Learning and Evaluation Situation

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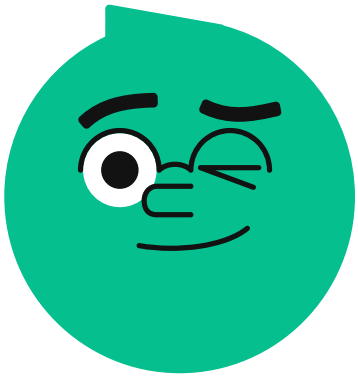


Design Your Dream Room

Scale and Dimensioning

Teacher Booklet

120 min.

Activity Summary

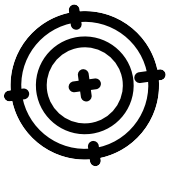
In this learning and evaluation situation, students will simulate some of the steps involved in a bedroom renovation project. Working within the defined constraints, students will choose and cut out furniture and accessories for their room, then arrange and glue them on a floor plan. This floor plan will then be used as a jumping-off point for students to acquire new knowledge relating to scales and dimensioning. At the end of the LES, each student will hand in their Student Booklet and a dimensioned floor plan. The assessment can be summative or formative at the teacher's discretion.

Prerequisites

Students must have mastered or be in the process of learning the following concepts:

Basic lines

- Naming the basic lines in a drawing
- Associating the basic lines in a drawing with the contours and details of a simple part



Learning Objectives

The following objectives are addressed during the LES.

* Objectives marked with an asterisk may have been covered in Sec. I or Sec. II.

Scales

- Associating scales with their use (actual-size representation, reduction or enlargement of an object)
- Choosing a simple scale for a drawing
- Taking the scale into account when interpreting drawings

Dimensioning

- Describing the main dimensioning rules
- Interpreting technical drawings, including the dimensions

Using Scales

- Associating real measurements with each of the dimensions in a drawing*
- Reducing or multiplying the dimensions of a technical object based on the scale*
- Dimensioning a technical drawing in accordance with the main dimensioning rules

Materials

- 1 copy of the Student Booklet for each student
- 1 copy of the Floor Plan Template for each student (print on 11 x 17 paper)
- 1 copy of Appendix 1: Dream Room Furniture and Accessories List for each student (print single-sided on 8 ½ x 11 paper)
- 1 copy of the Rubric for each student
- 1 pair of scissors for each student
- 1 glue stick for each student
- 1 ruler (30 cm) for each student **or** 1 triangular scale ruler with a 1:20 scale

Planning

This LES is designed to be completed over 120 minutes following the schedule below.

Activity	Duration
Scenario	5 min.
Part 1: Making a Floor Plan	30 min.
Part 2: Reactivating Knowledge of Basic Lines	10 min.
Part 3: Scale and Dimensioning	75 min.

Recommended Steps

Scenario

About 5 minutes

The students read the scenario in the Student Booklet and look over Appendix 1.

The teacher circulates to answer questions and clarify the instructions if necessary.

As soon as each student is ready, they begin Part 1.

Part 1 : Making a Floor Plan

About 30 minutes

The students choose items for their room from Appendix 1. Then, they cut out the items and arrange them on their floor plan templates.

The teacher circulates to answer questions and clarify the instructions if necessary.

The teacher can give the following reminders:

- There is a minimum and maximum number of items for each category.
- It's important to arrange everything in a logical way (don't put the wardrobe in front of the window, don't block the door, etc.).

After about 20 minutes, the teacher encourages the students to finish choosing their items, cut them out, arrange them, and glue them to their floor plan.

By the end of the 30-minute period, all students must have completed Part 1, since Part 2 is a group activity.

Part 2 : Reactivating Knowledge of Basic Lines

About 10 minutes

Basic Lines

The students should have their floor plans in front of them and their Student Booklets opened to “Part 2: Reactivating Knowledge of Basic Lines.”

The teacher explains the purpose of each of the basic lines and leads a group discussion to make sure that students can identify them on their floor plans.

Suggested Questions to Ask the Class:

Questions	Possible Answers
Do you see any **visible contour lines** on your floor plan?	*Yes, all the object perimeters are drawn with visible contour lines. Visible contour lines are medium-weight and solid.*
Do you see any **hidden contour lines** on your floor plan?	*Yes, most of the furniture has hidden contour lines. Hidden contour lines are medium-weight and dotted.*
Do you see any **hatched lines** on your floor plan?	*Yes, the interior of the walls is represented with hatched lines.*
Do you see any **centre lines** on your floor plan?	*Yes, round objects (except the ball) have a centre line to identify their centre.*
Which basic lines are missing from your floor plan?	*On my floor plan, there are no dimension lines, extension lines, centre lines, or construction lines.*

The teacher concludes the reactivation period by pointing out that dimension lines, extension lines, and leader lines will have to be added to the floor plan later on in the activity.

Part 3 : Scale and Dimensioning

About 75 minutes total

Scale

The following table gives an example of a 30-minute lesson on scale.

<table>
<tr><th>Topic</th><th>Procedure</th><th>Approximate Duration</th></tr>
<tr><td>The uses of scales</td><td>As a class

Led by the teacher</td><td>5 min.</td></tr>
<tr><td>Where and how to indicate the scale on a drawing</td><td rowspan="2">Individually

The students read the “Scale” section of the Student Booklet.</td><td rowspan="2">10 min.</td></tr>
<tr><td>The three types of scale</td></tr>
<tr><td>Example of a scale calculation</td><td>As a class

Led by the teacher</td><td>5 min.</td></tr>
<tr><td>Individual work time</td><td>Individually

The students answer questions 1 to 3 in the Student Booklet.</td><td>10 min.</td></tr>
</table>

The Uses of Scales

About 5 minutes, as a class

The teacher explains the different types of scale and explains when each type should be used. A brief group discussion can then be led to check understanding.

Suggested Explanation:

In technical drawing, scales are often necessary to:

- Improve the clarity of a drawing
- Improve the precision of a drawing
- Adapt the size of the object being drawn to the size of the sheet of paper

Suggested Questions to Ask Students:

Questions	Possible Answers
Would it be possible to draw a floor plan without using a scale?	*No, that's not possible. You'd need a sheet of paper as big as the room. It's not realistic.*
Which of the objects in Appendix 1 do you think could be drawn on an 11 x 17 piece of paper without scaling down their dimensions?	*- Tablet* *- Book* *- Soccer ball* *- Video game controller*
Would it be possible to draw a Monopoly game piece without using a scale?	*No, that's not possible. The drawing would be so small that too many details would be lost.*

Where and How to Indicate the Scale on a Drawing

About 10 minutes, individually

The students read the “Scale” section of the Student Booklet.

The teacher circulates to answer questions if necessary.

Example of a Scale Calculation

About 5 minutes, as a class

The teacher explains how to calculate a scale from the dimensions in the drawing and the actual dimensions, using the following example on the board.

Example Calculation

A bookcase has an actual width of 400 mm. In the drawing, this measurement is represented by a 50 mm line. What is the scale of the drawing?

1. **We identify the data**

   Dimensions in the Drawing = 50 mm
   Actual Dimensions = 400 mm

2. **We write down the scale ratio**

   The scale corresponds to the following ratio, which can also be expressed as a fraction.

   $$\textit{Dimensions in the Drawing} : \textit{Actual Dimensions} \iff \frac{\textit{Dimensions in the Drawing}}{\textit{Actual Dimensions}}$$

3. **We replace the variables with our data**

   $$\textit{Scale} = \frac{50\ \textit{mm}}{400\ \textit{mm}}$$

4. **We reduce the fraction**

   $$\textit{Scale} = \frac{1}{8}$$

   $$\frac{1}{8} \iff 1:8$$

5. **We answer the question**

   The bookshelf is drawn at a 1:8 scale.

Individual Work Time

About 10 minutes, individually

The students answer questions 1 to 3 in the student booklet.

Answers to Questions 1 to 3

1. The floor plan of your dream room is drawn using a...

- [x] Reduction scale
- [ ] Enlargement scale
- [ ] Actual size scale

2. If you had to draw a Monopoly game piece, what would be the best scale to use?

- [ ] 1 : 1
- [ ] 1 : 5
- [ ] 2 : 1
- [x] 10 : 1

3.

- The actual length of the bed is 1900 mm. Write down this measurement in your calculation space.
- Using a ruler, measure the length of the bed on the floor plan of your room and write it in the calculation space below.
- Using the actual length of the bed and the length measured on the drawing, calculate the scale of your bedroom floor plan, then enter the scale in the "Scale" box on your floor plan.

1. We identify the data

   Dimensions in the Drawing = 95mm

   Actual Dimensions = 1 900mm

2. We write down the scale ratio
   The scale corresponds to the following ratio, which can also be expressed as a fraction.

   $$\textit{Dimensions in the Drawing} : \textit{Actual Dimensions} \iff \frac{\textit{Dimensions in the Drawing}}{\textit{Actual Dimensions}}$$

3. We replace the variables with our data

   $$\textit{Scale} = \frac{95\ mm}{1\ 900\ mm}$$

4. We reduce the fraction

$$Scale = \frac{1}{20}$$

$$\frac{1}{20} \iff 1:20$$

5. We answer the question

> The floor plan uses a 1:20 scale.

Dimensioning

The following table gives an example of a 45-minute lesson on dimensioning.

Topic	Procedure	Approximate Duration
Presentation of dimensioning rules	As a class The teacher explains the dimensioning rules using the visual aid.	10 min.
Individual work time	Individually The students dimension their floor plans.	35 min.

Presentation of Dimensioning Rules

About 10 minutes, as a class

The teacher presents the dimensioning rules using the visual aid provided.

Individual Work Time – Dimensioning the Floor Plan

About 35 minutes, individually

The students dimension their plans, making sure to include the information listed in points 4 and 5 of the Student Booklet. They can check off each dimension as they work to make sure they don't forget anything. If needed, they can refer to the "Dimensioning" section of the booklet to review the dimensioning rules.

The teacher circulates to answer questions.

Tip

The teacher can give the students tips and suggest that they do each step of dimensioning in a specific order to make it easier.

- Suggest that students start dimensioning their floor plans by lightly sketching out the lines, so it's easier to erase them if needed. Once they're done dimensioning, they can make the lines thicker and darker.

Suggested Approach

1. Draw all the extension lines.
2. Draw all the dimension lines and arrows.
3. Erase the middle of the dimension lines to make a blank space.
4. Draw the leader lines to indicate the radius or diameter of any circles.
5. Draw the curved lines to identify angles.
6. Measure all the objects in the floor plan, then calculate the actual dimensions using the scale.
7. Write all the dimensions in between the dimension lines
8. Check that nothing has been forgotten, using the checklists in points 4 and 5 of the Student Booklet.

When the students have finished dimensioning their floor plans, they will hand them in along with the Student Booklet.

Dimensions of Furniture and Accessories

The following table lists the dimensions as shown in the drawing and the actual dimensions of each object. Please note that the dimensions in the drawing may vary slightly due to printing or depending on the ruler used by the student.

Object	Dimensions in the Drawing	Actual Dimensions
Twin bed	95 mm × 50 mm	1 900 mm × 1 000 mm
Double bed	95 mm × 70 mm	1 900 mm × 1 400 mm
Armchair	50 mm × 50 mm	1 000 mm × 1 000 mm
Loveseat	90 mm × 50 mm	1 800 mm × 1 000 mm

Desk chair (including legs)	50 mm × 50 mm	1 000 mm × 1 000 mm
Laptop	20 mm × 18 mm	400 mm × 360 mm
Game console	15 mm × 13 mm	300 mm × 260 mm
Skateboard	30 mm × 8 mm	600 mm × 160 mm
TV stand with TV	80 mm × 20 mm	1 600 mm × 400 mm
Tablet	10 mm × 13 mm	200 mm × 260 mm
Book	10 mm × 13 mm	200 mm × 260 mm
Dresser	80 mm × 40 mm	1 600 mm × 800 mm
Desk	80 mm × 30 mm	1 600 mm × 600 mm
Bookshelf	90 mm × 25 mm	1 800 mm × 500 mm
Nightstand (including handle)	30 mm × 25 mm	600 mm × 500 mm
Wardrobe	125 mm × 30 mm	2 500 mm × 600 mm
Rug	DIA = 70 mm R = 35 mm	DIA = 1 400 mm R = 700 mm
Coffee table	DIA = 40 mm R = 20 mm	DIA = 800 mm R = 400 mm
Lamp	DIA = 15 mm R = 7,5 mm	DIA = 300 mm R = 150 mm
Soccer ball	DIA = 10 mm R = 5 mm	DIA = 200 mm R = 100 mm

Plant	DIA = 30 mm R = 15 mm	IA = 600 mm R = 300 mm
Door width	90 mm	1 800 mm
Overall dimensions (exterior walls)	250 mm × 160 mm	5 000 mm × 3 200 mm
Overall dimensions (interior walls)	240 mm × 150 mm	4 800 mm × 3 000 mm
Door swing angle	90 °	90 °