



# Title of the STEAM Unit: Chair Design

## AUTHORS:

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RELATED SUBJECTS	GRADE RECOMMENDATIONS	TOTAL ACTIVITY TIME	LEARNING OBJECTIVES DURING THE LESSON SUBJECT-SPECIFIC COMPETENCIES	LEARNING OBJECTIVES AFTER THE LESSON
Physics Mathematics Art Engineering	Grade 1 / 2 Age 12 - 14	Total time needed to complete the activity (in minutes).	Introduction to learning objectives during the lessons (short term)	Introduction to learning Objectives after the lessons, e.g. goals for follow-up (long-term)

## OVERVIEW: TOPIC & PURPOSE

The "Chair Design" unit is an educational program designed to integrate elements of Physics, Mathematics, Arts, and Engineering. Targeted at students aged 12-14, this curriculum spans multiple sessions, where students explore the complexities of designing and building a functional and aesthetically pleasing chair. This project not only engages students in practical design and engineering challenges but also deepens their appreciation for the artistic and ergonomic aspects of everyday objects. This unit aims to cultivate a holistic understanding of the interdisciplinary nature of design and engineering. By creating a chair, students are not just making an object to sit on; they are engaging in a complex integration of art, science, and practical functionality. The goal is to empower students to think critically and creatively about the design challenges and to appreciate the integration of aesthetics into functional everyday objects.





## Learning Goals

The unit is structured around a set of progressive learning objectives:

- **Technical and Design Skills:** Students will learn the basics of ergonomic design, material properties, and the engineering behind stable structures.
- **Artistic Expression and Appreciation:** Emphasizing the art and history of chair design, the unit encourages students to explore various artistic styles and cultural significances of chairs.
- **Mathematical Application:** Through activities such as scaling and measurement, students will apply mathematical concepts to ensure their designs are both practical and proportionally accurate.
- **Collaborative Learning:** Working in teams, students will enhance their communication and cooperative skills, crucial for successful project-based learning.

## Structure

The unit is divided into several key phases, each focusing on different aspects of the chair design process:

1. **Concept and Design:** Introduction to ergonomic principles and the history of chairs, followed by brainstorming and initial sketches.
2. **Scientific and Mathematical Exploration:** Investigation of the forces acting on chairs and the material properties needed for stability and durability.
3. **Artistic Development:** Students will create detailed designs, considering aesthetic elements like color, form, and texture.
4. **Engineering and Construction:** Transition from design to prototype, using various tools and materials to construct a chair that is both functional and visually appealing.





- Evaluation and Iteration:** Testing and refining their designs based on peer feedback and practical use to understand the real-world applications of their creations.

## ACTIVITY PREREQUISITES: -

## STEAM ELEMENTS

<b>ELEMENT 1:</b> context presentation	Real-world / scientific / artistic context of the unit.
<b>ELEMENT 2:</b> creative design	Summary of creative activities in the unit.
<b>ELEMENT 3:</b> emotional and social learning	Summary of emotional and social skills development in the unit.

## STEAM SUBJECT ELEMENTS

STEAM SUBJECTS	SCIENCE	TECHNOLOGY	ENGINEERING	ARTS	MATHEMATICS
<b>SHORT INTRODUCTION TO RELATED SUBJECT ELEMENTS</b>	Ergonomy Matter and material	The technology behind a chair, how can a chair stand and how can you use it?	Connections	History of chairs Everybody makes a different chair	Measuring Scaling





**SYLLABUS**

LESSONS	SUBJECTS	TOPIC OF THE UNIT	LEARNING OBJECTIVES DURING THE LESSON: SUBJECT SPECIFIC COMPETENCIES	LEARNING OBJECTIVES AFTER THE LESSON: STEAM COMPETENCIES
1	DiVa	<b>KICK-OFF</b> Brainstorm + Introduction Which chair does fit you?	What ergonomic type am I?	Design thinking Collaboration Emotional Learning
2	M&N	What are the forces acting on a chair?	Forces: Students can identify the forces acting on a chair when it is in use, such as the gravitational force acting on the chair and the person sitting on it, as well as the reaction forces from the floor.	Critical thinking Problem-solving skills
3	K&C	Designing a chair?	3D-Design Students can perform measurements and calculations to determine and optimize the dimensions, proportions, and angles of a chair.	Creative design Design principles Critical thinking Problem-solving skills





			Students can apply mathematical concepts such as geometry and algebra in designing a chair, for example, to calculate stability and balance.	
4	M&N	Materials Checklist Go/Don't go before prototyping	<p><b>Matter and Materials:</b></p> <p>Students can analyze the properties of materials and understand how different materials can be used in designing and constructing a chair.</p> <p>Students can create creative designs for a chair, considering aesthetic aspects such as shape, color, texture, and composition.</p> <p>Students can use various visual art techniques and</p>	<p>Creative design</p> <p>Design principles</p> <p>Critical thinking</p> <p>Problem solving</p>





			materials to create a prototype or scale model of a chair and present it effectively.	
5	M&N K&C	Prototyping	<p><b>Structural Design</b></p> <p>Students can create and interpret technical drawings for the design and construction of a chair, including schematic views, dimensioned drawings, and exploded views.</p>	<p><b>Creative design</b></p> <p>Design principles</p> <p>Critical thinking</p> <p>Problem solving</p>
6	M&N K&C	Reflecting on prototype	<p>Students can follow a design process, from problem identification and idea development to prototype construction and evaluation, in designing a chair.</p> <p>Students can reflect on their design process and results, receive and process feedback, and justify their design decisions to others.</p>	<p><b>Creative design</b></p> <p>Design principles</p> <p>Critical thinking</p> <p>Problem solving</p>





7	M&N K&C	Making the chair	Students can use various production methods and tools in manufacturing parts for a chair, such as cutting, drilling, sanding, and assembly.	Creative design Design principles Critical thinking Problem solving
8		Presentation		Presentation skills Problem-solving skills Creativity

## INSTRUCTIONAL PLAN BY LESSON

### LESSON 1 / Introduction Designing Comfort

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
<b>INTRODUCTION</b> (15 minutes)	Draw an object you can sit on!	Paper and Pencils	Students learn that a seat is for everyone else. -> personal preferences
<b>LEARNING ACTIVITIES</b> (20 minutes)	Chair Observation + Debate about chair	Different chairs	Have students individually choose and observe a chair. They should note what they like about the chair and what they would change.  After the observation, they can share their findings with a





			classmate and discuss why they find certain aspects important.  Extra; Draw this chair
<b>LEARNING ACTIVITIES</b> (20 minutes)	Reflection on Personal Experience	Questions	Ask questions such as: What is your favorite sitting posture? How do you feel after prolonged sitting? Have you ever experienced back pain due to a bad chair?  Let students share their experiences with a partner and discuss which aspects of a chair are important to them based on their own experiences.
<b>WRAP-UP &amp; EVALUATION</b> (15 minutes)	Chair Comparison		Have your students compared different chairs based on predetermined criteria, such as comfort, stability, and ergonomics.  Let them discuss in small groups which chair would best meet their needs and why.

## LESSON 2 / A force to be reckoned with

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
<b>INTRODUCTION</b> (10 minutes)	Show images of different types of chairs and ask students to share what they notice about them.	Images of chairs	Forces: Students can identify the forces acting on a chair when it is in use, such as the gravitational force acting on the







	Discuss with students how chairs support our weight and what forces might be acting on them when someone sits on them.		chair and the person sitting on it, as well as the reaction forces from the floor.
<b>LEARNING ACTIVITIES (20 minutes)</b>	<p>Divide the class into small groups and provide each group with a large sheet of paper or a section of the whiteboard.</p> <p>Explain the concept of forces acting on a chair, including gravitational force pulling downward and reaction forces pushing upward from the floor.</p> <p>Instruct each group to draw a simple diagram of a chair and label the forces acting on it.</p> <p>Encourage students to discuss within their groups and justify their choices of force identification.</p>	<p>Large sheet of paper or whiteboard</p> <p>Markers or colored pencils</p> <p>Printed images of chairs</p> <p>Presentation slides or visual aids</p>	<p>Forces: Students can identify the forces acting on a chair when it is in use, such as the gravitational force acting on the chair and the person sitting on it, as well as the reaction forces from the floor.</p>
<b>LEARNING ACTIVITIES (20 minutes)</b>	<p>Present students with various scenarios involving chairs, such as:</p> <ul style="list-style-type: none"> <li>A person sitting still on a chair</li> <li>Someone leaning back on a chair's backrest</li> <li>A heavy object placed on a chair</li> </ul> <p>For each scenario, ask students to predict and discuss how the forces acting on the chair might change. Facilitate a class discussion on the implications of different forces on chair stability and safety</p>		
<b>WRAP-UP &amp; EVALUATION (15 minutes)</b>	<p>Recap the key concepts learned about the forces acting on chairs.</p> <p>Engage students in a reflective discussion on the importance of</p>		





considering forces when designing and using chairs.  
Encourage students to relate their understanding of forces to real-world examples of chair design and engineering.

### LESSON<sub>3</sub> / Exploring 3D Design in Chair Design

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
<b>INTRODUCTION</b> (10 minutes)	introduction	Examples various chair designs (art history)	<ul style="list-style-type: none"> <li>Start the lesson by discussing the importance of 3D design in creating functional and aesthetically pleasing chairs.</li> <li>Show examples of various chair designs and highlight how dimensions, proportions, and angles play a crucial role in their functionality and appearance.</li> </ul>
<b>LEARNING ACTIVITIES</b> (30 minutes)	Dimensions and proportions + Personal preferences	Big protractor or apps/ online tools that can help them calculate angles and measurements	Explain to students the significance of accurate measurements in chair design. Demonstrate how to measure and calculate dimensions such as seat height, width, depth, backrest height, etc. using tools





			like rulers, protractors, and measuring tapes. Introduce students to apps or online tools that can help them calculate angles and measurements accurately. Provide examples of chair designs and discuss how proportions contribute to their comfort and usability.
<b>LEARNING ACTIVITIES</b> (30 minutes)	Fast build	Clay or Lego e.g.	Sketching in3D the shape that you want
<b>WRAP-UP &amp; EVALUATION</b> (x minutes)	Critical thinking / reflect		Encourage students to compare different chair designs and justify their opinions based on the discussed principles.

## LESSON 4 / What's the matter with your chair?

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
<b>INTRODUCTION</b> (10 minutes)	<p>Begin the lesson with a brief discussion about chairs and the materials they are typically made of. Show students samples of different materials and discuss their properties (e.g., strength, flexibility, durability, texture).</p> <p>Ask students to brainstorm ideas about how different materials could be used in designing a chair.</p>	<p>Samples of different materials (e.g., wood, plastic, metal, fabric)</p> <p>Large sheets of paper or whiteboard</p> <p>Markers, colored pencils, and other art supplies</p> <p>Printed images of chairs for inspiration</p> <p>Presentation slides or visual aids</p>	<p><b>Matter and Materials:</b> Students can analyze the properties of materials and understand how different materials can be used in designing and constructing a chair.</p> <p>Students can create creative designs for a chair, considering aesthetic aspects such as shape, color, texture, and composition.</p> <p>Students can use various visual art techniques and materials to</p>





			create a prototype or scale model of a chair and present it effectively.
<b>LEARNING ACTIVITIES (20 minutes)</b>	<p>Divide the class into small groups and provide each group with samples of different materials.</p> <p>Instruct students to analyze the properties of each material and discuss how they could be utilized in designing and constructing a chair.</p> <p>Facilitate a class discussion on the advantages and disadvantages of each material for chair design.</p>		
<b>LEARNING ACTIVITIES (20 minutes)</b>	<p>Provide students with paper, markers, and other art supplies.</p> <p>Instruct students to create a design for a chair, considering aesthetic aspects such as shape, color, texture, and composition.</p> <p>Encourage students to think creatively and experiment with different design ideas, drawing inspiration from the materials and their properties.</p> <p>Circulate the classroom to provide guidance, answer questions, and facilitate discussions about design choices.</p>		
<b>WRAP-UP &amp; EVALUATION (15 minutes)</b>	<p>Have each group presented their chair design to the class, explaining their material choices and design concepts.</p> <p>Encourage students to ask questions and provide feedback to their peers.</p>		





Facilitate a discussion about the different design approaches and the creative use of materials.

## EVALUATION PLAN BY LESSON

LESSON	EVALUATION CRITERIA	EVALUATION METHOD
1	E.g. Does the student now what ergonomy	E.g. Make a sketch of a chairlike object
2	E.g. Students present/discuss their chairlike design with each other	E.g. Observation, comparing products
3	E.g. Students can identify forces that being generated on chairs	E.g. Observation, peer-review of presentation materials
4	E.g. Is the student able to implement ... ?	E.g. Creating a project for recontextualizing and adapting the idea
5	E.g. Did the students cooperate ...?	E.g. Observation, self-evaluation of groups / students.

## NOTES

Maak een bouwinstructie voor de stoel

## ACTIVITY SHEETS TO BE LINKED

Optional

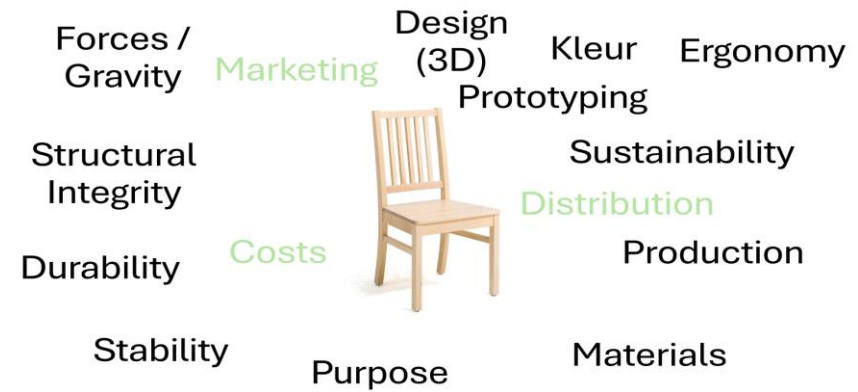
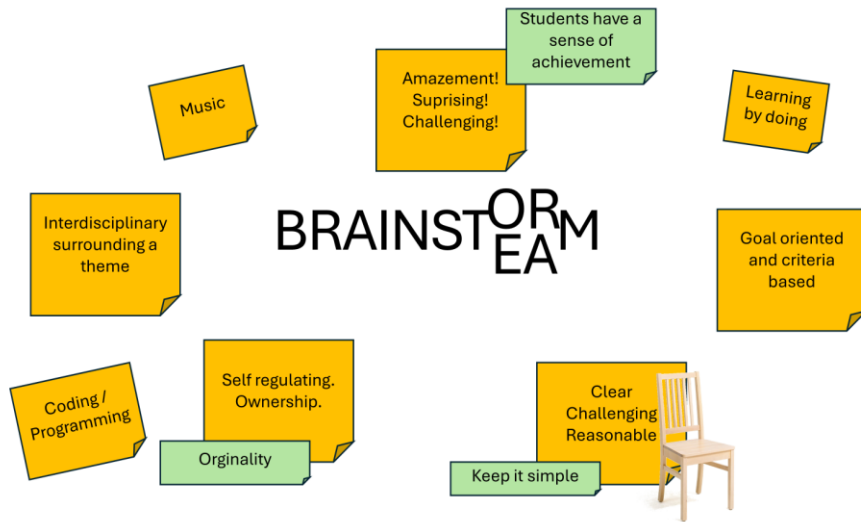
## EVALUATION MATERIALS TO BE LINKED

Optional





## REFERENCES / SUPPORTING MATERIALS TO BE LINKED





3 UUR KNIPPEN, PLAKKEN EN VLOEKEN (MAAR DAN HEB JE OOK WAT).  
GEDRUKT EN ONTWORPEN IN POLEN

DIT IS EEN **SCHAALMODEL 1:65** VAN PAPIER. GEKOCHE IN HET **CENTRAAL-MUSEUM IN UTRECHT**

VOOR 7 EURO

CENTRAAL TEN OPZICHT VAN WAT OF WAAR?

EEN ORIGINALE RIETVELD STOEL IS VOLGENS DE EXPERTS **ECHT** ALS DEZE TIJDENS HET LEVEN VAN GERRIT RIETVELD (1888-1969) IS GEBOUWD.

IN 1923 KOSTTE EEN "FJINE" UITVOERING VAN DEZE STOEL IN HOUT 22 GULDEN

BIJ VEILINGHUIS CHRISTIE'S IS IN 2007 EEN ONBESCHILDERD EXEMPLAAR VAN DEZE STOEL VERKOCHT VOOR 264.000 EURO.

BIJ GIBALTARFURNITURE.COM IS DIT MODEL NU IN DE AANBIEDING VOOR 025 DOLLAR (DIT IS EEN KODIE EN NIET ERKENND DOOR) **PLAGIAAT**

RIETVELD BEGON IN 1911 ZIJN EIGEN MEUBELMAKERIJ. HI INTRODUCEERDE MEUBELS OM ZELF TE MAKEN. ZOALS IKEA (HAD GERRIT WAT EEN MIJNE WINKEL GEVONDEN...)

DE SCHAAK KLOPT NIET HELEMAAL

DE RUGLEUNING IS VERMILJVEN ROOD. BEST DONKER

DE KOPPE KANTEN ZIJN CHROMAAT GEEL.

ULTRA-MARIJN BLAUW

BIJON-TIX

GEEL

IN DE HOUTEN STOEL IS HET ZWART GEBEITST (DAT SUIJT HEEL NIET)

DIT IS EEN FOOT IN HET PAPIEREN SCHAALMODEL.

DE HOUTEN VERSIE BESTAAT UIT 15 BEUKEN-HOUTEN BALKJES EN 2 TRIPLEX PLATEN.

MIKADO?

IN 1971 ZIJN DE PRODUCTIE-RECHTEN VERKOCHT AAN **CASSINA** (ITALIAN DESIGN).

**COMFORT?**  
VOLGENS RIETVELD WAS ZITTEN EEN WERKWOORD HET LASTIGE VAN DEZE STOEL IS NIET HET ZITTEN, MAAR HET WEER UIT DE STOEL KOMEN (DE ZIT IS ERG LAAG EN DIEP)





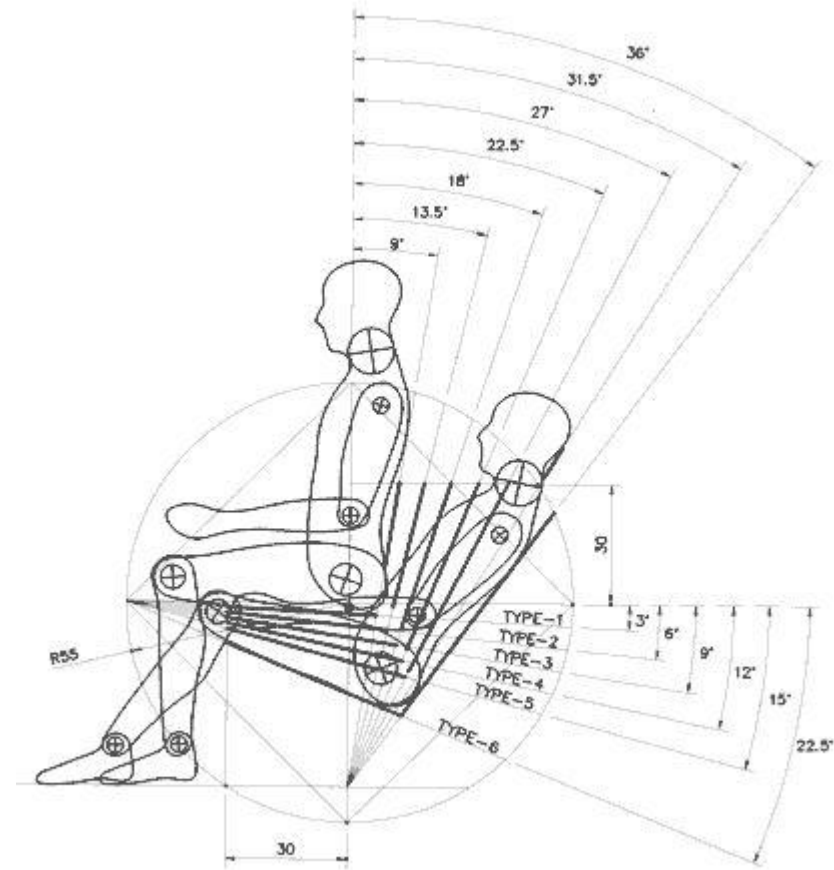
## STEAM Connect Material Collection







## STEAM Connect Material Collection





# STEAM Connect Material Collection

