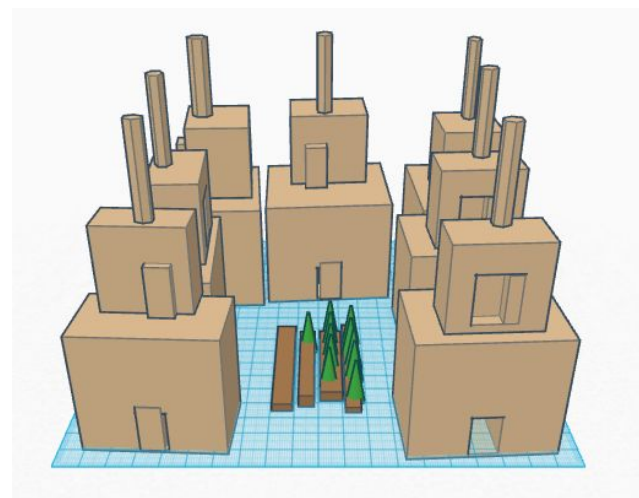
Second Graders were asked to use TinkerCAD to design an example of a Native American home that represented the architecture and materials available in the region!



REAL WORLD EXAMPLE: THE PUEBLO WAS BUILT BY AMERICAN INDIANS IN THE SOUTHWEST EITHER INSIDE CAVES OR ON THE SIDES OF LARGE CLIFFS.

- Built of bricks made from adobe clay by mixing clay, sand, grass, and straw together and then setting them in the sun to harden.
- Clay rooms were built on top of each other, sometimes as high as 4 or 5 stories tall. Each room got smaller the higher the pueblo was built.
- Ladders were used to climb between the floors.

SECOND GRADERS NEEDED TO DESIGN A HOME THAT WAS REALISTIC TO THE TIMES. THEY INCLUDED BOTH STRUCTURAL AND LANDSCAPING TO SHOW OFF THEIR KNOWLEDGE OF NATIVE AMERICANS.



Third Grade:

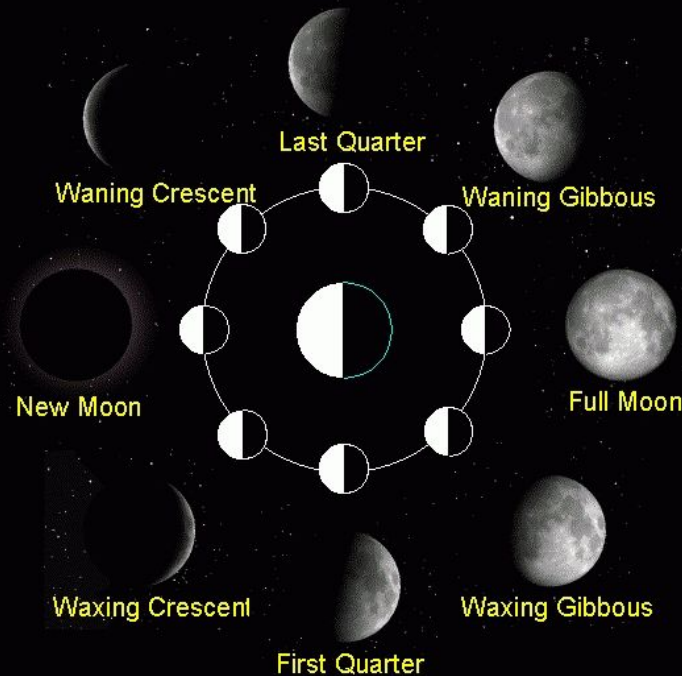
Phases of the Moon

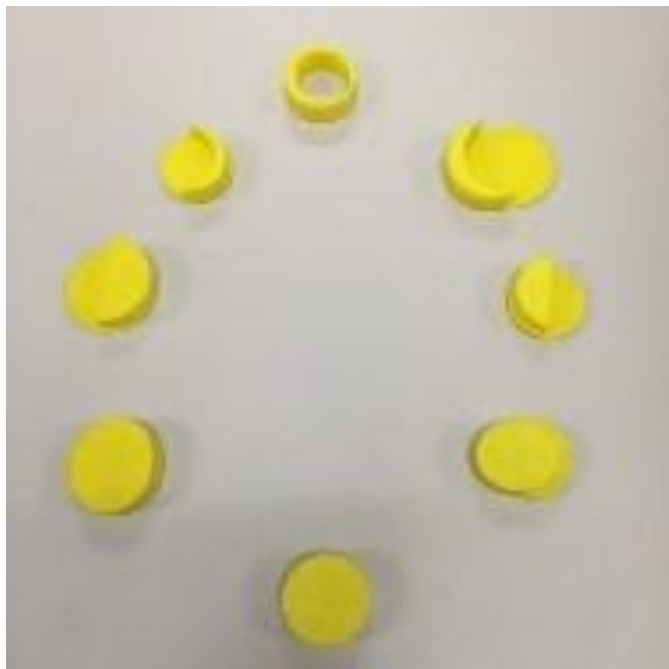
Lesson Plan: <https://www.thingiverse.com/thing:1711573>

Third Graders were asked to use TinkerCAD to design the 8 moon phases by dragging, resizing, rotating, and grouping geometric shapes and holes!

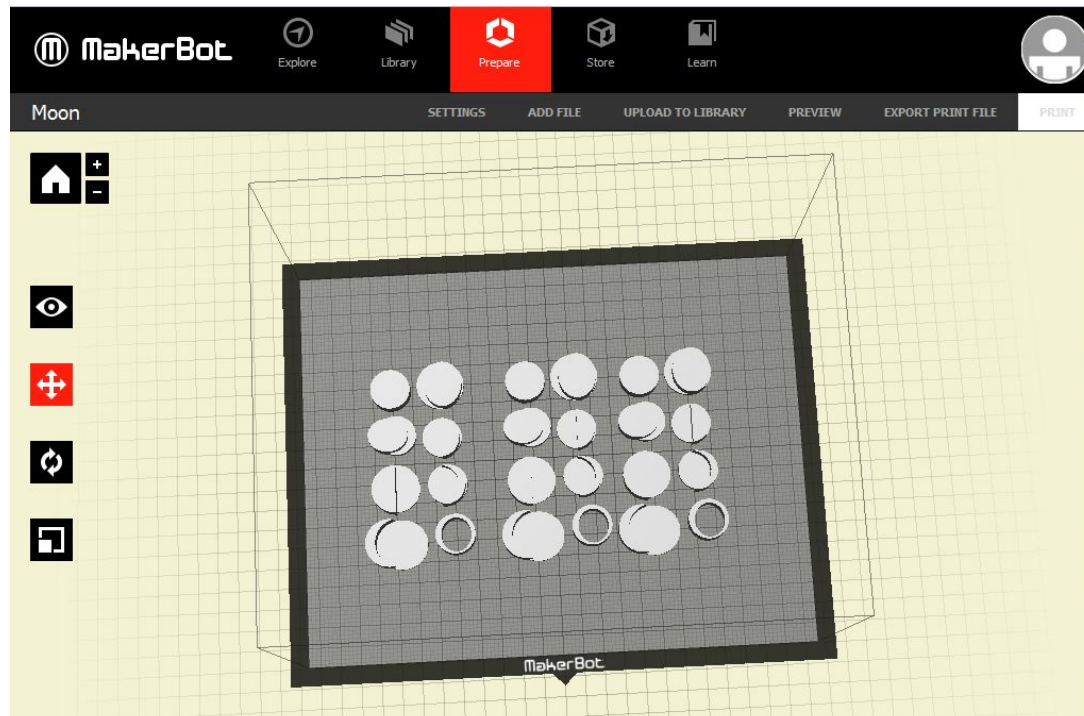
REAL WORLD EXAMPLE: AS THE MOON REVOLVES AROUND THE SUN WE SEE THE MOON IN IT'S 8 DIFFERENT PHASES

Third graders needed to design and order their own moon phase cycle by identifying the attributes that we see here on Earth throughout a month's time.





Took the best model. Created activities with the pieces: sorting games, partnering up, descriptions, grouping, etc.



Fourth Grade:

Weather Tools

Lesson Plan: <https://www.thingiverse.com/thing:1711784>

Fourth Graders were asked to use TinkerCAD to build actual weather tools (Rain Gauge, Anemometer, etc.) that would work in the real world!

REAL WORLD EXAMPLE: BY UNDERSTANDING PATTERNS OF TEMPERATURE, WIND, AND RAINFALL AS MEASURED BY INSTRUMENTS, WE CAN DESCRIBE OUR LOCAL WEATHER AND CLIMATE.

- Barometers and Anemometers
- Thermometers and Rain Gauges
- Wind Vanes

Different Types of Weather Tools

Barometer

- Measures air pressure (Low means Lousy; High means Dry)
- Used to predict rain or sun
- Measured in millibars (mb)

Anemometer

- Measures wind speed
- Measured in Miles per Hour (mph), Feet per Minute (f/min), etc.

Thermometer

- Measures temperature or amount of thermal energy in the air
- Measured in degrees Farenheit, Celcius, or Kelvin

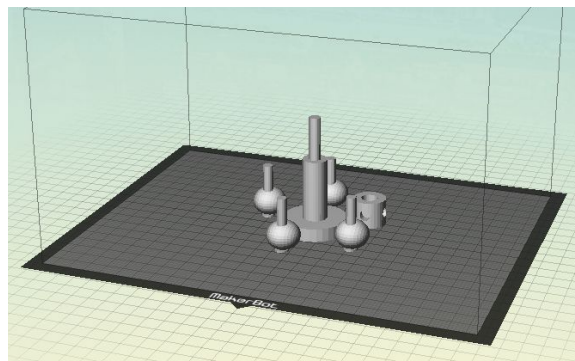
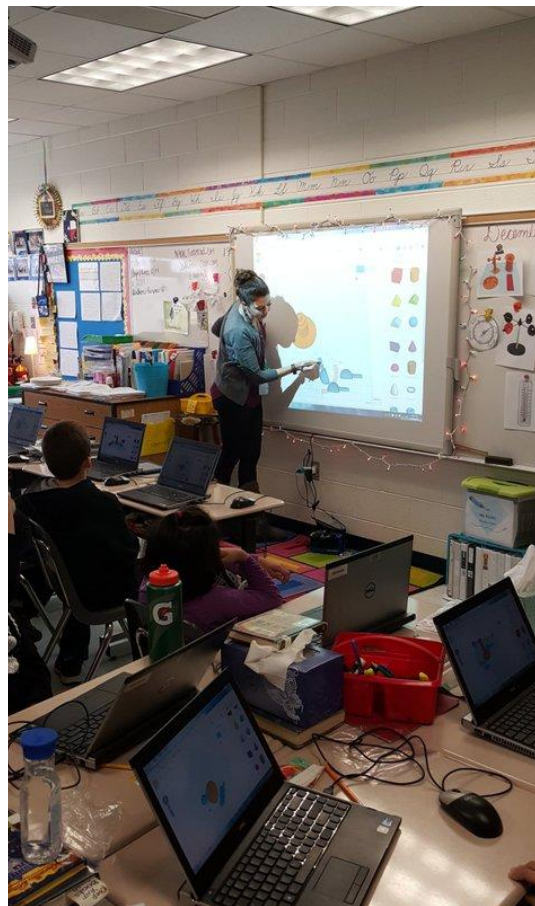
Rain Gauge

- Measures the amount of precipitation in a given amount of time
- Measured in millimetres (mm)

Wind Vane

- Measures wind direction
- Measured in cardinal & intermediate directions (N, S, E, W, NE, SE, NW, SW)

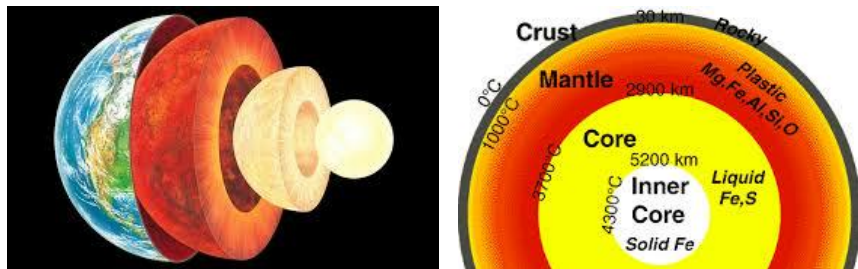




Fifth Grade:

Layers of the Earth

Fifth Graders were asked to use 3D Shape Creator: 3D Revolved Modeling App to design their interpretation of the four main layers of the Earth!



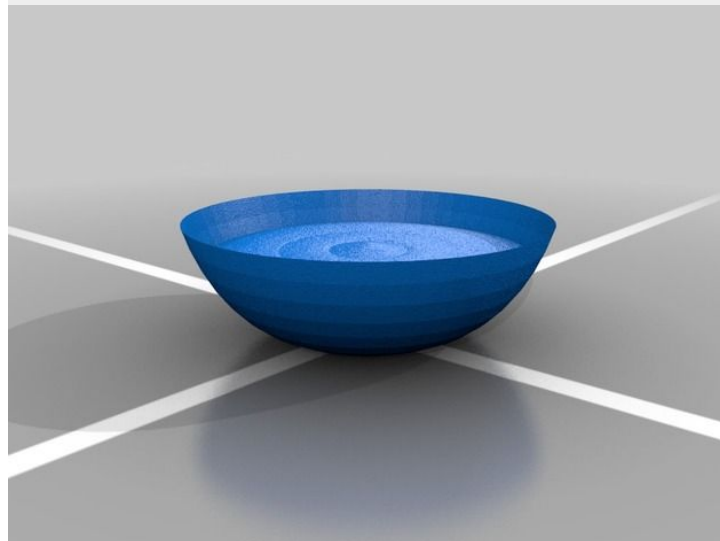
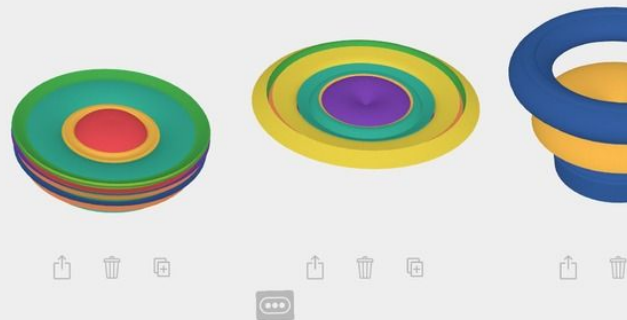
REAL WORLD EXAMPLE: RESEARCHERS HAVE GATHERED ENOUGH DATA TO PROVIDE THE WORLD WITH DETAILED ACCURATE MAPS OF THE LAYERS OF THE EARTH'S INSIDE

- Scientists are focusing on the boundaries between layers, rather than the layers themselves
- Earthquake prediction lies in understanding these boundaries

FIFTH GRADERS CREATED AND DESIGNED THE CRUST, MANTLE, OUTER CORE, AND INNER CORE OF THE EARTH. THE SIZE OF THE DIFFERENT LAYERS NEEDED TO BE PROPORTIONAL IN RELATION TO ONE ANOTHER.



Revolved



Fifth Grade:

Ocean Floor

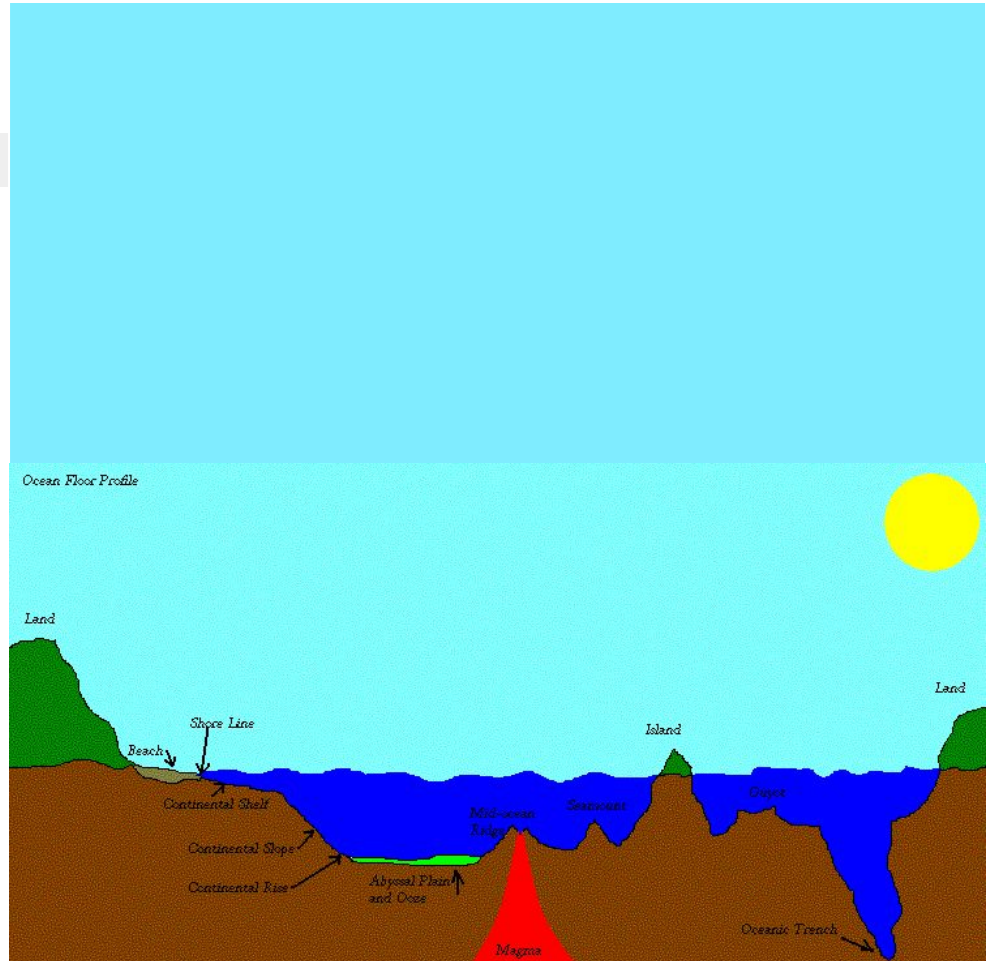
Lesson Plan: <https://www.thingiverse.com/thing:1716893>

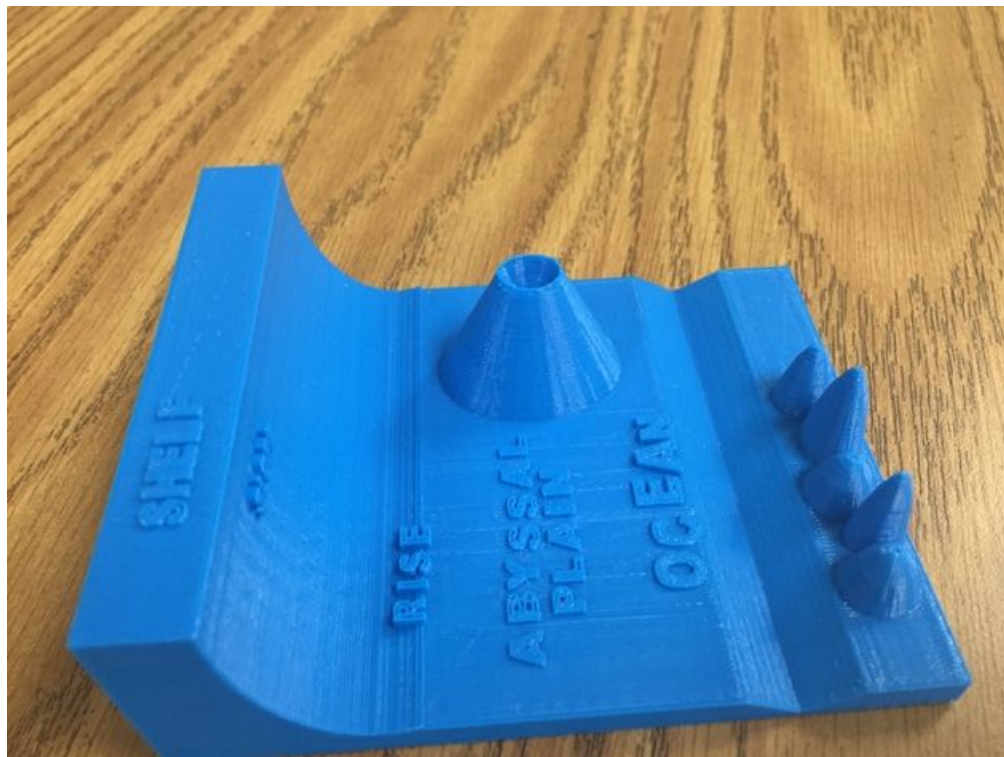
Fifth Graders were asked to become an oceanographer to conduct research about the components of the ocean floor. By using TinkerCAD, students built these features.

REAL WORLD EXAMPLE: THE OCEAN FLOOR INCLUDES:

- continental shelves and slopes
 - canyons and oceanic ridges
 - trenches and abyssal plains
 - volcanoes, etc.
-

FIFTH GRADERS DESIGNED THE LAYERS OF THE OCEAN FLOOR FOCUSING ON THE DIFFERENT DEPTHS OF EACH COMPONENT.

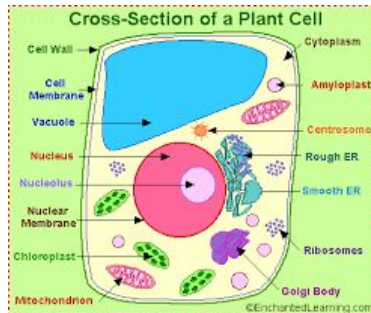
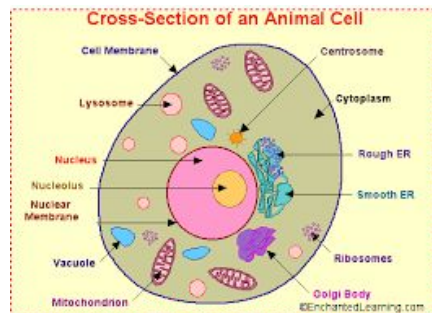




Fifth Grade:

Plant and Animal Cells

Fifth Graders were asked to choose between an animal cell or a plant cell. Students used TinkerCAD to draw and label the fundamental structures!



REAL WORLD EXAMPLE: THE CELL IS ONE OF THE MOST BASIC UNITS OF LIFE AND ARE GROUP TOGETHER IN COLLECTIONS CALLED TISSUES

Some cell types include: Bone, Muscle, Nerve, Cartilage, Blood, etc.

ALL CELLS HAVE 3 MAIN AREAS: CELL MEMBRANE, CYTOPLASM, AND NUCLEUS

FIFTH GRADERS NEEDED TO DESIGN THEIR CELLS TO HAVE EACH OF THE MAJOR CELL STRUCTURES AND DESIGN THEM ACCORDING TO THEIR CORRECT PLACEMENT AND SIZE WITHIN THE CELL.



Resources!

- [Bit.ly/3DMakerbot](https://bit.ly/3DMakerbot)
- Thingiverse Education
- The Smithsonian Institute & Downloads
- Pinshape Education
- Your Own Building!
- Twitter

Cool Tools

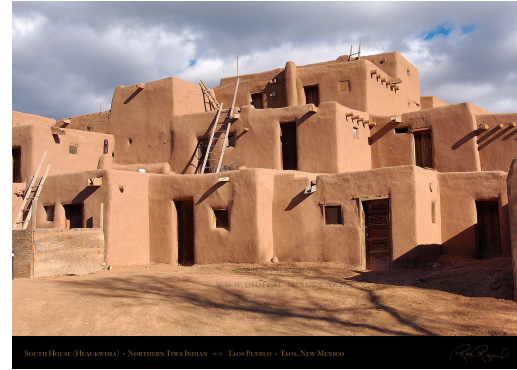
- **3D Modeling:**
 - TinkerCAD
 - 3DC.io
 - Morphi
 - 3D Shape Creator: 3D Revolved Modelling App
 - 3D Scanner
- **Turn 2D into 3D:**
 - Selva 3D
 - Embossify

Creation Challenge

Working with at least one of the following -
TinkerCAD, 3DC.io, Morphi, Selva 3D, Embossify, the
3D Scanner - Create a design that fits this criteria:

Original work that represents one of the 3 major types
of Native American Homes:

Pueblo, Long House, Wigwam



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www.makerbot.com