

NET-BOTS/PLAYFUL SOLIDS

GRADES: 4th-5th

OVERVIEW DESCRIPTION OF UNIT:

Through exploring and developing skills in sculpture, students will create individual three-dimensional sculptures inspired by contemporary sculptors such as Nam June Paik, (robot iteration) or David Smith and Anthony Caro (public art sculpture iteration) as well as images from visual culture. With restricted materials, students will use three-dimensional forms and concepts of negative space to show how artists can create volumetric sculptures. Students will demonstrate their knowledge of technology by using iPad applications and strengthen their math abilities in finding area, volume, identifying shapes and solving multiple step word problems.

HABITS OF MIND:

- Students will learn and practice persistence throughout the unit
- Students will be teamed up to engage, envision, stretch and explore in unit activities
- Students will be encouraged to observe and reflect on their work and the work of others

VOCABULARY-ACADEMIC/SHARED:

sculpture, shape, solid, figure, measure, three-dimensional, two-dimensional, nets, critique, analyze, determine, value, architect, compare, emphasis, balance, design, grid, surface, detail, base, height, scale, angle, edge, polygon, rectangle, rhombus, trapezoid, cone, cylinder, cube, face, vertices, rotate, plane, attribute, parallel, perpendicular, right angle, obtuse angle, acute angle, rectangular prism, right rectangular prism, triangular prism, square prism, square pyramid

ART LEARNING

EMBEDDED STRANDS:

- 1-Art-making
- 2-Developing Art Literacy: Looking/ Discussing; Arts Vocabulary; Interpreting/ Analyzing (Reading & Writing)
- 3-Connections: Other Disciplines; Observing/Interpreting the World
- 4-Community & Cultural Resources: Public Art; Online Resources/Libraries; Community-based Organizations; Artists' Studios
- 5-Careers & Life-long Learning

GOALS:

Students will:

- explore how two-dimensional paper can be cut and folded to make three-dimensional solids
- understand the importance of negative (empty) space in sculpture
- create original sculptures of figures/ robots/playgrounds/abstractions or public art sculptures by folding paper into solid shapes individually or as collaborative groups (groups artwork can be based on differentiation for student's ability)

BIG IDEAS/ENDURING UNDERSTANDINGS:

- using negative space and positive

space to create figures or forms

- using geometric shapes in art
- applying creative solutions to visual problems

ESSENTIAL QUESTIONS:

What is sculpture and how does it differ from painting or drawing? What are some ways we can use paper to make it three-dimensional?

MATERIALS AND TOOLS:

- graph paper
- construction paper
- colored index or bright card stock paper, suitable for a copier or printer
- pencils (#2, B or 3B)
- erasers
- white glue (not school glue) for making the solids and/or glue sticks
- chipboard for bases
- *Optional:* Foil paper, cellophane, collage printed paper, googly eyes, color-coated wires, buttons, pipe cleaners, broken watch parts, bottle caps, recycled motherboard, old computer parts, etc.

VOCABULARY:

composition, negative space, positive space, color, rhythm, symmetry, asymmetry, abstract, configuration,

component, experiment, fabrication/ fabricator, fringe, fan, curl, scoring/ crease

BENCHMARK SKILLS:

Create a sculpture that demonstrates:

- Stable construction of a three-dimensional form
- Uses 3-D solids, boxes, wood, tubes, found objects: ability to apply techniques of cutting, taping, and slot joining that result in a united balanced assemblage
- Placement of components that describe gesture, movement, and expression
- Identification and rendering of detail
- Additive techniques
- Imaginative ability to build with and mold materials; paper bending and folding
- Organization of parts to a whole
- Controlled use of scissors to cut detailed geometric shapes
- Ability to neatly and evenly apply glue
- Inventive use of positive and negative space

ANCHOR STANDARDS (from National Visual Art Standards):

Creating

1. Generate and conceptualize artistic ideas and work
2. Organize and develop artistic ideas and work
3. Refine and complete artistic work

Performing/Presenting/Producing

4. Select, analyze and interpret and artistic work for presentation
5. Develop and refine artistic techniques and work for presentation
6. Convey meaning through the presentation of artistic work

Responding

7. Perceive and analyze artistic work
8. Interpret intent and meaning in artistic work
9. Apply criteria to evaluate artistic work

Connecting

10. Synthesize and relate knowledge and personal experiences to make art
11. Relate artistic ideas and works with societal, cultural, and historical context to deepen understanding

MATH LEARNING

GOALS:

Students will:

- understand that volume is an attribute of solid figures
- understand concepts of volume measurement
- a cube with a side length of 1 unit is called a “unit cube” and said to have “one cubic unit” of volume, and can be used to measure volume.
- a solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n square units.
- area is an attribute of plane figures
- understand concepts of area measurement
- a square with a side length 1 unit is called a unit square and said to have one square unit of area and can be used to measure area
- a plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units

VOCABULARY:

area, perimeter, volume, bisect, cubic units, unit cube, volume of a solid, degree measure of an angle, kite, parallelogram, perpendicular bisector, quadrilateral, square units

ESSENTIAL QUESTIONS:

How can we use our knowledge of geometry to understand how a flat net will be transformed when folded into a three-dimensional volume? What are some of the various shapes we can construct using nets? What forms can we make with nets?

UNIT MATERIALS AND TOOLS:

- rulers
- pencils,
- graph paper
- worksheets

MATH PRACTICES AND SKILLS:

- apply and extend previous understandings of multiplication and division to multiply and divide fractions
- measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft and improvised units
- solve real world problems involving multiplication of fractions and mixed numbers
- relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume

STANDARDS/Common Core:

- MP1 Make sense of problems and persevere in solving them
- MP2 Reason abstractly and quantitatively
- MP3 Construct viable arguments and critique the reasoning of others
- MP4 Model with mathematics
- MP6 Attend to precision
- MP7 Look for and make use of structure

TECHNOLOGY LEARNING

TECHNOLOGY GOALS:

Students will:

- use an iPad in their art making to sketch and plan
- use *Google Drive* to access art references and to document progress and final work
- use the application *Explain Everything* to record a peer and/or self-reflection and assessment
- observe smart board references of art work

ESSENTIAL QUESTIONS-TECHNOLOGY:

How can we use iPads in our art making? What is a portfolio and how can students document their process and final products?

UNIT TECHNOLOGY NEEDED:

- smart board/digital projector
- iPads with *Explain Everything*, *Shapes*, *Google Drive* loaded
- printer/copy machine

MATH LESSON #1A

Graphing a Shape

Essential Questions:

How does area of three-dimensional solid relate to the volume of a three-dimensional solid?
How much more space does a three-dimensional shape take up if it were to be laid out flat?

Learning Goals:

- Students will be able to use centimeter cube units to build a structure and measure the area and volume.
- Students will compare area and volume to understand the amount of space volume can fill.

Possible Math Component:

After seeing the work of David Smith and Joel Shapiro, students will be asked to create an interesting three-dimensional structure consisting base 10 block units, rods, and flats. The structure should have a base, extend vertically into space, and should have at least doubled blocks (example not just a single row of units, rods or flats). After creating the structure have students count the area that the base of the sculpture fills. Instruct the students to shade/ color the area on graph paper.

Next have students look their base 10 structures/sculpture and identify groupings of rectangular prisms (example: a student may have stacked 6 rods together having two columns and three rows. Another student may have used 6 rods but made three rectangular prisms only with one column and two rows). Explain that volume not only includes length x width, but also includes height. Record the length x width x height of the rectangular prism groupings and solve to find the volume. Add up all the volumes from your rectangular prism groupings. Explain that this is the total volume of the sculpture.

Instruct students to color/shade the total volume of their structure on the graph paper. (Example: The total volume might be 240 cubic centimeters. You would shade in two 10 X 10 squares and four 1 X 10 rectangles.)

Ask the students what they notice about the amount of shaded space that is the area of their sculpture compared to the volume. Why is the volume so much more? What does this tell you about knowing/understanding the volume of something rather just the area?

Differentiation:

Learning or physically-disabled students may need to work with an aide. For advanced students, add an extra follow-up lesson, if possible.

Materials/Tools/Technology:

- base-10 blocks (units, rods, flats)
- graph paper
- pencils
- colored pencils or markers to shade graph paper
- graph paper

Motivation/Visuals/References:

- David Smith and/or Joel Shapiro sculptures of boxy figures

Vocabulary:

graph paper, grid, area, volume, length, width, height

Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Envisioning

Inquiry Question:

- When would it be important for you to know the volume of an object instead of just knowing the area?

ART-MAKING LESSON #1B

Positive and Negative Space in a Collage

Art Essential Questions:

How do artists use shapes to build compositions that have positive and negative space? How do artists create artwork using limited materials and/or shapes?

Goals:

- Students will find creative solutions while working with restrictions.
- Students will understand the difference between positive and negative space in a sculpture.
- Students will understand the difference between a sculpture, which is three-dimensional, and a drawing or painting, which is two-dimensional.

Materials/Tools/Technology:

- pencils
- construction paper (two different colors per student, one 9 x 12" and the other 6 x 9")
- scissors
- glue sticks

Motivation/Visuals/References:

Joel Shapiro and/or David Smith sculptures

Engagement:

Artist/teacher will show or review examples of geometric sculptures on the smart board, pointing out what is a positive shape and what is negative space. Students will be asked to determine the area of the smaller piece of paper (6 x 9= 54" inches). They then will be tasked to create a collage with positive and negative shapes, by cutting up the smaller piece of paper into shapes inspired by David Smith, or if they are doing the robot variation, a figure. No scrap should be discarded and the entire piece of smaller paper should be used. Normally, one would encourage overlapping, but in this lesson, in order to make the point we are trying to make, we need to have the shapes only touch.

Math skills being targeted:

- Understanding how two-dimensional area stays the same as long as all the pieces are used—no area has disappeared

Differentiation:

For learning and/or physically-disabled Students: pair students with an aide, if possible. For advanced students, encourage them to make a second collage with the understanding that it

National Visual Arts Standards:

VA: Cr1.1.4—Brainstorm multiple approaches to a creative art or design problem.

VA: Cr2.1.4—Explore and invent art-making techniques and approaches.

VA: Cr2.1.5—Experiment and develop skills in multiple art-making techniques and approaches through practice.

Vocabulary:

positive, negative, two-dimensional, three-dimensional, area, volume, asymmetry, balance

Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Reflecting, Envisioning

Student Checklist:

- I understand what positive space is
- I understand what negative space is
- I used all of my paper in my collage design, without overlapping

be completely different from the first.

Reflection:

Artist/Teacher will share a few examples of the finished collages, if time.



MATH LESSON #2A

Nets, Prisms, Solids

Essential Questions:

- How are solids created? What 2-D shapes are used to create 3-D solids? What is the relationship between a flat net and the solid I can make by folding up the sides?

Learning Goals::

- Students will be able to use the iPad *Shapes* application to learn about the parts of a solid (base, faces, edges and vertices).
- Students will identify the 2-D shapes that are used to create 3-D solids.
- Students will create a net of 2-D shapes that would create a solid.
- Students will identify multiple solutions of shape combinations to create nets.

Inquiry Question:

- What is a solid and what are its parts?

Materials/Tools/Technology:

- iPads loaded with *Shapes* app
- printouts of nets
- scissors
- rulers
- white glue

Possible Math Component:

- Students will use the *Shapes* application to explore how flat (two-dimensional) shapes can be folded to make solid shapes.
- Explain to the students that there are multiple ways to configure the net for one 3-D solid. Challenge the students to find as many configurations of nets as they can. Have the students use the “Create Nets” section of the *Shapes* application to figure out all the different configurations. As they find a net that work, sketch the shapes flat in their math notebook or on the blank paper so they can keep track of their discoveries.

Differentiation:

Learning disabled and/or physically disabled students may need extra assistance.

Motivations/Visuals/References:

- *Optional:* Teachers may review artworks from Lesson 1 and lead a discussion about the names of some of the solids students observe.

Vocabulary:

net, solid, base, face, edge, vertex (vertices)

Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Reflecting, Envisioning

ART-MAKING LESSON #2B

Nets and the Third Dimension

Art Essential Questions:

- How can an artist use solids in sculpture? What are some of the shapes we can make using paper nets?

Goals:

- Students will explore nets and how they relate to solids.
- Students predict what the shapes of a solid might look like two-dimensionally, drawn as a net.
- Students will demonstrate artistic behavior by making three-dimensional components for a sculpture.

Engagement:

Artist/teacher should begin lesson with a review of what a solid is and what a net is. In cubed and rectangular form, students should be able to understand that if we know how many cubic units are in a solid and add up the number of units times the volume of each individual cubic unit (height x width x length), we will arrive at the volume of the larger shape. Being able to count the cubic units (or squares on the nets or graph paper), should help them visualize the process of finding the volume.

Students should be told that they are eventually going to combine many solids to create individual sculptures and that this lesson was just the first step in learning how an artist can combine components to make a whole, much like David Smith or Joel Shapiro.

Have students look at, and then sketch, a net or a cube. Then have students graph the net on paper, starting in the middle of their paper and working out. In order to make a cube, see if they can figure out how many square sides the solid should have (6). There should be 4 faces and 2 bases (top and bottom). In a cube all the faces and bases need to be the same size. For example, draw an outline of a square that is 5 x 5 units on the graph paper. Then graph another 5 x 5 square for the adjoining face. Graph all the squares needed to create the net of the cube.

Once the net is graphed on paper, the shape can be cut out and folded to form a solid. Tape the edges of the shape together to create the cube, but leave the top base open like a lid to a box. It's okay to use tape here, but explain that once we are making actual sculptures, we will use tabs for neatness and put the graph lines on the inside.

National Visual Arts Standards:

VA: Cr1.1.4—Brainstorm multiple approaches to a creative art or design problem.

VA: Cr2.1.4—Explore and invent art-making techniques and approaches.

VA: Cr1.1.5—Combine ideas to generate an innovative idea for art-making.

VA: Cr1.2.5—Identify and demonstrate diverse methods of artistic investigation to choose an approach for beginning a work of art.

VA: Cr2.1.5—Experiment and develop skills in multiple art-making techniques and approaches through practice.

Materials/Tools/Technology:

- pencils, paper and erasers
- net templates copied on a copier

Vocabulary:

net, fold, crease, two-dimensional, three-dimensional, component, prediction, prism, cube

Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Reflecting, Envisioning

You could also have some pre-made, copied nets and ask the class to predict what shape they will become, once cut out and folded. Hopefully in the end they will have time to make more than one solid and gain practice cutting and folding.

Differentiation:

For learning and/or physically-disabled students: pair with an aide, if possible. Advanced students might have time to work with one or two more complicated shapes (hexagonal prism, pyramid).

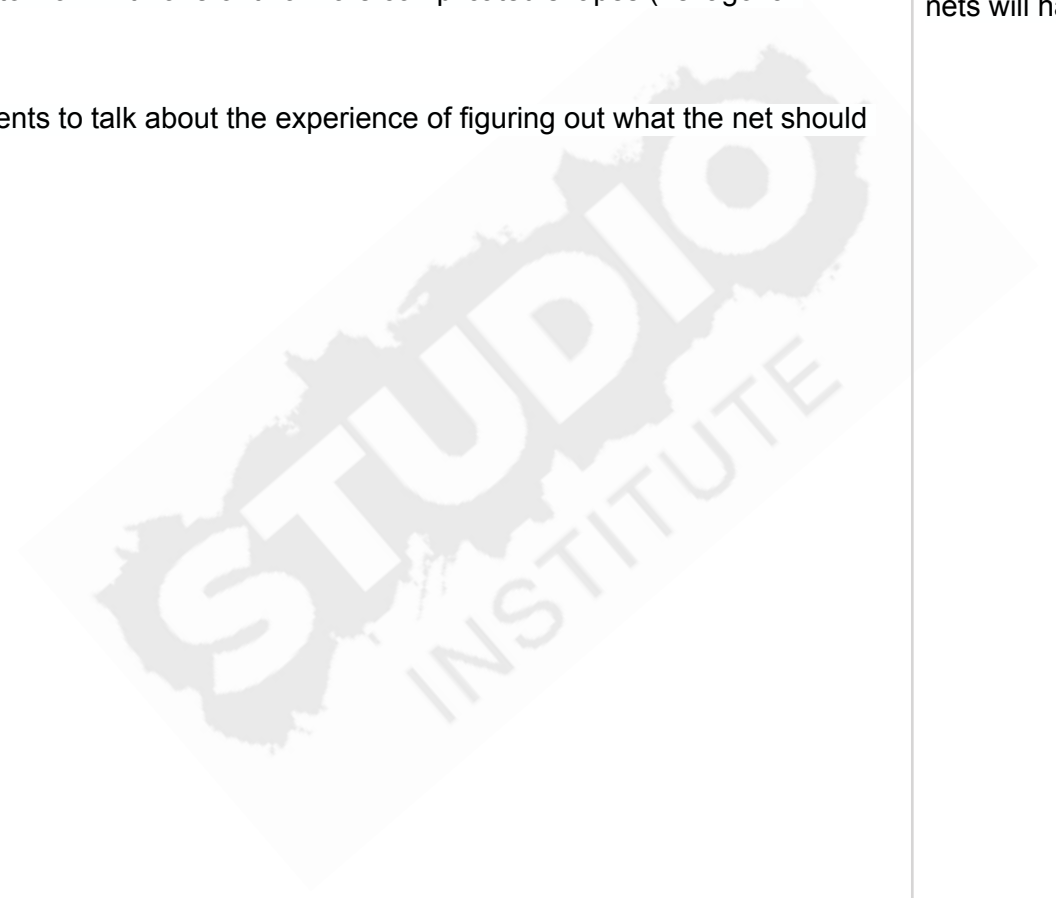
Reflection:

Artist/teacher directs students to talk about the experience of figuring out what the net should look like.

Student Checklist:

I made one or more shapes by folding my templates (nets) into volumes

I am beginning to understand how to predict what shape the nets will have, once folded



ART-MAKING LESSON #3A

Designing a Sculpture

Art Essential Questions:

What is a negative shape and why are negative shapes important in the design of a geometric sculpture? How do artists plan a sculpture by making a sketch of their ideas?

Goals:

- Students will design an individual plan for their net sculpture.
- Students will work to combine shapes in an interesting way, being mindful of negative shapes as well as positive ones.

Motivation/Visuals/References:

Robot images: Name June Paik and or continue looking at Joel Shapiro sculpture images; for site-specific sculptures: Anthony Caro or Richard Serra links for both. Discuss the different shapes they students see in the work and how they are configured to create interesting positive and negative space. Encourage the students to notice how basic shapes are used in different size variations and combinations to create an interesting sculpture.

Engagement:

Artist/teacher should be show students examples of artworks that are made up of geometric solids and reflect the chosen theme (figures, robots, fire abstractions, playgrounds, outdoor sculptures, and discuss their components). What shapes do they see? Where are negative shapes? Positive shapes?

Next, teacher should demonstrate iPad use (or graph paper use) and how to create their own design plans. Students will then be tasked to use their iPads (or pencils) to create a plan for a sculpture using basic geometric shapes. Limit students to using rectangles or squares, that will be later translated to prisms and cubes.

Suggested iPad Application: The application *Pixable* will allow students to create their own shapes and colors on a grid format. In the application set up the grid to create a portrait oriented image a large as possible. This will allow students to plan/create a sculpture that is not limited by size.

Students should document their work by exporting their robot sculpture sketch from *Pixable* to the camera roll. In groups of two students will use Explain Everything to document a peer assessment of their sketches to give each other feedback on their ideas. Students will should comment on each the use of positive and negative space, balance and the use of large and

National Visual Arts Standards:

VA: Cr1.1.4—Brainstorm multiple approaches to a creative art or design problem.

VA: Cr2.1.4—Explore and invent art-making techniques and approaches.

VA: Cr1.1.5—Combine ideas to generate an innovative idea for art-making.

VA: Cr1.2.5—Identify and demonstrate diverse methods of artistic investigation to choose an approach for beginning a work of art.

VA: Cr2.1.5—Experiment and develop skills in multiple art-making techniques and approaches through practice.

Materials/Tools/Technology:

- iPads loaded with *Pixable* or *Bamboo Paper* or other drawing program, styli or
- pencils, erasers and graph paper

Vocabulary:

design, sketch, negative shape, positive shape, prism, pyramid

Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Reflecting, Envisioning

small shapes to activate the space.

Differentiation:

For learning and/or physically-disabled students: pair students with an aide and make any accommodations necessary (larger pencil or stylus). Advanced students might be encouraged to add one or two more challenging solids to their design.

Reflection:

Artist/teacher asks one or two students to share their work.

Student Checklist:

I made a sketch on my iPad or on my paper of a design for a sculpture made up of squares or rectangles.



MATH LESSON #3B

Measuring and Figuring Out What Nets We Need

Math Essential Questions:

How can we look at a design and use our measuring and math skills to figure out how many (and what kinds) of components we need to make? What size or sizes do they need to be?

Learning Goals:

- Students will understand that artists often need to use math in order to make their work.
- Students will be able to determine what nets they will need to make their sculptures.

Inquiry Questions:

What role does math play in planning a sculpture?

Possible Math Components:

Students will be challenged to use the sketches they made the last lesson to work out a list of what components they need to make. An illustrated graphic of various net solids could be put on the smart board for reference.

Perhaps as a group, students could look at a design from another class (or an absent student) and, as a class, be asked what nets they think they would need to fabricate the sculpture.

Students will then individually be challenged to work like a project manager/fabricator and decide how many solids they need to make. They will also determine the names of each solid and the scale of each of the pieces. They will then create a materials/shopping list of the solids they need to create their sculpture. There are different-sized cubes and rectangular prisms based on the cubic scale. Students will need to determine how many of each size they will need. The solids can be combined, once folded, to create different sized prisms or cubes if there is not a net that makes that desired size.

Differentiation:

Students with learning or physical disabilities may need extra assistance from an aide or specialist. Advanced students may be asked to create a smaller, second work if time.

Materials, Tools/Technology Needed:

- smart board, digital projector and/or iPads
- work from previous lesson
- nets of prisms and cubes (multiple sizes)
- worksheets

Motivation/Visuals/References:

- images of geometric solids

Vocabulary:

fabricator, prism, grid, net, solid

Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Reflecting, Envisioning

ART-MAKING LESSON #4A

Folding Solids

Art Essential Questions:

How do artists make work in components (additive sculpture)? How do I figure out what parts I need and determine their sizes?

Goals:

- Students will begin to make their solids using copied templates or drawn nets.
- Students will develop and improve their paper-engineering skills.
- Students will choose appropriate colors they think will work with their designs.

Habits of Mind:

Engaging and Persisting, Stretching and Exploring, Observing, Reflecting, Envisioning

Engagement:

The artist/teacher should demonstrate how to choose a net (paying attention to color choice), cut it out carefully and fold in both ways to give the paper a memory of the crease. Each fold line, including the tabs, need this done. (The grids should be on the interior.) Explain that practicing patience is a part of this particular lesson. Applying a little bit of glue along each tab and holding them in place for a couple of minutes is important. Using tape is not attractive and not suggested as an option.

Work should be stored in such a way as to keep students' nets from intermingling. (They will start to look similar.) Students' work could be stored in individual recycled shopping bags labeled with students' names. The bags can be easily stored in a large box.

Differentiation:

For learning and/or physically-disabled students: pair students with an aide and make any accommodations necessary (larger pencil, angular templates or tracers). Advanced students should make as many shapes as they have time for.

National Visual Arts Standards:

VA: Cr1.1.4—Brainstorm multiple approaches to a creative art or design problem.

VA: Cr2.1.4—Explore and invent art-making techniques and approaches.

VA: Cr1.1.5—Combine ideas to generate an innovative idea for art-making.

VA: Cr1.2.5—Identify and demonstrate diverse methods of artistic investigation to choose an approach for beginning a work of art.

VA: Cr2.1.5—Experiment and develop skills in multiple art-making techniques and approaches through practice.

Materials/Tools/Technology Needed:

- sculpture plans from last art session
- bright colored nets of different styles (with tabs for interior gluing) copied on cover stock or index paper
- bright colored cover stock or index paper for special shapes
- pencils, erasers and rulers
- scissors

Reflection:

Artist/teacher might ask a student or two what they found hard or what surprised them.

- white glue (not school glue)
- labeled bags or other means of storing the solids for each student

Vocabulary:

surface, score/fold/crease,
component

Student Checklist:

I determined the nets I needed
for my sculpture

I made progress on neatly
folding and constructing my nets



MATH LESSON #4B

Continuing to Make A Variety of Solids

Math Essential Questions:

Can students compute the surface area of their cubes and rectilinear solids? Can students begin to understand the idea of volume equaling height times width (area) times depth?

Learning Goals:

Students will be able to figure out the surface areas of some of their nets. Students will use manipulative cubes to fill a net to help begin to process the idea of volume.

Inquiry Questions:

If I know how many physical cubes fit into a cube or a prism, how can I compute the volume of the whole? How does surface area of the sides relate to volume...or does it?

Possible Math Component:

Students will need to have many shapes for their sculptures—probably a minimum of 9 or so. This lesson should be a continuation of the art lesson above, except for two exercises: computing the surface areas of one net shape and filling a folded net (with top open), with the small manipulative cubes, so they can see how the math of getting the volume works in practice.

Divide the students into groups and have them find the volume all the nets that are available for their sculptures.

Differentiation:

For learning disabled or students, an aide or specialist may be of help. For physically challenged learners, appropriate adaptations may be made. Advanced students could be given an extra net and asked to predict the volume and then test it out by filling it with the small manipulative cubes.

Materials, Tools/Technology:

- nets
- math manipulative cubes

Vocabulary:

volume, solid, prism, net

Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Reflecting, Envisioning

ART-MAKING LESSON #5A

Folding/Gluing/Constructing

Art Essential Questions:

How does an artist make decisions? Do all artistic decisions have to be final? What part might play have in making a sculpture?

Goals:

- Students will perfect their cutting and folding skills in the making of their solids.
- Students will understand how a sculpture is often made of numerous parts and show patience in executing the necessary pieces.

Engagement:

Artist/teacher might remind students to check on many parts they will need for their sculpture and review the steps to making a clean solid. Review students that folding and gluing need to be done carefully and mindfully. Students may want to “check off” the parts on their planning drawings as they make them. As students have enough solids constructed encourage them to stack and balance their parts starting to build their sculpture as seen in their sketch. Allow students to move and change their design give them the opportunity to play with balance, placement, movement and gesture. This is something that their sketch has not allowed them to explore.

This is a working session an most likely needs little introduction or motivation time. At the end of the lesson students need to document their artwork so the image could be used in the math component.

Differentiation:

For learning and/or physically-disabled students: pair students with an aide and make any accommodations necessary. Advanced students might be able to make enough solids to do a second (smaller) figure.

Reflection:

The artist/teacher might ask students to share something new they noticed/learned that day.

Technology Application:

Students can continue to add slides on their iPads each session, if time permits.

National Visual Arts Standards:

VA: Cr1.1.4—Brainstorm multiple approaches to a creative art or design problem.

VA: Cr2.1.4—Explore and invent art-making techniques and approaches.

VA: Cr2.2.4—When making works of art, utilize and care for materials, tools, and equipment in a manner that prevents danger to oneself and others.

VA: Cr1.1.5—Combine ideas to generate an innovative idea for art-making.

VA: Cr1.2.5—Identify and demonstrate diverse methods of artistic investigation to choose an approach for beginning a work of art.

VA: Cr2.1.5—Experiment and develop skills in multiple art-making techniques and approaches through practice.

VA: Cr2.2.5—Demonstrate quality craftsmanship through care for and use of materials, tools, and equipment.

Materials/Tools/Technology:

- nets printed on bright card stock
- scissors
- white glue (not school glue)

Student Checklist:

- I continued making the pieces of my sculpture
- I am taking my time to make the cleanly-folded and well-constructed pieces

Vocabulary:

score/crease/fold, net

Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Reflecting, Envisioning



MATH LESSON #5B

Computing Volume & Volume Estimation Game

Math Essential Question:

- If I know the height, width and depth of a solid prism or cube, how do I compute the volume?

Learning Goal:

- Students will be able to understand how the volume of a prism or cube is calculated.

Inquiry Question:

- How do we estimate volume by comparing a known solid with an unknown solid?

Possible Math Component:

Separate the students in to groups (couples or trios). In the groups, students will find the volume for two of the three-dimensional solids. Divide all the nets there are available among the groups. Instruct students to label the length (l), width (w) and height (h) and the volume (v) with the units on the print out of the nets. Then each group will cut and fold a copy of the solid to display on the unit documentation wall/bulletin board with their labeled net.

After the volume for all the nets is calculated, use the images of students sculptures for an interactive estimation game. Ask a student to volunteer their artwork to use as a model. Explain that three-dimensional solids combined together to create one large unit that is called a composite figure.

Look at the artwork and have the students count the number of solids used. Instruct the students to look for any solids that are duplicates and record the number of duplicates. Then look at the unit documentation wall/bulletin board and record the volume that corresponds with the solid. Students will add up the volume to calculate the total volume of the sculpture.

While the students calculate the volume of the nets and the teacher leads the class in finding the volume of the example, the artist needs to be finding 5-6 student works from the art-making class that are good examples of sculpture and are almost complete. The artist can print out copies of these images for the teacher to use in the game. The artist can also set up a *Power Point* or *Keynote* slide with the images the students' work for display.

The game: Teachers could do variations of the game. *Option 1:* Students could be given the images, then the fastest one to calculate the volume for the composite figure wins. *Option 2:* Student groups could calculate the volume for the composite figure/sculpture they are given

Materials, Tools/Technology:

- smart board, digital projector
- print outs of sculpture images from student portfolios
- strips of paper for students to write volumes
- pencils

Vocabulary:

volume, composite figure, length, width

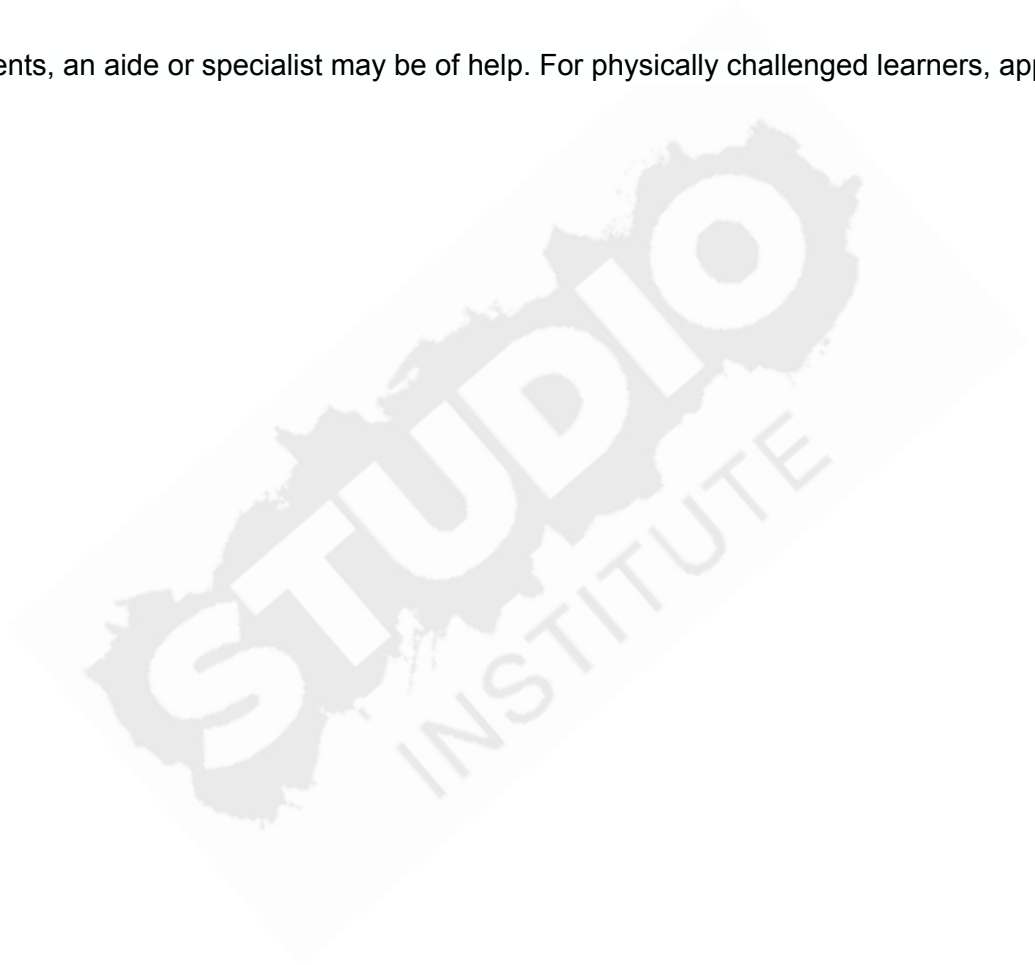
Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Reflecting, Envisioning

and write the volume on large slips of paper (not showing them to the other students). Teachers will mix up the volumes and add in some random additional volumes. Have a student volunteer to place the volume under the image they think is the corresponding volume. Ask the groups if they have guessed the correct volume for the sculpture they calculated. If any of them are correct they would leave those and switch the incorrect ones.

Differentiation:

For learning disabled students, an aide or specialist may be of help. For physically challenged learners, appropriate adaptations may be made.



ART MAKING LESSON 6A

Continuing Making the Sculptures/Adding Optional Collage

Art Essential Questions:

• How can parts be put together to form a sculpture? *Optional:* What is a base? How does an artist add details to a surface to make a sculpture more interesting?

Goals:

- Students will finish making any other parts they need for their sculptures.
- Students will practice gluing their sculptures/figures together being mindful of negative space as part of the whole.
- Students will collage and draw on their sculptures with a variety of materials to add interesting details.
- *Optional:* Students will learn how to cover a piece of cardboard with colored paper to form a base.

Vocabulary:

base, balance

Habits of Mind:

Engaging and Persisting, Stretching and Exploring, Observing, Envisioning

Engagement:

Students will be putting their sculptures together if they have made all their parts. If they are constructing a playground or outdoor sculpture, they will definitely need a base for their work. If they are making robots, etc. a base might make the sculpture stand better. Demonstrate how to cover a piece of chipboard with paper by folding over the edges and taping on the bottom. to make the corners especially neat, the corners may be cut, envelope-style.

An important aspect of putting the solids together is balancing them carefully as you glue. Make sure students put their pieces together thoughtfully and carefully. Demonstrate how students should glue their solids together to start constructing their sculptures. Encourage students to think about their sculpture might move or take up space. Once put together, the sculptures can be collaged and/or drawn on, using a variety of materials. If doing robots, expressions may be made to give them personality.

Students will create an *Explain Everything* project and peer-assess how well each other's sculpture shows the goals of the unit. Students should give each other suggestions on how to improve their sculpture. Possible criteria might include: create a sculpture that has positive

National Visual Arts Standard(s):

VA: Cr1.1.4—Brainstorm multiple approaches to a creative art or design problem.

VA: Cr2.1.4—Explore and invent art-making techniques and approaches.

VA: Cr2.2.4—When making works of art, utilize and care for materials, tools, and equipment in a manner that prevents danger to oneself and others.

VA: Cr1.1.5—Combine ideas to generate an innovative idea for art-making.

VA: Cr1.2.5—Identify and demonstrate diverse methods of artistic investigation to choose an approach for beginning a work of art.

VA: Cr2.1.5—Experiment and develop skills in multiple art-making techniques and approaches through practice.

VA: Cr2.2.5—Demonstrate quality craftsmanship through care for and use of materials, tools, and equipment.

Materials and Tools:

- folded and glued solids
- nets copied on cover stock or index paper
- scissors
- white glue (not school glue)

and negative space, shows a movement or gesture, show balance, attention to construction and gluing (solids are folded and glued neatly), has an expressive or original quality

Differentiation:

For learning and/or physically-disabled students: pair students with an aide and make any accommodations necessary. Advanced students might continue making a second figure or sculpture.

Reflection:

Artist/teacher might ask one or two students to share something new they notice/learned.

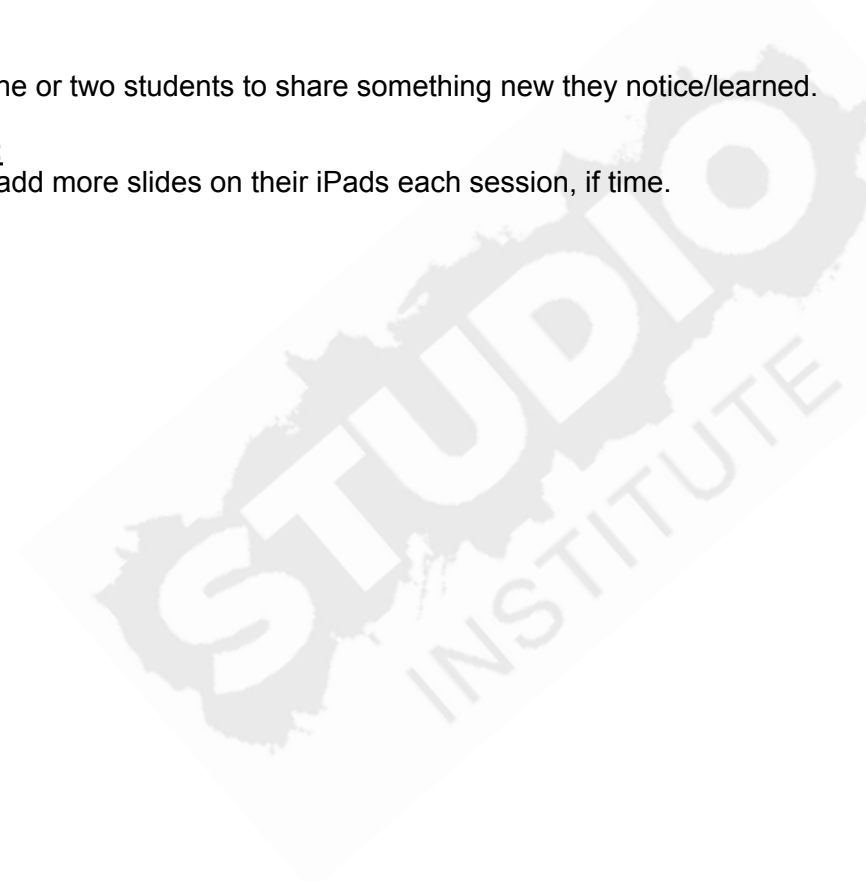
Technology Application:

Students can continue to add more slides on their iPads each session, if time.

- materials for collage and surface decoration— markers, foil pieces, cellophane, collage printed paper, googly eyes, pipe cleaners, old watch parts, bottle caps, etc.
- Optional:* cardboard (chipboard) cut for bases; construction paper or other paper larger than the base size; tape

Student Checklist:

- I continue to make excellent progress on my sculpture
- I am willing to consider making changes as I work the way an artist does



MATH LESSON #6B

Creating and Solving Math Word Problems Around Our Figures/Sculptures

Essential Question:

How can I make up a math word problem, based on my sculpture? (It might be about the volume of one net, volume of all of them together, footprint, height and width measurements, etc.).

Learning Goals:

- Students will make their own original word problems, based on some aspect of their sculptures.
- Students might then trade sculptures with a partner and solve that word problem.

Possible Math Component:

Have students make up a word problem around their sculpture. Example: "My robot fell off the shelf and lost one arm and one leg. How much volume did it lose in total?" Students could be paired up and given iPads to use a calculator to help them solve each other's word problems.

Inquiry Question:

How might I create an original math word problem based on my sculpture?

Differentiation:

For learning and/or physically-disabled Students: pair students with an aide and make any accommodations necessary. For advanced students, have them solve several problems.

Materials/Tools/Technology:

rulers, pencils, paper/notebook
Optional: iPads

Vocabulary:

word problem

Habits of Mind:

Engaging and Persisting,
Stretching and Exploring,
Observing, Envisioning

ART-MAKING LESSON #7A

Finishing the Sculptures and Possibly Creating a Place/Backdrop

Art Essential Questions:

How do I know my sculpture is finished? What details could I add to my robot/sculpture to give it more visual interest? If I am done, what environment might I put my sculpture in? If my artwork was installed as a public art installation, where would be the best location?

Goals (Depending on the Focus):

Robots/Figures:

- Students will continue to add details to their sculptures and mount them on a base if they haven't already done so.
- Students will collage and draw on their sculptures with a variety of materials to add interesting details (ie. Gadgets, gages and gizmos as details or design elements).
- If time, students will create a photo of the their sculpture installed in a specific environment.

Public Sculptures/Playgrounds:

- Students will understand that outdoor sculptures must take into consideration many factors when being placed in an environment.
- Students will place their sculptures in a setting by creating a photomontage of their sculpture installed in a public space.

Motivation/Visuals/References:

- Possibly show students images of public art sculptures and discuss how people might interact with these sculptures.

Possible Engagement:

Reviewing Peer-Assessment/Feedback:

Students should review and listen to their peer-assessments from last week. Reflect on their peer's comments and make adjustments to their sculptures. Students should feel encouraged to make adjustments to their work based on their peer-feedback or based on how well they think their own sculpture meets the criteria.

Collage Details:

After construction of robot/figure is complete students may add collage details. The students can create their own details or select from curated elements of gadgets, gages, valves, knobs, etc.

National Visual Arts Standards:

VA: Cr1.1.4—Brainstorm multiple approaches to a creative art or design problem.

VA: Cr2.1.4—Explore and invent art-making techniques and approaches.

VA: Cr2.2.4—When making works of art, utilize and care for materials, tools, and equipment in a manner that prevents danger to oneself and others.

VA: Cr1.1.5—Combine ideas to generate an innovative idea for art-making.

VA: Cr1.2.5—Identify and demonstrate diverse methods of artistic investigation to choose an approach for beginning a work of art.

VA: Cr2.1.5—Experiment and develop skills in multiple art-making techniques and approaches through practice.

VA: Cr2.2.5—Demonstrate quality craftsmanship through care for and use of materials, tools, and equipment.

VA: Pr.5.1.4—Analyze the various considerations for presenting and protecting art in various locations, indoor or outdoor settings, in temporary or permanent forms, and in physical or digital formats.

Digital Background:

After they finish making all the solids and attaching them in their composition, students may place them in an environment by creating a photomontage. Instruct students to take a photo of their sculpture in front of the white backdrop for documentation. Lead students in finding a public space their sculpture could be installed using *Google Maps* (street view). The students will take a screen shot of the street view where they want to install their sculpture. As you search on *Google Maps*, continue the discussion that outdoor sculptures must take into consideration many factors when being placed in an environment. Once a public space that is suitable for the sculpture is found take a screen shot of the location. Students will need to go in to photos and crop the image. Students will import the image of their sculpture into *Explain Everything* and cut out around the sculpture using the lasso-drawing tool. Next, students will import the street view photo they captured from *Google Maps*. Scale the image of the location to fill the screen and then send it to the back, behind the image of the sculpture. Students will then scale and position the sculpture so that it looks like it is installed into the public space. Instruct the students to save and upload their work as an image into their *Google Drive* folder.

Drawn Background:

Students may just want to invent their own backgrounds on paper, using markers or other art materials.

Group Project of Drawn or Painted Mural (for Robots/Figures):

Another option is to have the class make a large mural on kraft paper and display their works as a group.

Differentiation:

For learning and/or physically-disabled Students: pair students with an aide or willing partner and make any accommodations necessary. Advanced students might be challenged to add more details to their backdrops or environments.

Reflection:

Artist/teacher takes time to reflect on one or two works, if time.

Technology Application:

Students should add the final slides to their iPads and share their process with one another. They also may be using technology to make a background.

Student Checklist:

- I have finished my sculpture
- I am beginning to work on the background, either digitally or drawn

VA: Pr.6.1.5—Cite evidence about how an exhibition in a museum or other venue presents ideas and provides information about a specific concept or topic.

Optional Materials/Tools/Technology:

- covered cardboard for the base
- drawing paper or roll of paper for backdrop (create a studio-like setting for photographing sculptures)
- kraft or roll of paper for making large mural and acrylic or tempera paints and brushes
- markers, colored pencils, collage materials, etc.
- white glue (not School Glue)
- scissors
- iPads loaded with *Explain Everything*, *Google Drive*, or computer, printer
- sample image(s) of White House or Taj Mahal or some famous places to act as backgrounds

Vocabulary:

backdrop, environment, photomontage, install/installation, public art

Habits of Mind:

Engaging and Persisting, Stretching and Exploring, Observing, Reflecting, Envisioning

MATH LESSON #7B

Reflecting and Sharing

Essential Questions:

For a group exhibition: How do individual artworks come together in an exhibition and make a powerful statement? Is the whole greater than the parts?

General question: How important was it to use math in order to make our art? What are some of the differences we can see in our sculptures?

Learning Goals:

- Students will practice discussing and describing the experience of making art and looking at art.
- Students will understand the role math can play in the making of art.

Possible Components:

Students should be encouraged to spend time in an in-depth reflection to share their work more completely. The class could spend time looking at the work and then participate in a group discussion led by the teacher. The math word problems might be displayed next to the sculptures to solidify the connection between art and math.

Another possibility is to have the students pretend they are reporters for the fictional *Journal of Using Math in Our Lives*. They each might write a short news article about the exhibition in general or a work in particular, using the importance of math as a theme. They could interview another student briefly and ask them a question about their work, which could be put in the article.

Differentiation:

For learning and/or physically-disabled students, support them with a classroom aide, if possible.

Inquiry Questions:

How important is math in making art sometimes? In what ways do artists (painters, sculptors, animators) use math?

Habits of Mind:

Engaging and Persisting,
Observing

Possible Materials/Tools/

Technology:

iPads, interactive white board,
notepads