

THE CASE STUDY

Anyone who works sitting down knows what it's like to have back pain. Thanks to ergonomics, it is now possible to have chairs that are designed to help prevent such discomfort. The field of ergonomics studies working conditions and the relationship between people and objects. The designer, by adapting the object to its user, increases the user's well-being and productivity. More and more companies are integrating ergonomic norms into their workplace design. The municipal library recently received complaints from users who have experienced back pain sitting in its chairs. In an effort to maintain its patronage, the library has decided to purchase some ergonomic reading chairs.

WORK ORDER

Good Measure Designs, Inc.

TO: All designers
 DATE: April 12, 2018
 SUBJECT: Signing of a contract with the municipal library

We are proud to announce that we have just signed an important contract with the municipal library. To ensure the comfort and well-being of its patrons, the library has ordered ergonomic reading chairs adapted to its clientele. They have chosen to target four separate groups: young children, children, small adults and tall adults. We are asking our designers to submit multiview projections for each of the target clientele, keeping in mind technical and ergonomic norms. Later, the designers will undertake to create the chair's style and maximize its potential for comfort.

Thank you for your collaboration.

Jim Gray

President

In this learning and evaluation situation, you will play the role of a designer. To complete the task, you will need to:

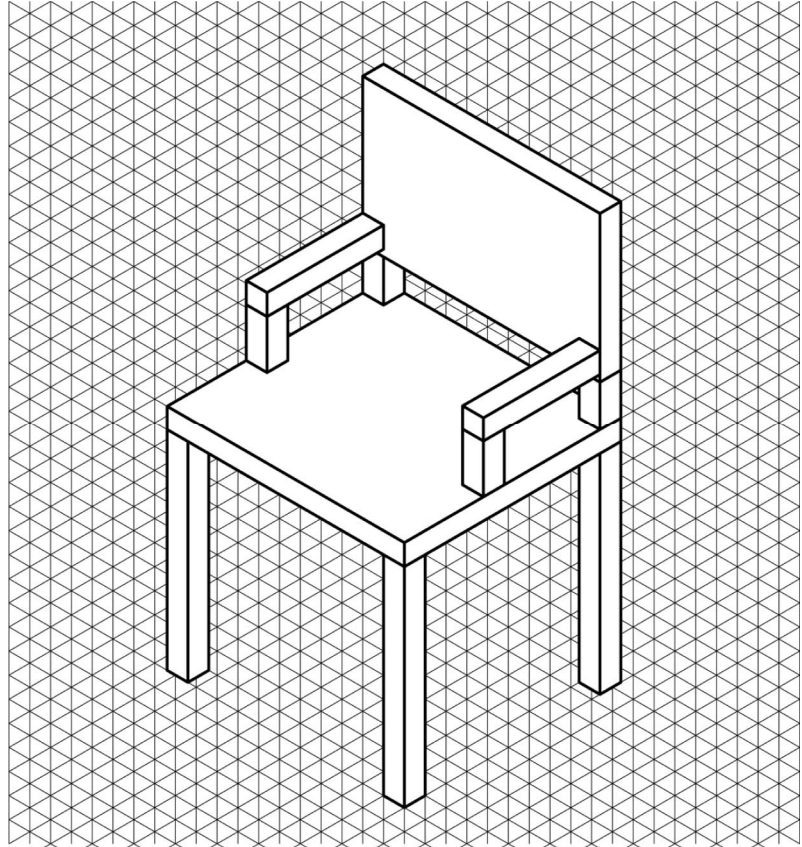
- Calculate the measurements for each part of the chair.
- Make multiview projections of the chair at a scale of 1:10.
- Provide dimensions for each of the following chair parts:

| | |
|-------------------------------------|----------------------------|
| – height of the chair-back supports | – length of the armrests |
| – total height of the chair back | – depth of the chair seat |
| – height of the armrest supports | – width of the chair seat |
| – height of the armrests | – height of the chair legs |



THE CASE STUDY *(continued)*

Technical and ergonomic norms established by Good Measure Designs, Inc.



Technical norms

- 1.1 The chair-back supports, armrest supports, armrests and chair legs are made of square wooden balusters (posts), measuring 5 cm × 5 cm.
- 1.2 The chair seat and the chair back are 5 cm thick.

Ergonomic norms

Chair legs

2.1 Height

The highest part of the chair seat should be at knee height. In this way, the user, when seated, can rest his/her feet comfortably on the floor.

Seat

2.2 Depth

When seated, the user should be able to rest his/her back against the chair back without there being any pressure on the back of the knees from the seat; there should be 5 cm of space between the back of the user's knees and the edge of the seat.

2.3 Width

The seat should be wide enough so that there is no pressure placed on either side of the user's thighs and pelvis, so leave 2.5 cm of space on either side of the pelvis when the legs are slightly apart. In addition, the designer must leave 10 cm for space to secure the armrests.



THE CASE STUDY *(continued)*

The chair back

2.4 Total height

The height of the chair back should correspond to the height of the user's shoulders when he/she is seated. The user should be able to rest his/her neck on the top of the chair back when stretching.

2.5 Width

For maximum comfort, the chair back should be the same width as the seat.

The chair-back supports

2.6 Height

The chair-back supports should be 10 cm high. They should be positioned on the right and left sides of the chair back and at the two back corners of the seat.

Note: The space that this creates will allow the natural curve in the user's lower spine to occupy the 5-cm space below the chair back.

The armrests

2.7 Length

The armrests should provide enough room for the user's entire forearms—from elbow to wrist—to rest comfortably.

The armrest supports

2.8 Height

The user should be able to rest his/her elbows on the armrests, with arms vertical and shoulders relaxed. The armrests must not hamper natural movement.



THE CASE STUDY *(continued)*

Measurements for the target groups

Unit of measurement: cm

Young child

- A. Length floor–knee 30
- B. Length knee–hip 30
- C. Length hip–top of shoulder 35
- D. Length top of shoulder–top of head 22
- E. Length shoulder–elbow 15
- F. Length elbow–beginning of wrist 12
- G. Length wrist–tips of fingers 14
- H. Width of pelvis, legs slightly apart 24

Child

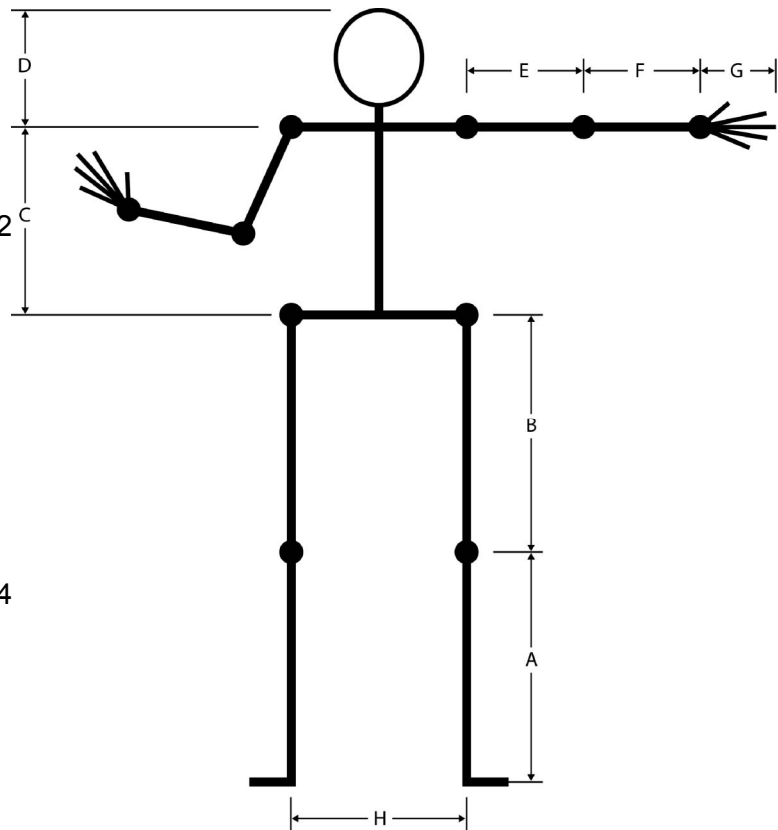
- A. Length floor–knee 40
- B. Length knee–hip 40
- C. Length hip–top of shoulder 38
- D. Length top of shoulder–top of head 24
- E. Length shoulder–elbow 22
- F. Length elbow–beginning of wrist 20
- G. Length wrist–tips of fingers 16
- H. Width of pelvis, legs slightly apart 26

Small adult

- A. Length floor–knee 42
- B. Length knee–hip 46
- C. Length hip–top of shoulder 42
- D. Length top of shoulder–top of head 24
- E. Length shoulder–elbow 26
- F. Length elbow–beginning of wrist 22
- G. Length wrist–tips of fingers 17
- H. Width of pelvis, legs slightly apart 37

Tall adult

- A. Length floor–knee 55
- B. Length knee–hip 57
- C. Length hip–top of shoulder 45
- D. Length top of shoulder–top of head 28
- E. Length shoulder–elbow 28
- F. Length elbow–beginning of wrist 28
- G. Length wrist–tips of fingers 18
- H. Width of pelvis, legs slightly apart 42



Name: _____

Group: _____

CREATING THE CONTEXT

Who is your target clientele?

I ask myself questions

1. What is ergonomics?

2. Who are the actors in this case study?

3. Formulate the questions that you will have to answer as you make a technical drawing of your chair.

I must

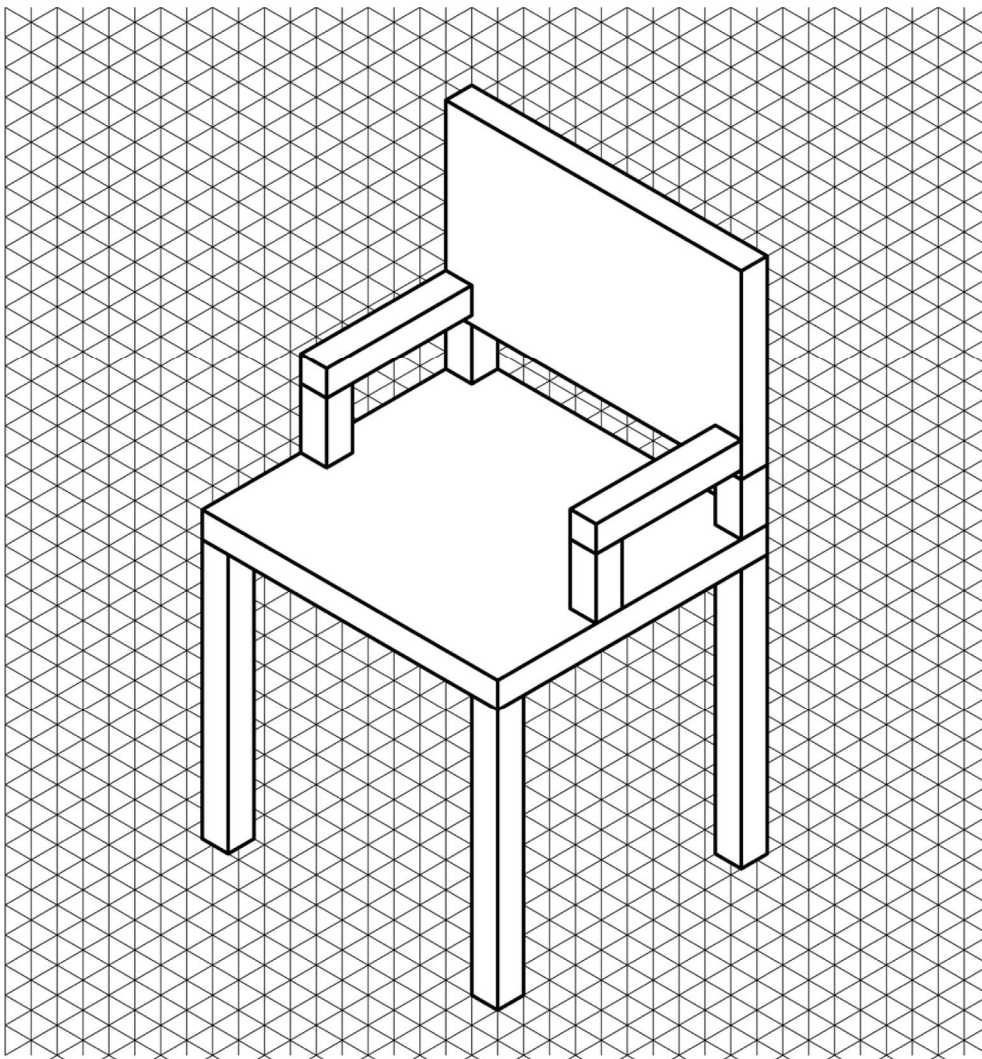
4. Reformulate the case study goal.



CREATING THE CONTEXT *(continued)*

I think

5. Which views do you think should appear on the drawing (i.e. front view, top view, bottom view, right-side view, left-side view, rear view)? Use arrows to indicate your choices on the drawing below, and justify your answers.



Justification:



Name: _____

Group: _____

GATHERING INFORMATION

I prepare my work

1. To make a technical drawing of a custom-made chair, you need to use certain basic lines.
In the table below, name the lines and explain their use.

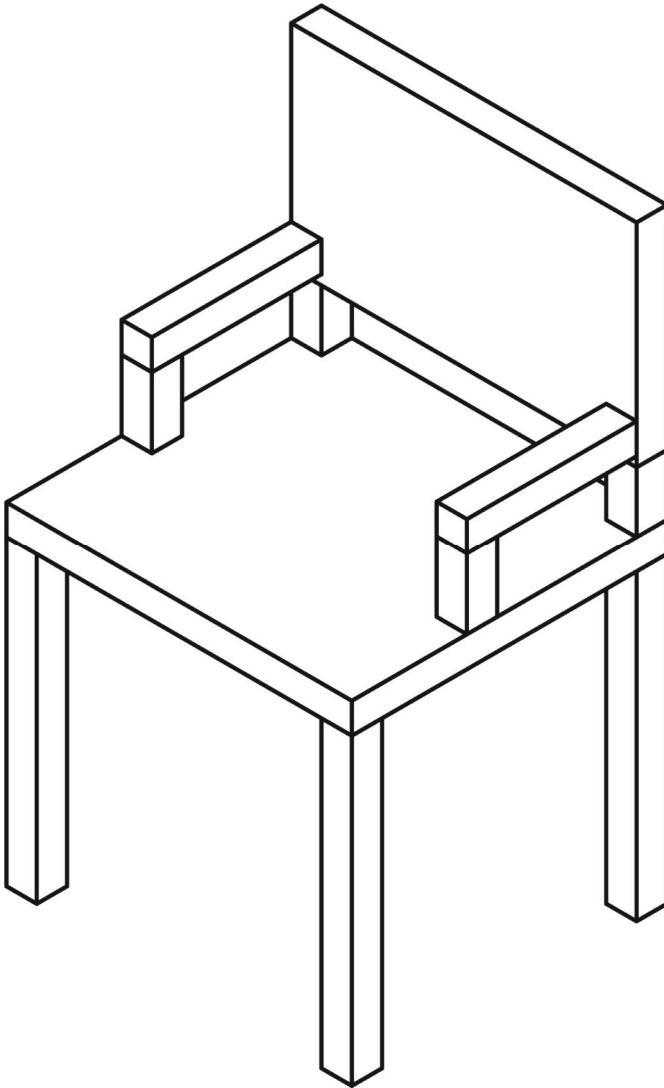
| Name of the basic line | Line | Use |
|--|------------------------|--|
| <div><div></div><div></div><div></div></div> | <div><div></div></div> | <div><div></div><div></div><div></div></div> |
| <div><div></div><div></div><div></div></div> | <div><div></div></div> | <div><div></div><div></div><div></div></div> |
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| <div><div></div><div></div><div></div></div> | <div><div></div></div> | <div><div></div><div></div><div></div></div> |

2. What calculation should be used to convert a real measurement to a scaled reduction of 1:10?



GATHERING INFORMATION *(continued)*

3. Here is the chair that you will need to draw. On the drawing, label each of the parts using dimension lines.



| Parts | |
|-------|---|
| Nos. | Characteristics |
| 1 | Thickness of chair seat |
| 2 | Depth of chair seat |
| 3 | Width of chair seat |
| 4 | Dimensions (length, width) of chair legs |
| 5 | Height of chair legs |
| 6 | Thickness of chair back |
| 7 | Dimensions (length, width) of chair-back supports |
| 8 | Height of chair-back supports |
| 9 | Width of chair back |
| 10 | Height of chair back |
| 11 | Total height of chair back |
| 12 | Dimensions (length, width) of armrests and their supports |
| 13 | Length of armrests |
| 14 | Height of armrest supports |
| 15 | Total height of armrests |



Name: _____

Group: _____

GATHERING INFORMATION *(continued)*

4. What is the formula that you will use to determine the measurements for each of the parts of your chair? Your formula will include the measurements for your target group, and where necessary, the extra space for ease as defined by the norms of the firm.

Width of chair seat= _____

Height of chair leg = _____

Width of chair back = _____

Height of chair back = _____

Total height of chair back = _____

Length of armrest = _____

Height of armrest supports = _____

Total height of armrests = _____

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Name: _____

Group: _____

GATHERING INFORMATION *(continued)*

I apply my research results

5. Using the data gathered in No. 4, find the measurements of the chair parts and record them in the column “True value” in the table below. Next, record the value to scale in the adjacent column.

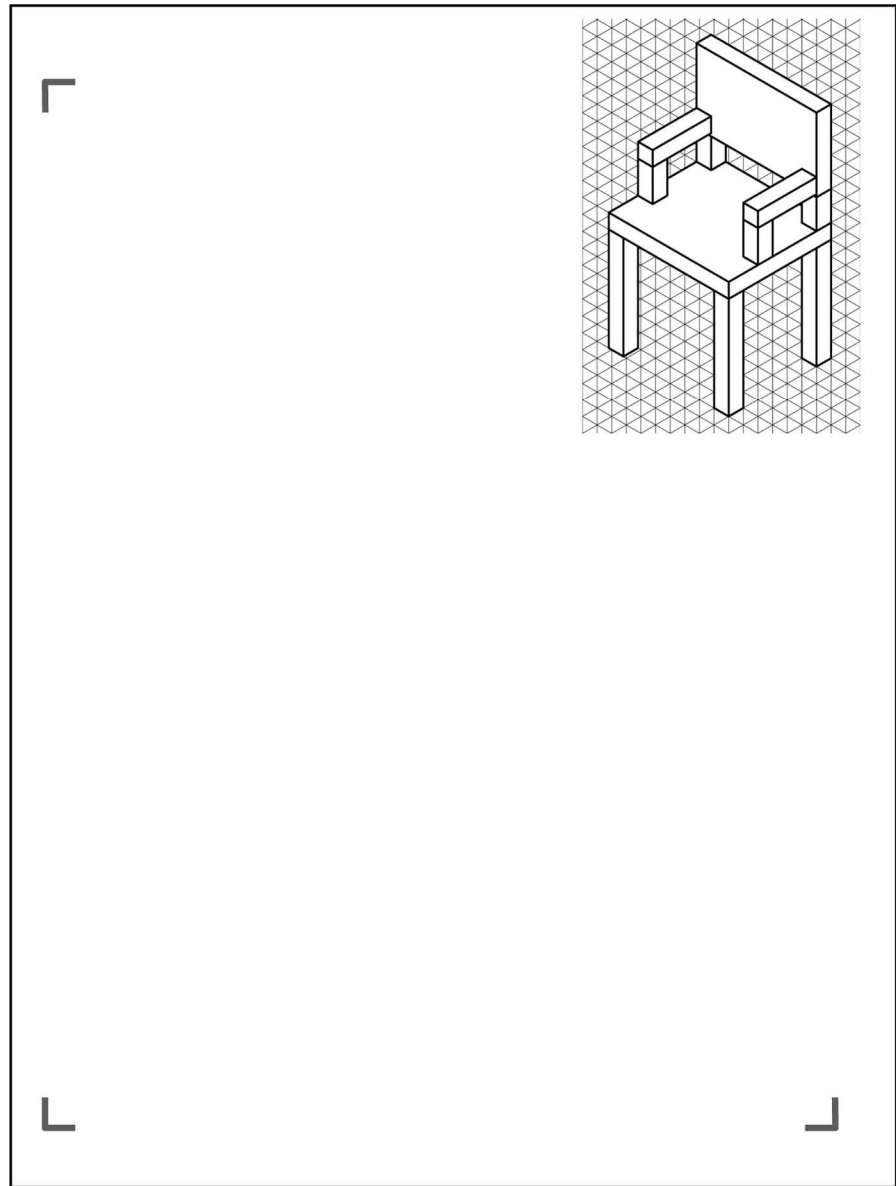
| Chair part | | Measurement of part | |
|------------|---|---------------------|-------------------------------|
| No. | Aspect | True value (mm) | Value to a scale of 1:10 (mm) |
| 1 | Thickness of seat | | |
| 2 | Depth of seat | | |
| 3 | Width of seat | | |
| 4 | Dimensions (length, width) of chair legs | | |
| 5 | Height of chair legs | | |
| 6 | Thickness of chair back | | |
| 7 | Dimensions (length, width) of chair-back supports | | |
| 8 | Height of chair-back supports | | |
| 9 | Width of chair back | | |
| 10 | Height of chair back | | |
| 11 | Total height of chair back | | |
| 12 | Dimensions (length, width) of armrests and their supports | | |
| 13 | Length of armrests | | |
| 14 | Height of armrest supports | | |
| 15 | Total height of armrests | | |



GATHERING INFORMATION *(continued)*

6. Make sketches of the front view, the right-side view and the top view of the chair illustrated here.

- Lay out the three views in an L-shape.
- You don't have to make a drawing to scale just yet.



Reflection

Do I have a good understanding of:

- geometric lines?
- forms of representation (such as sketch, perspective drawing, oblique projection)?
- basic lines?
- orthogonal projections (multiview, isometric)?
- dimensioning?

| Yes | No |
|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |

Name: _____

Group: _____

COMPLETING THE CASE STUDY

I make suggestions

1. On the next page, complete your drawings of the front, right-side and top views of the chair that is adapted to your target group.
 - Make your technical drawing to a scale of 1:10.
 - Use dimensioning to indicate:
 - ☐ height of the chair-back supports
 - ☐ total height of the chair back
 - ☐ height of the armrest supports
 - ☐ height of the armrests
 - ☐ length of the armrests
 - ☐ depth of the chair seat
 - ☐ width of the chair seat
 - ☐ height of the chair legs

Reflection

Have I explored different ways of using drafting instruments?

Yes

☐

No

☐

Group: _____

[illegible]

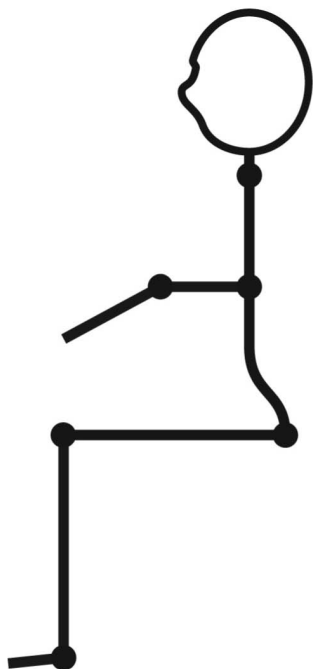
SCALE:

Name: _____

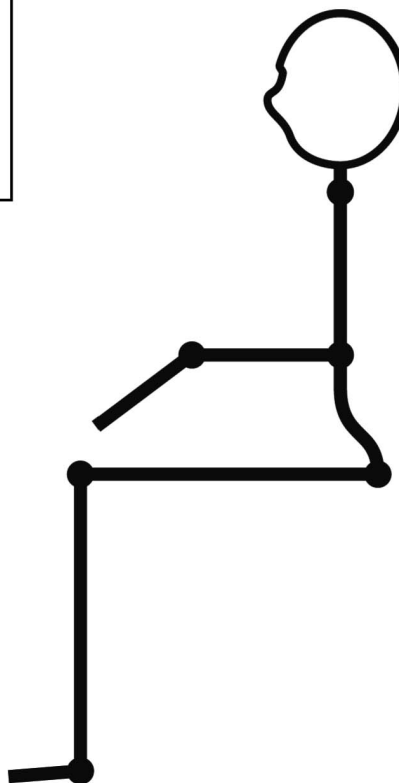
Group: _____

VALIDATING THE CASE STUDY *(continued)*

Young child



Child



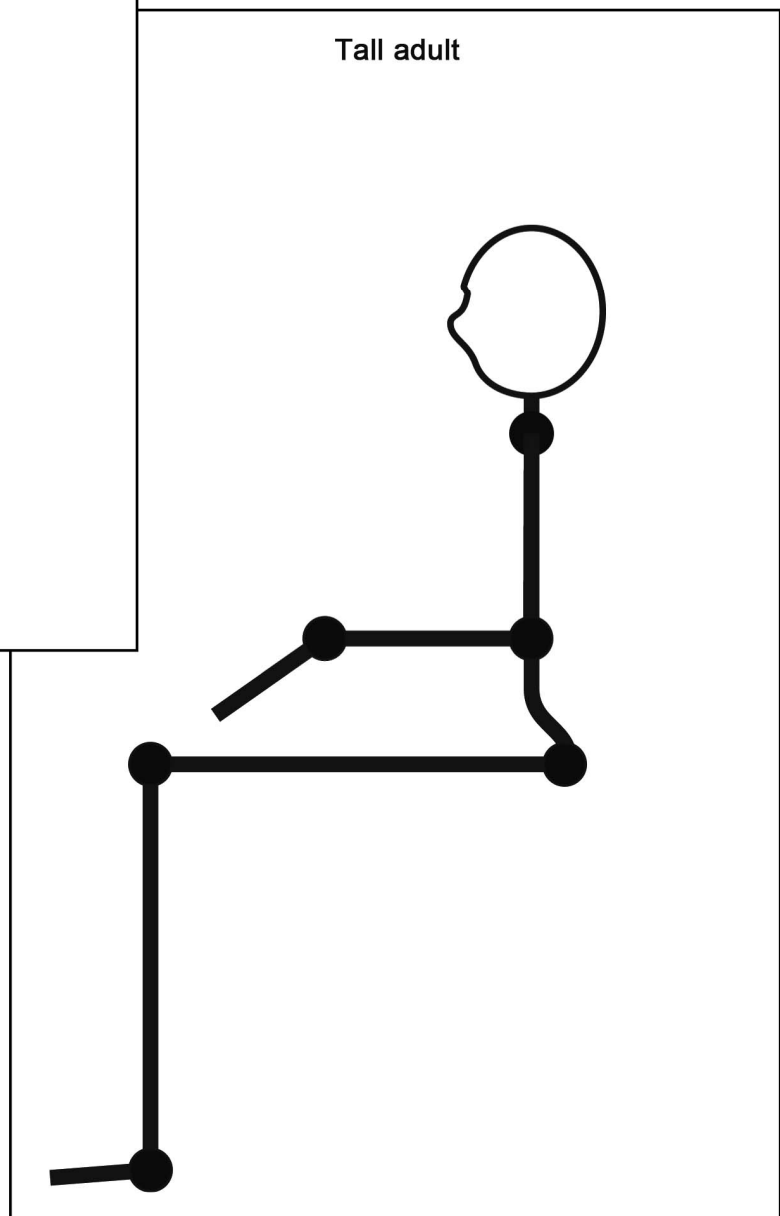
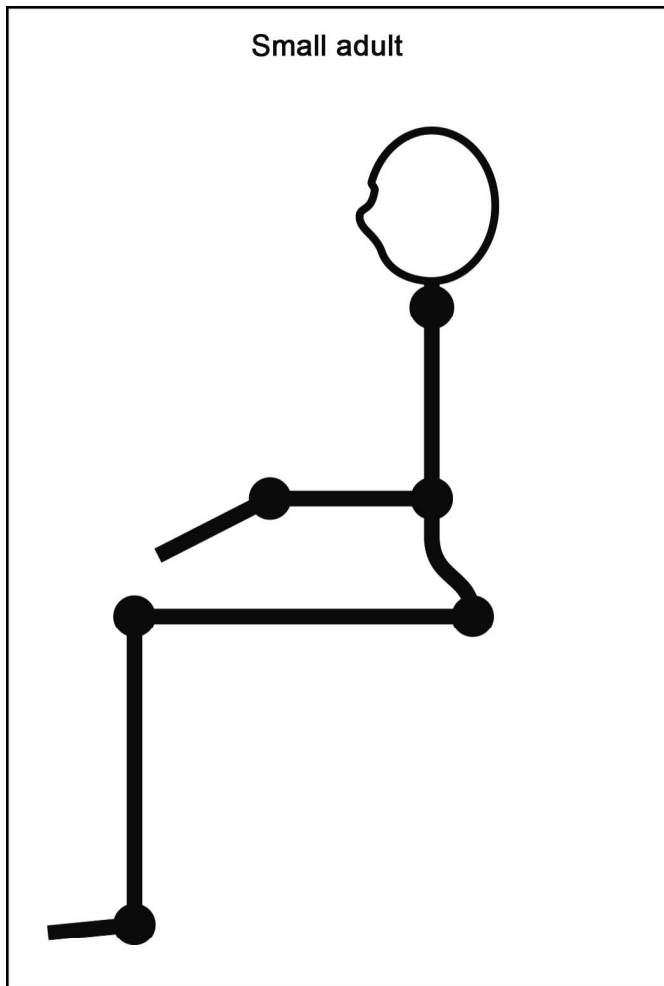
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Name: _____

Group: _____

VALIDATING THE CASE STUDY *(continued)*



Name: _____

Group: _____

MY EVALUATION

Use the evaluation grid on the next page to do a self-evaluation. Write A, B, C, D or E in the appropriate place in the table.

| SSC2 Makes the most of his/her knowledge of science and technology | | | | |
|---|---|----|---------------------------------------|----------|
| Criteria* | Observable indicators | Me | Teacher | Comments |
| 1 | Creating the context | | <input type="checkbox"/> With help | |
| | Statement of the case study goal and formulation of questions for information gathering | | | |
| | | | | |
| | | | | |
| | | | | |
| 2 | Gathering information | | <input type="checkbox"/> With help | |
| | Respect for the norms when calculating the dimensions for the chair | | | |
| | | | | |
| | | | | |
| | | | | |
| 3 | Completing the case study | | <input type="checkbox"/> With help | |
| | Production and dimensioning of multiview projections | | | |
| | | | | |
| | | | | |
| | | | | |
| 4 | Validating the case study | | <input type="checkbox"/> With help | |
| | Justification of the respect for ergonomic norms | | | |
| | | | | |
| | | | | |
| | | | | |

* Evaluation criteria

- 1 Formulation of appropriate questions
- 2 Appropriate use of scientific and technological concepts, laws, models and theories
- 3 Relevant explanations or solutions
- 4 Suitable justification of explanations, solutions, decisions or opinions

Name: _____

Group: _____

EVALUATION GRID

SSC2 Makes the most of his/her knowledge of science and technology

| Criteria* | Observable indicators | A | B | C | D | E |
|-----------|--|---|---|--|--|------------------------------|
| 1 | CREATING THE CONTEXT Statement of the case study goal and formulation of questions for information gathering | The questions directing the information gathering are relevant and the case study goal is very clear. | The questions directing the information gathering are relevant and the case study goal is clear. | The questions directing the information gathering are more or less relevant OR the goal is more or less clear. | The questions directing the information gathering are more or less relevant AND the case study goal is more or less clear. | The work needs to be redone. |
| 2 | GATHERING INFORMATION Respect for the norms when calculating the dimensions for the chair | All of the measurements for the chair parts are precise and respect the norms. | Most of the measurements for the chair parts are precise and respect the norms. | Many of the measurements for the chair parts are precise and respect the norms. | Some of the measurements for the chair parts are precise and respect the norms. | The work needs to be redone. |
| 3 | COMPLETING THE CASE STUDY Production and dimensioning multiview projections | The multiview projections are precise and respect the norms for technical drawing. | The multiview projections are precise and respect the norms for technical drawing, but the drawings contain a few minor errors. | The multiview projections are more or less precise OR more or less respect the norms for technical drawing. | The multiview projections are more or less precise AND more or less respect the norms for technical drawing. | The work needs to be redone. |
| 4 | VALIDATING THE CASE STUDY Justification of the respect for ergonomic norms | All of the explanations are relevant and clearly indicated on the drawings. | Most of the explanations are relevant and clearly indicated on the drawings. | The explanations are more or less relevant OR are poorly indicated on the drawings. | The explanations are more or less relevant AND are poorly indicated on the drawings. | The work needs to be redone. |

* Evaluation criteria

- 1 Formulation of appropriate questions
- 2 Appropriate use of scientific and technological concepts, laws, models and theories
- 3 Relevant explanations or solutions
- 4 Suitable justification of explanations, solutions, decisions or opinions