Build your dream house (Level 3)

Description	Learners will create a model of their dream house or room and learn about geometry and operations!
Leading Question	How can we use shapes to build our dream house?
Total Time Required	~ 6 hours in total over 5 days
Supplies Required	Paper/cardboard, ruler/measuring tape, color pens, scissors, glue/tape/stapler
Learning Outcomes	1. Understanding 2D shapes and 3D shapes and their properties 2. Calculate areas and perimeters 3. Write a project report
Previous Learning	• Multiplication within 20
Topics Covered and Skills Develop	• Names and properties of 3D shapes • Vocabulary – 3D shapes, faces, edges, corners, vertices, area, surface area and perimeter • Calculating area, surface area and perimeter • Drawing 3D shapes • Applications of 2D and 3D geometrical shapes in housing construction • Drawing and design skills • Creativity, presentation and communication skills • Report writing

Day 1

Today you will learn about creating a model of our dream house and practice some math!

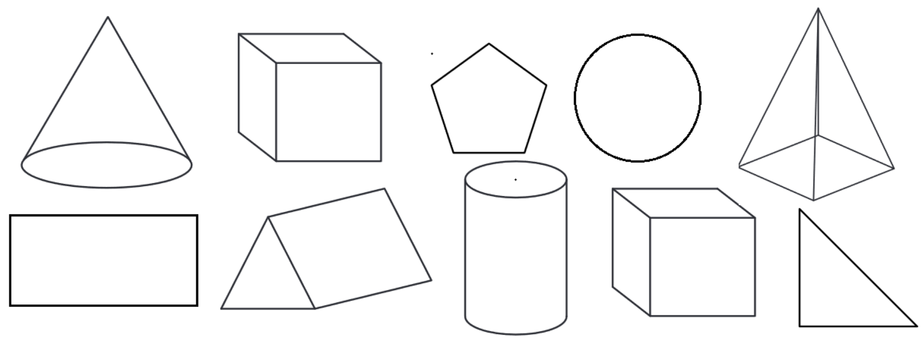
Suggested Duration	Activity and Description
20 minutes	• Introduction: you are going to learn how to create a model of our dream house and practice some math! First, let's learn about some shapes that you can use to build our house.

EAA welcomes feedback on its projects in order to improve, please use this link: https://forms.gle/LGAP9k17fMyJrKJN7

Activity 1: Checking Required Previous Learning

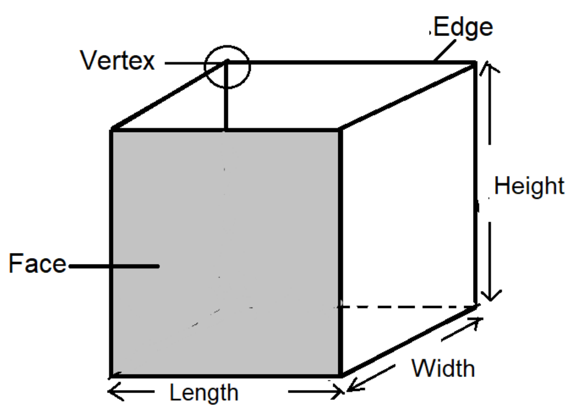
- In this activity, keenly observe each geometrical shape and decide which of the shapes are 2D shapes.

- Decide which shapes in the diagram below are 2D shapes and shade them. You can use colour for your shading



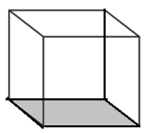
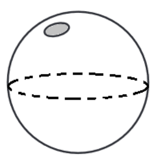
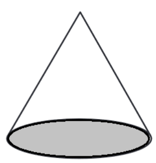
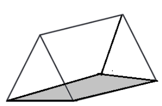
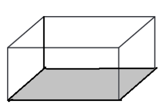
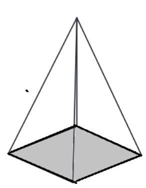
3D shapes vocabulary

- 3D shapes are solid shapes that have three dimensions (which are length, width and height).
- 3D shapes have faces, edges and vertices or corners.
- The flat surfaces of a 3D shape are called faces. Curved surfaces are not called faces because faces must be flat.
- The edge of a 3D shape is the line where two faces meet
- The corner of a 3D shape is where two or more edges meet. The corner is also called the vertex. The plural for vertex is vertices. Example:



20 minutes	Activity 2: Properties of 3D shapes

- In this activity, learners will identify the number of faces, edges and vertices of some basic 3D shapes
- Draw the 3D shapes below and ask the learners to count the number of faces, edges and vertices (corners) and to name the 3D shapes

3D shape	Number of faces	Number of edges	Number of corners (vertices)	Name of shape
				
				
				
				
				
				

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https://forms.gle/LGAP9k17fMyJrKJN7

Prompt:

- Do these shapes look familiar?
- What 2-dimensional shape does each one look like? (e.g. a cube looks like a square, a pyramid looks like a triangle etc.)

Wrap up the activity by reviewing some properties of 3-dimensional shapes:

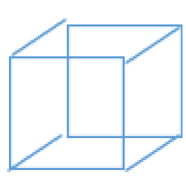
- A cone has 1 flat face, 1 curved surface, 1 edge, and 0 vertex..
- A sphere has 0 faces, 1 curved surface, 0 edges, and 0 vertices. All points on its surface are the same length from the center
- A cylinder has 2 faces, 1 curved surface, 2 edges, and 0 vertices.
- A cube has 6 faces that are identical, 12 edges, and 8 vertices. The edges are of equal length and faces are of equal size. The faces are square in shape
- A rectangular prism or cuboid has 6 faces, 12 edges, and 8 vertices. All the faces are rectangles. The opposite faces are always the same size
  A triangular prism has 5 faces, 9 edges and 6 corners. The triangular prism has 2 faces which are triangles and 3 faces which are rectangles. The two triangle faces are always the same size
- A square-based pyramid has 5 faces, 8 edges, and 5 vertices. The faces are the flat sides and square base. There are other types of pyramids such as the triangular-based pyramid.

20 minutes

Activity: Drawing 3D Shapes

In this activity, you will draw a cube, a rectangular prism (cuboid), a cone, a cylinder, a square-based pyramid and a circle

- Let's draw each shape! Bring out your paper, pen or pencil and a ruler or any flat object with a straight side like a phone/bookmark/cardboard or fortified paper and start drawing:
- Drawing a cube or rectangular prism: to get a cube, draw overlapping squares, then join the vertices (corners) using straight lines as shown in figure A to get the shape in figure B. if you start with overlapping rectangles and join the vertices, you will get a rectangular prism.



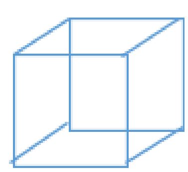


Figure B

- Drawing a cone: since a cone has a circular base, start with a flat circle as shown in figure A, then draw two lines connecting at the top to get figure B. Another way would be to draw a triangle, then draw two half circles above and below the base.

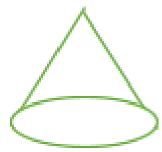
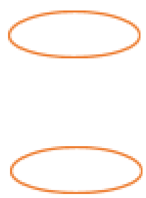


Figure A Figure B

Draw a cone

- Drawing a cylinder: since a cylinder has two circular parts, start with two circles stacked on top of each other with some distance in between, then join the circles from both sides with two straight lines as shown below



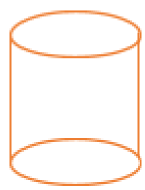
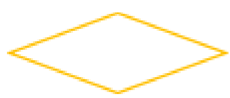


Figure A Figure B

Draw a cylinder

- Drawing a square-based pyramid: since a square-based pyramid has a square base, start with a flat square (that looks like a diamond) as shown in figure A, then join all the vertices at the top to get figure B as shown below:



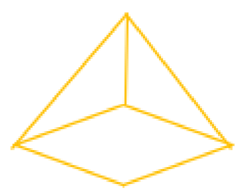


Figure A Figure B

Draw a square-based pyramid

- Drawing a sphere: start with a circle, then draw two curved lines across the middle part to show that a sphere is not flat like a circle

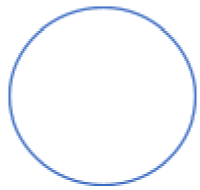


Figure A

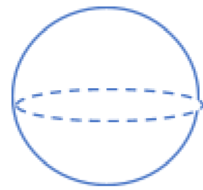


Figure B

Draw a sphere

20 minutes

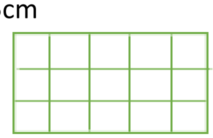
Activity 4: Calculating surface area of 3D shapes

In this activity, learners will calculate the surface area of the 3D shapes they drew in Activity 3.

- Learners will calculate the area of a square and surface area of a cube that they have drawn:
- Explain that the area of a shape is the total space covered by that shape
- Draw a rectangle with length 5cm and width 3cm. How many 1cm squares can you fit in the rectangle? You should be able to fit 15 such squares as shown below. This is the area of the rectangle, which we also get by multiplying the length by the width or 5 x 3 = 15.

5cm

3cm



- Remind the learner that a square is a type of rectangle, but the only difference is that all of its sides are the same length
- Draw a square with 4cm sides. Since the square is a rectangle, it has similar properties. The formula for area of a square is side x side or side^2 instead of length x width because all sides are the same length. You can visually see how many 1cm squares you can fit into the larger 4cm square and count them to find the area.
- Now, let’s see how we can figure out the area of a cube. We know that a cube has 6 faces. Since each face of a cube is a square, the area for each face is side^2. To get the total surface area of the cube, we multiply 6 x side^2.
- Use the method explained above to calculate the total surface area of the cube they drew in activity 3.
- Learn how to calculate the surface area of different 3D shapes.

	• What measurements to make and what formulae to use. Work out some examples.
10 minutes	• Now let's learn about the areas of these shapes. Look at the formulas below:

2D Shape	Area	Terms
Circle	$\pi \times r^2$	r = radius of the circle
Triangle	½ × b × h	b = base h = height
Square	a^2	a = length of side
Rectangle	l × w	l = length w = width

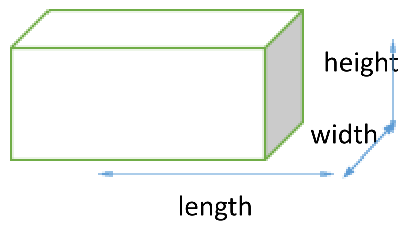
3D Shape	Area	Terms
Cube	$6a^2$	a = length of the edge
Rectangular prism	2 w l + 2 h l + 2 h w	l = length w = width h = height
Cylinder	$2 \pi r^2 + 2 \pi r h$	r = radius of circular base h = height of the cylinder
Cone	$\pi r l + \pi r^2$	r = radius of circular base l = slant height
Sphere	$4 \pi r^2$	r = radius of sphere

Source: https://byjus.com/maths/area-of-shapes/

• We know that:

- π = 3.14
- The radius is the distance from the midpoint of the circle or sphere to any point on the surface
- The base and height of a triangle can be found by drawing a straight line from the top vertex to the opposite side. The base is the side at the bottom where the height line forms a 90-degree angle. The height is the length of the line drawn from the top vertex to the base
- The lengths of a rectangle are the two long sides and the widths are the shorter sides

- The slant of a cone is the length from the edge of the circle to the tip of the cone
- The height of a cylinder is its length (distance from top surface to the bottom)
- The length, width and height of a rectangular prism are represented below



Make the necessary measurements and use the relevant formulae to calculate the surface areas of the 3D shapes they drew in activity 3.

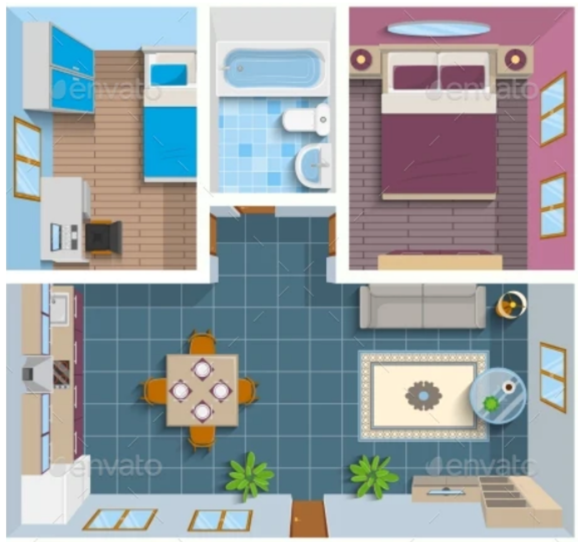
Day 2

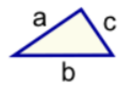
Today you will think about how you can design your dream house by first understanding how your current home was designed.

Suggested Duration	Activity and Description
15 minutes	**Understanding House Design Considerations** ● First, let's understand how our own house or apartment was designed. ● The learner will walk around the house and try to identify basic geometric shapes in ceilings, walls, and different objects around the house.
20 minutes	● With the help of an adult, the learner will list the shapes and objects in their notebook as follows: - Living room: square wall, rectangle table, rectangle couch etc. - My bedroom: square wall, rectangle ceiling, round window etc. ● The learner will do a tally count of the total number of shapes in each room and complete the table below in her or his notebook

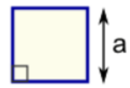
Room	Square	Circle	Rectangle	Triangle
e.g. living room	II	I	~~IIII~~	
e.g. kitchen	I	III	II	I
Total	3	4	7	1

Reflection questions:

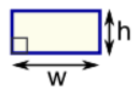
	● What 2D shape is most common in our house? ● What 3D shape is most common in our house?
30-40 minutes	● The learner will try to draw the design of their current house on a piece of paper to create a floor plan for his or her current home: ● Let's start with your bedroom. Think of what your bedroom would look like if we could remove the ceiling and look at it from the top. Example of rooms with a top view:  [Source link] ● Tip: if this is too difficult, instead of a top view, the learner can draw the walls of one or more rooms or spaces on separate pieces of paper/pages of his or her notebook with the help of an adult if needed. ● The learner will draw a plan for his or her current home, apartment, or room: - Draw the entire space first either from a top view or side/cross-section - Section the different rooms or spaces with lines representing walls. Where will you place the kitchen? Bathroom? - Draw the beds, tables, rugs etc. that you find in each space
10-20 minutes	● The learner will calculate the perimeter of the 2D shapes. The perimeter is the distance around 2D shapes. Calculate the perimeter of the shapes he or she just drew using the formulas below:



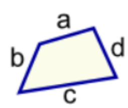
[Triangle](#)
Perimeter = a + b + c



[Square](#)
Perimeter = 4 × a
a = length of side



[Rectangle](#)
Perimeter = 2 × (w + h)
w = width
h = height



[Quadrilateral](#)
Perimeter = a + b + c + d

[Circle](#)
Circumference = $2\pi r$
r = radius

Source: https://www.mathsisfun.com/geometry/perimeter.html

Share the plan of your current house, apartment or room with family members. Ask family members any additional information you need to help them in the design of your dream house.

Reflection

Learners will reflect on their personal learning and experience in doing the project so far.
What are the three most important things I have learned so far ?
What challenges have I encountered so far ? What additional support do I need to successfully complete the project ? Who can provide me that support ?

DAY 3

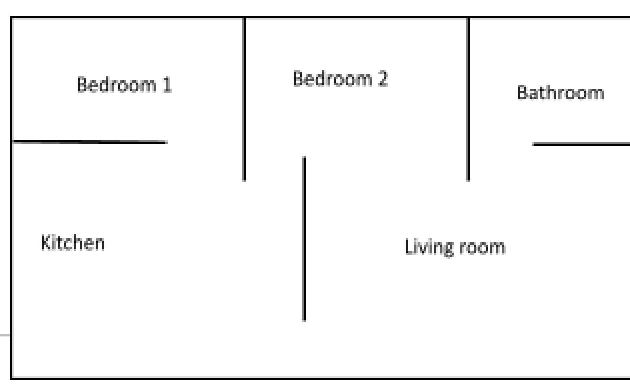
Today you will come up with ideas for their house or room floor plan.

Suggested Duration	Activity and Description
10 minutes	**Designing the Dream House** ● Today, the learner will come up with the ideas and design for their dream house or room floor plan. Prompts: - How do you want your house or room to look? Will the walls be square or rectangular? Can they be triangular? - What other objects do you want there that you can draw or make?
20 minutes	● The learner will recreate and complete this table in his or her notebook:

Room	Object 1	Shape 1	Object 2	Shape 2	Object 3	Shape 3	Object 4	Shape 4
Bed room	Wall	Square	Bed	Rectangular prism	Table	Cube	Pillow	Rectangle
Living room	Wall	Square	Couch	Rectangular prism + rectangle	Table	Cube		

30 minutes

- The learner will draw a plan for his or her dream home, apartment, or room based on the table above:
  - Draw the entire space first either from a top view or side/cross-section
  - Section the different rooms or spaces with lines representing walls. Where will you place the kitchen? Bathroom?
  - Draw the beds, tables, rugs etc. that you want in each space
  - Decorate and color your floor plan
- The plan can be basic following the plan the learner made yesterday or the template below, but it must contain all the items the learner wants in each room



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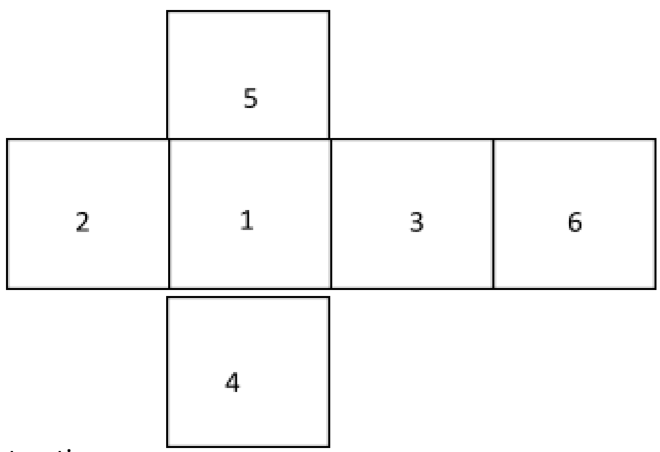
Day 4

Today you will create the shapes from the table completed yesterday and finalize the design of the house!

Suggested Duration	Activity and Description
40-60 minutes	**Activity 7: Producing Pre-Fabricated Material for the Dream House** ● The learner will make all the shapes using paper. The learner will draw 2D shapes on paper and cut them out using scissors. For 3D shapes, paper will be cut in the following ways: 1. To make a cube: we know that a cube has equal or square sides. First, draw six squares in this shape on a piece of paper then cut out the entire shape:  Instructions: ● Keep square 1 down and bring up squares 2, 3, 4, and 5 ● Tape or glue all of them together to create an open cube ● Bring up square 6 to close the cube. You can cut out square 6 if you want an open cube for your house. ● You can use this cube as a table or other object to place in your rooms! 2. To make a rectangular prism: we know that a rectangular prism has rectangular sides. First, draw six rectangles in the shape shown below

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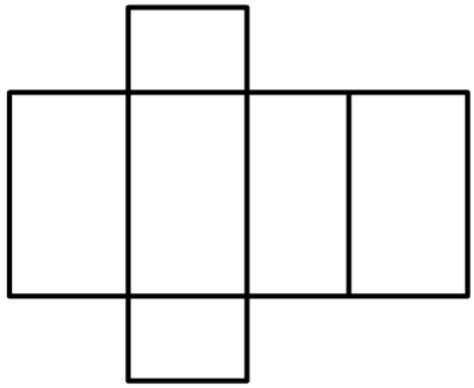
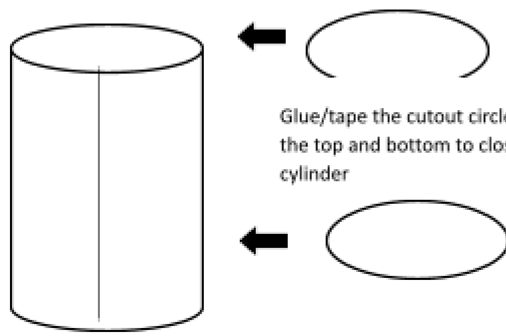
and cut out the entire shape. Then repeat the instructions from the cube, keeping rectangle 1 down and raising the other sides:

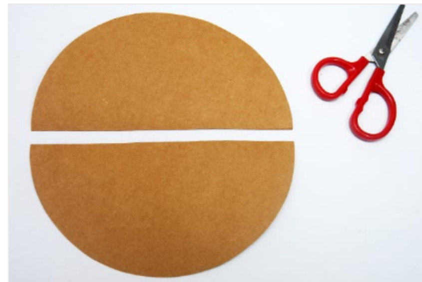


3. To make a cylinder:
    - Cut out the piece of paper you want to use to make a cylinder for your furniture
    - Roll the paper so both ends meet as shown below:



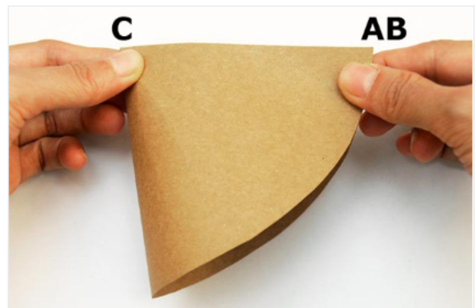
    - Tape the line where both ends meet to make a cylinder
    - If you want to close the cylinder, you can take the shape you have made and draw two circles on a separate piece of paper using one of its ends. Cut out the circles and tape or glue them on to the top and bottom parts of the cylinder (the faces of the cylinder)
4. To make a cone: we know that a cone has a circular base, so first, draw a circle, then follow the instructions below:

1. Cut out a circle

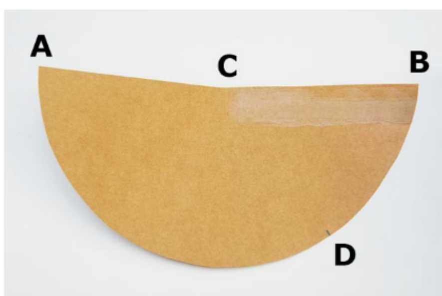


2. Cut it in half

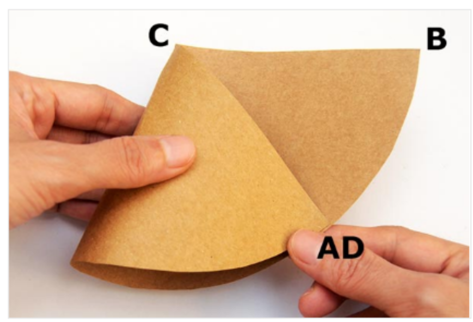
3. take one half-circle



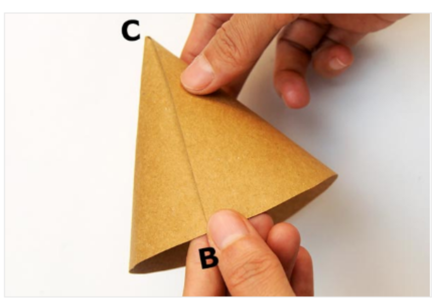
4. Join both ends and mark the vertex C



5. Apply glue and mark point D at the bottom



6. Bring one tip to the bottom, mark that point AD



7. Bring point B down to the curved edge to make a cone!

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	● Tip: make sure you color the papers before you make the shapes!
30 minutes	**Activity 8: Project Report Writing** ● The learner will write a short report on the design process in his or her notebook or a piece of paper and provide the dimensions and areas for his or her house and objects constructed. The report must contain the following sections: - Title of project: My dream house/room/apartment - Process of design: what was the first step in designing the house? How did you decide on the shapes used? How did you construct the different parts? - Dimensions and areas: o What are the dimensions of each 2D shape? i.e. length and breadth of rectangles, radius of circles, length, breadth, and width of rectangular prisms etc. o What are the areas of all 2D shapes used? o What are the surface areas of all 3D shapes used? - Reflection: what went really well? What could you have done better? - Attachment of floor plan (the learner can attach the floor plan she or he designed using glue, tape, stapler etc.)

Day 5

Today you will finalize the design of his or her house and present it to the family!

Suggested Duration	Activity and Description
30 minutes	**Assembling the Own Dream House** ● First, the learner will create a big cube or rectangular prism for his or her dream house, room, or apartment. Make sure the shape is big enough to fit all the objects you created yesterday!
20 minutes	● The learner will assemble all the objects inside the larger rectangular prism and finalize the design of the house. He or she can draw any additional decoration such as mirrors, paintings, photo frames etc. if he or she does not want to create more shapes
15 minutes	**Activity 10: Project Final Product Presentation** ● The learner will present the finalized design to the family and describe: - How she or he decided on the shape of the house and rooms

- How she or he created the objects and the shapes used - The areas and surface areas of all shapes - Overall thoughts about the process

Assessment criteria

- Completed house or room with walls, floors, and furniture objects composed of 2D and 3D shapes.
- Final presentation of design process
- Final report on design process.

Additional Enrichment Activities

- More complex 3D shapes can be added to the activity such as pyramid and prism variations
- Learners can be asked to find the volumes of 3D shapes

Modifications to simplify

- More complex 3D shapes can be added to the activity such as pyramid and prism variations
- Learners can be asked to find the volumes of 3D shapes