JK LAKSHMIPAT UNIVERSITY
Institute of Design
NAAC 'A' Grade Accredited

Creating an Inclusive Learning Environment: Designing an Accessible Educational Facility for Diverse Students

VOL. 1 of 1

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THE GRADUATION PROJECT 2025

The Evaluation Jury has recommended **Arihant Jain**

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with specialization in **Product Design**

Herewith, for the project titled "**Designing Products for Practical Learning in School Makerspaces"**

on fulfillment of requirements by

Jury Chairman

Jury Member

Jury Member

Subsequent remarks regarding fulfillment of requirements

Dean, Institute of Design
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Abstract

As the demand for innovation and hands-on learning continues to grow in the Indian education system, traditional classroom models are being increasingly questioned. This project investigates the possibility of enhancing school learning environments through the design of a product specifically tailored for school makerspaces — collaborative, student-centred environments where ideas come to life through making.

The focus is on students from grades 6 to 12, who are at a critical stage of developing not just knowledge but essential skills like problem-solving, creativity, teamwork, and confidence. Grounded in research on constructivist and experiential learning theories, this project aims to bridge the gap between curriculum and creativity by integrating a product that enables project-based and activity-driven learning.
The research methodology combines qualitative insights from educators and students with curriculum mapping, classroom observations, and iterative prototyping. It explores the psychology of learning, cognitive development stages, and behavioural needs to ensure the final product aligns with both academic and emotional needs.

The final outcome is a scalable, modular product designed to transform traditional classrooms into active learning zones, supporting various subject areas such as science, mathematics, arts, and environmental education. It is ergonomically and aesthetically developed for students' comfort, safety, and adaptability across spaces.

This report presents the design journey — from identifying the problem to ideation, development, prototyping, testing, and impact analysis — with a commitment to improving education by making it more tactile, interdisciplinary, and meaningful.

Backgroung & context

In today's educational context, there is a growing awareness of the limitations of traditional learning systems that rely heavily on rote memorisation and passive instruction. As the world shifts toward innovation, collaboration, and real-world problem solving, the demand for 21st-century skills in education becomes critical. Schools are now exploring new methods to create active and engaging learning environments, and makerspaces are emerging as one of the most promising solutions.

A makerspace is more than just a room filled with tools; it is a mindset and a movement. It is a space that encourages curiosity, creativity, and innovation — values that are often missing in conventional classroom settings. These spaces allow students to learn by doing, engage in interdisciplinary projects, and apply theoretical concepts in tangible, meaningful ways.

This project is rooted in the belief that design has the power to transform educational experiences. By designing a product that serves as an anchor for practical learning within a makerspace, the goal is to enable teachers and students to work together in a more collaborative, explorative manner.

Throughout the course of the project, extensive research was conducted on existing learning models, makerspace case studies, pedagogy, child psychology, curriculum design, and behavioral patterns in school environments. The product design process is aligned with these insights to ensure that the solution is educationally relevant, emotionally engaging, physically safe, and easy to use.

Ultimately, this project is an attempt to contribute to the larger goal of democratizing design in education — making it accessible, inclusive, and transformative for young learners.

Company Overview

CIVOM is an organization working at the intersection of cognitive development, curriculum innovation, and user behavior in learning environments. With a strong focus on research-backed methodologies, CIVOM aims to create interventions that foster deep, meaningful learning outcomes for children and young adults.

Their mission is rooted in the belief that learning is not just about consuming information but about transforming understanding through reflection, action, and self-discovery. They design tools, strategies, and programs that promote curiosity, empathy, and resilience in learners.

CIVOM operates in the learning space category, collaborating with educational institutions, curriculum designers, and pedagogical experts to create systems that support whole-child development. Their work spans curriculum mapping, teacher training, product design, and user experience analysis.

For this project, CIVOM served as both a collaborator and knowledge partner, helping define the scope of intervention and ensuring alignment with educational needs. Their inputs were crucial in understanding the psychology of learning, classroom realities, and scalable implementation models.

Initial Design Brief

To design a range of products that encourages hands-on, practical learning experiences in school classrooms, aligned with curriculum needs. These products aim to enhance engagement, creativity, and critical thinking through making and doing.

Scope of the Project

- Researching student development stages
- Mapping learning activities to curriculum
- Defining zones within a makerspace
- Designing functional, manufacturable products
- Creating prototypes for selected ideas

Constraints:

- Budget limitations in school infrastructure
- Space constraints in existing classrooms
- Safety and durability of products in high-use environments
- Use of standard manufacturing tools and processes

Makerspace as a learning environment

Makerspaces act as an open-ended lab for curiosity-driven learning. They democratize innovation and allow students to approach curricular subjects through physical engagement—be it building a working model of a science concept, designing a product for a social cause, or prototyping a solution for a local challenge.

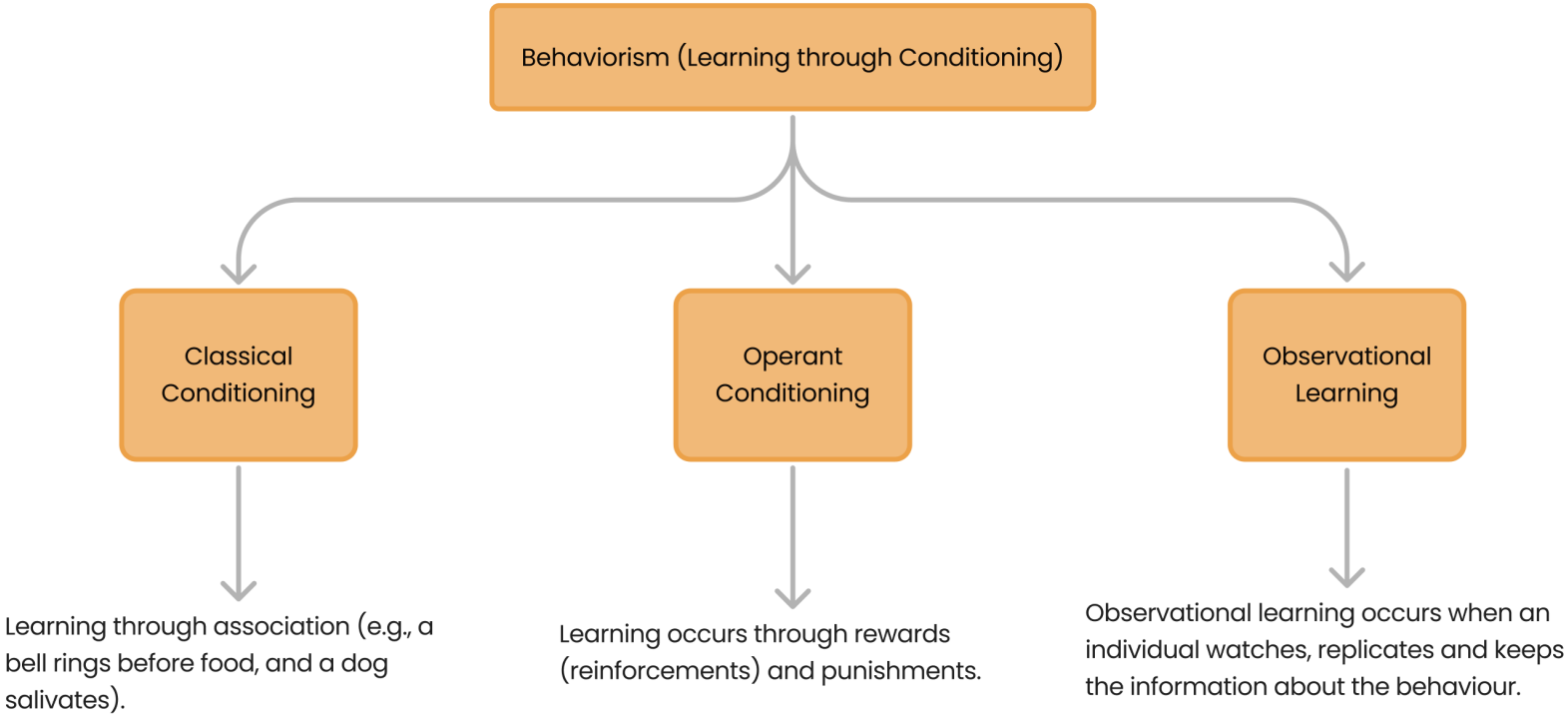


Understanding the educational context

Psychology of Learning

Understanding how students learn is critical for designing effective educational products. Cognitive development theories, learning styles, and motivational psychology all influence how children absorb and apply knowledge.

- The study of how people learn and develop skills through experiences and interactions
- Psychology of learning allows educators and researchers to understand strategies of learning.



How do we develop as human at different age group?

Factors of Development

Psychological

- Emotional Development
- Social Development
- Behavioral Development
- Personality Development

Physiological

- Brain Development
- Motor Development
- Sensory Development

Analytical

- Pattern Recognition
- Problem-Solving
- Decision-Making
- Abstract Thinking

Cognitive

Stages of Cognitive development

- Sensorimotor Stage (0-2 years)
- Preoperational Stage (2-7 years)
- Concrete Operational Stage (7-11 years)
- Formal Operational Stage (12+ years)

Psychological Development

	0–2 years (Infancy & Toddlerhood)	2–7 years (Early Childhood)	7–11 years (Middle Childhood)	12+ years (Adolescence to Adulthood)
Emotional Development	- Forms attachment - Expresses basic emotions	- Begins empathy - Develops self-concept - Seeks approval	- Understands complex emotions - Builds friendships - Learns social norms	- Forms identity - Manages emotions better - Focuses on peer acceptance - Develops long-term personality
Social Development	- Recognizes familiar people - Begins basic interaction	- Learns to share, cooperate, play - Follows group rules	- Joins teams, groups - Understands social roles and fairness	- Builds deeper relationships - Seeks independence - Develops social responsibility
Behavioral Development	- Mimics behavior - Explores surroundings - Shows preferences	- Tests limits - Imitates adults - Improves impulse control	- Adheres to rules - Develops consistent habits	- Exhibits self-regulation - Explores identity - May engage in risk-taking
Personality Development	- Temperament shows (easy/difficult)	- Personality traits begin to emerge	- Self-confidence grows - Values feedback	- Stable traits form - Identity becomes clear

Physiological Development

	0–2 years (Infancy & Toddlerhood)	2–7 years (Early Childhood)	7–11 years (Middle Childhood)	12+ years (Adolescence to Adulthood)
Brain Development	- Brain grows rapidly - Crawling to walking - Basic senses functional	- Language centers grow - Senses nearly `matured	- Coordination improves - Brain pruning increases focus - Physical growth stabilizes	- Puberty begins (12+) - Prefrontal cortex still developing - Physical peak around 20s
Motor Development	- Learns walking, grasping - Explores objects physically	- Improves hand-eye coordination - Fine motor improves	- Participates in physical tasks/sports - Writes fluently	- Refined physical skills - Possible decline in later adulthood
Sensory Development	- Develops hearing, vision, touch sensitivity	- Uses senses to explore - Responds to sounds, visuals	- Integrates senses for learning (reading, music)	- Senses sharpen but may dull gradually in adulthood

Analytical Development

	0–2 years (Infancy & Toddlerhood)	2–7 years (Early Childhood)	7–11 years (Middle Childhood)	12+ years (Adolescence to Adulthood)
Pattern Recognition	- Begins recognizing faces/patterns - Explores cause-effect	- Matches shapes & colors - Basic problem-solving (puzzles, tasks)	- Applies logic to real-life situations - Understands strategies	- Thinks abstractly - Plans ahead - Evaluates consequences - Develops critical thinking
Problem Solving	- Simple (e.g., how to get a toy)	- Trial-and-error, manipulatives	- Logical steps, math problems	- Complex situations, real-life scenarios
Decision-Making	- Chooses between toys/ foods	- Makes basic choices (play, clothes)	- Understands outcomes of decisions	- Long-term planning (education, career)
Abstract Thinking	- Not yet developed	- Begins imaginative thinking	- Understands concrete logic - Begins abstract ideas	- Fully develops abstract, hypothetical, ethical thinking

Cognitive Development

	Sensorimotor Stage (0–2 yrs)	Preoperational Stage (2–7 yrs)	Concrete Operational Stage (7–11 yrs)	Formal Operational Stage (12+ yrs)
Stages of cognitive development (Piaget's Stages)	- Learns through senses and actions - Object permanence forms	- Egocentric thinking - Symbolic play - Language expands	- Logical thinking with tangible concepts - Understands conservation	- Thinks abstractly - Hypothetical reasoning - Forms moral/ethical views

Vygotsky's Social Constructivism

- **Zone of Proximal Development (ZPD):** Learning occurs best when students are challenged just beyond their current ability, supported by scaffolding.
- **Role of social interaction:** Peer learning and mentorship accelerate cognitive development

Neuroscience and Hands-on Learning

hands-on, active learning experiences, which engage multiple senses and promote active participation, are crucial for effective learning and knowledge retention, as they stimulate brain plasticity and strengthen neural pathways

Why to design for specific age group?

Cognitive Readiness

- Around age 11 (Grade 6), students enter Piaget's formal operational stage, where they begin developing abstract reasoning.
- Practical learning (e.g., experiments, model-building, real-world problem-solving) helps bridge abstract concepts (like algebra, physics, ethics) with tangible `experiences.
- It allows them to see "why this matters" instead of just learning theory.

Identity formation & curiosity

- Adolescence is when students explore their interests, form identities, and ask "What do I want to do in life?"
- Practical learning exposes them to diverse fields (STEM, arts, design, business, social sciences) and helps them discover passions early on.

Development of life skills

- Grades 6–12 is the ideal window to build critical thinking, collaboration, problem-solving, and communication skills.
- These are better developed through doing rather than just memorizing — e.g., working on group projects, creating prototypes, engaging with the community.

Why to design for specific age group?

Prepares for higher education & careers

- Many higher education paths and jobs demand applied knowledge, not just theoretical.
- Introducing practical learning in these grades ensures students are college and career ready — familiar with research, presentations, fieldwork, and iterative processes.

Increased engagement and motivation

- Middle and high school students are at higher risk of disengagement because they question relevance of academics.
- Practical learning helps answer “Why am I learning this?” by connecting lessons to real-world problems.

Safe space for trial and error

- In this stage, students are still in a low-stakes environment where they can experiment, fail, and learn — which builds resilience.
- Practical learning gives them early exposure to failure as part of growth, not as a negative.

What are the factors which contributes towards it?

Pedagogical Approaches That Support Practical Learning

1. Constructivist Learning
Knowledge is constructed through active engagement and personal experience. A constructivist classroom encourages students to build their understanding through experiments, models, and iteration—key aspects of makerspaces.

2. Experiential Learning (Kolb's Cycle)
Teaching method that emphasises student actively build knowledge through their prior knowledge which involves:

- Concrete experience
- Reflective observation
- Abstract conceptualization
- Active experimentation

3. Inquiry-Based Learning (IBL)
IBL encourages curiosity and questioning. Students investigate real problems, gather information, and present solutions. The makerspace product acts as a physical medium through which such inquiry becomes tangible.

4. Project-Based Learning (PBL)
PBL involves long-term, student-centered projects that integrate knowledge from multiple subjects. The product is meant to anchor such projects by providing a practical, tool-enabled platform for building, testing, and showcasing solutions.

Why a Practical Learning Environment is Necessary?

Bridging Theory and Real-World Application

Practical learning environments prepare students for real-world challenges by applying academic concepts.

Developing 21st-Century Skills

- Collaboration, adaptability, critical thinking, and problem-solving are essential for modern careers.
- Traditional methods do not effectively foster these skills, but maker-based environments do.

Enhancing Creativity and Problem-Solving

- Students learn by failing and iterating, which enhances resilience and adaptability.
- Design thinking approaches improve innovation and structured problem-solving abilities.

Encouraging Lifelong Learning and Adaptability

- Hands-on experiences foster a mindset of continuous learning and self-improvement.
- Practical learning environments help students develop independence and self-efficacy in their educational journey.

Curriculum Analysis (Grade 6-8)

Learning Focus:

- Design Thinking & Problem-Solving: Encouraging critical thinking and hands-on experimentation.
- Integration of Humanities & Sciences: Cross-disciplinary projects.
- Introduction to Coding & Engineering Concepts.

Subject	Topics	Makerspace Integration
Language Arts	Essays, debates, poetry	Podcast creation, blog writing
Math	Algebra, ratios, percentages, data interpretation	Probability games, geometric design
Science	Chemistry (basic reactions), human body, environmental science	Chemistry kits, dissection models, upcycling projects
Social Studies	Economy, culture, globalization	Role-playing, model UN, historical re-enactment
Art & Craft	Printmaking, digital art, mixed media	DIY stamps, stop-motion animation
Physical Education	Sports techniques, team building	Adventure sports, strategy-based games
Technology & Coding	Python basics, website creation	Arduino projects, 3D modeling, app design

Curriculum Analysis (Grade 9-10)

Learning Focus:

- Skill-Based Learning: Career exploration and real-world application.
- STEM & Humanities Integration: Encouraging independent research projects.
- Entrepreneurship & Innovation: Prototyping and business-oriented thinking.

Subject	Topics	Makerspace Integration
Language Arts	Research writing, persuasive speech, literature analysis	Video storytelling, digital presentations
Math	Trigonometry, statistics, financial literacy	Business simulation, stock market project
Science	Physics (energy & motion), chemistry (acids & bases), biology (genetics)	DIY microscopes, robotics, circuit analysis
Social Studies	Political science, global issues, economics	Model parliament, entrepreneurship challenge
Art & Craft	Graphic design, photography, architecture basics	Digital painting, 3D printing, model building
Physical Education	Sports analytics, sports medicine basics	VR-based sports training, motion tracking
Technology & Coding	JavaScript, game development, AI concepts	AI chatbot design, robotics, app prototyping

Curriculum Analysis (Grade 11-12)

Learning Focus:

- Specialization & Real-World Application: Preparing for careers or higher education.
- Capstone Projects & Internships: Developing in-depth research or product design.
- **Collaborative Learning:** Group challenges, industry projects, and leadership.

Subject	Topics	Makerspace Integration
Language Arts	Thesis writing, advanced rhetoric, creative non-fiction	Video storytelling, digital presentations
Math	Calculus, data science, financial modeling	Business simulation, stock market project
Science	Quantum physics, biochemistry, environmental sustainability	DIY microscopes, robotics, circuit analysis
Social Studies	Philosophy, ethics, international relations	Model parliament, entrepreneurship challenge
Art & Craft	Industrial design, UX/UI, animation	Digital painting, 3D printing, model building
Physical Education	Advanced kinesiology, psychology of sports	VR-based sports training, motion tracking
Technology & Coding	Blockchain, cybersecurity, advanced AI	AI chatbot design, robotics, app prototyping

AEIOU Framework

A – Activities - What people are doing: tasks, routines, or practices. It captures what users do and how they do it.

E – Environment - The physical space and context where activities occur. Includes layout, objects, and sensory aspects (light, noise, etc.).

I – Interactions - How people interact with others, objects, systems, or interfaces. Includes both digital and physical touchpoints.

O – Objects - The things people use or are surrounded by in the environment. What objects are present, and what role they play in the activity.

U – Users - The people involved: their roles, goals, emotions, behaviors, and needs. Often includes demographic or psychographic info.

Why is AEIOU useful?

- Helps capture rich qualitative data in real-world contexts.
- Encourages empathy and deeper understanding of users.
- Aids in uncovering hidden needs or pain points.
- Supports the early phases of human-centered design, especially for user research and ideation.

AEIOU Framework

Through curriculum analysis, I collected data under each AEIOU category.

Activities

Dismantling Product	Chemistry/Crystallisation	Sketching
Clay Modelling	Thermocol models	Rendering
Paper Craft	Acid/Base	Robotics
Painting	AR/VR	Internet of Things
Water Filtration	Rain water harvesting System	Brainstorming
Circuits	Wood Working	Building Models
Volcano model	Art and Craft	Metal Work
3D Printing	Paper Engineering/origami	
Laser Cutting	Textile Work	

AEIOU Framework

Through curriculum analysis, I collected data under each AEIOU category.

Envitonments

Organised space	Maintenance Zone
Class room equipped with tools	Safe and well-lit area
Clear safety Guidelines and waste management	Digital Display or inspiration board
	collaborative setup
Natural Lighting	space for brainstorming and design
Cleanliness and material accessibility	Well-ventilated area
A quiet, well Lighting area	Integrated digital environment
Soft music & inspirational Environment	Signages
Influence of surrounding	Safety Zone

AEIOU Framework

Through curriculum analysis, I collected data under each AEIOU category.

Interactions

- User & Tools
- Peer-Peer
- Mentor-Student
- Group Discussion
- User-Material
- Feedback & critique
- Collaboration
- Showcasing
- Guidance form Instructor
- Student-Teacher
- Community Involvement

AEIOU Framework

Through curriculum analysis, I collected data under each AEIOU category.

Objects

Tools required for Dismantling	Cutting mat	3D printer / Laser cutter
Desk & chair	Whiteboard and Display Board	Display Units
Containers & Bins	Finished Craft	Storage units
Safety Gears	Instruction materials	Rotating base
Documentation aids - Labels, ta...	Switch boards	Water supply
Primary Materials	Reference Material	

AEIOU Framework

Through curriculum analysis, I collected data under each AEIOU category.

Users

Primary Users: Students (Grades 6–12)
Secondary Users: Teachers, Lab Assistants
Occasional Users: Mentors, Parents (during showcases), Admins

Creating a Maker's Zones

Based on the insights, I identified key zones for the makerspace:

Concentration zone

- Mind Mapping
- Pattern Recognition Games
- Algorithm Challenges
- Programming Exercises
- Concept Visualisation
- Brainstorming
- Storyboard Creation

Electronics zone

- Basic Circuit Exploration
- Breadboarding & Component Integration
- Arduino & Microcontroller Experiments
- Robotics & Automation
- Energy & Power Projects

Woodworking zone

- Wood Identification & Properties
- Measuring & Marking
- Hand Tool Handling
- Basic Cutting & Sawing
- Sanding & Smoothing

Creating a Maker's Zones

Based on the insights, I identified key zones for the makerspace:

Fabrication zone

- Measuring & Marking
- Drilling & Fastening
- Cutting & Shaping Practice
- Metal Welding & Riveting
- Moulding & casting
- Metal Sheet Bending

Science experiment zone

- Volcano Eruption
- Density Tower
- Plant Growth Observation
- Magnetic Slime Making
- DIY Solar Oven
- Lens and optics experiments
- Water filtration models

Craft zone

- Cardboard Furniture Making
- Clay Modelling
- Origami & Paper Engineering
- DIY Toy Making
- Recycled Material Art
- Stop-Motion Animation
- Typography & Calligraphy
- DIY Fabric Printing

Product Categories and Subcategories

With the six makerspace zones defined, the next critical step was identifying the products necessary to support the learning activities and functional objectives of each zone.

Workbenches / Tables			
Individual Desk	Light -Duty Desk	Heavy-Duty Desk	Features Table
• Reading & Writing table • Computer Desk	• Craft Table • wood working • Perforated Table	• Hard wood Workbench • Metal workbench	• Writable Top • Light Table • Height adjustable • Drafting Table • Electronic Table • Lab Table
• Collaborative space • Electronic Zone • Concentration zone • Science Experiment Zone	• Wood working Zone • Craft Zone	• Fabrication Zone • Wood Working • Fabrication Zone	• Concentration Zones • Electronic Zone • Science experiment Zone

Product Categories and Subcategories

With the six makerspace zones defined, the next critical step was identifying the products necessary to support the learning activities and functional objectives of each zone.

Seatings			
Ergonomic Chair	Floor Seatings	Stools	Soft seatings
• 4 Legs • Cantilever • swivel • Stackable • Nesting chair	• Zaisu (Japanese Floor Chairs) • Low Wooden Stools • Rugs	• Heightened stools • Height Adjustable • Lab Stools • Anti-static	• Bean Bags • Tatami Mats • Floor Cushions • Memory form mats
• Concentration Zone • Electronics Zone • science experiment zone	• Collaborative space • Concentration Zone	• Fabrication Zone • Wood working • Electronic Zone	• Concentration Zone • Craft Zone

Product Categories and Subcategories

With the six makerspace zones defined, the next critical step was identifying the products necessary to support the learning activities and functional objectives of each zone.

Storage			
Open Storage	**Closed Storage**	**Mobile Storage**	**Modular Storage**
• Bookshelves • Material Storage • Hardware Storage	• Lockers/Personal storage • Power tools Storage • Chemical Storage • Specimen Storage	• Rolling Tool Carts • Tools Trolley • Material Trolley	• Adjustable Shelving Units • Stackable Bins & Containers
• Electronics Zone • science experiment zone	• Concentration Zone • Wood working Zone • Science Experiment Zone • Fabrication Zone	• Fabrication Zone • Wood working • Electronic Zone • Fabrication Zone	• Concentration Zone • Craft Zone • Wood Working

Provisions Mapping

After finalizing the product categories for each zone, the next step was to define detailed provisions

Light-Duty Workbench				
Ruler		Fixed ruler , movable	Engraved ruler on table top, movable metall sheet ruler	☑
Clamping/ vise		Clamping on table top , clamping on alluminium Rail	Fixto Clamping tools, aluminium rail attached on the sides of table top	☑
Storage		Material storage, Hardware Storage, Tools storage	Totes trolly, attached cabinets in table, Pegboard	☑
Task Light		Clamping Task light	can be clamped on th table top or alluminium rails	☑
Grid layout		On Table top for allignment	engraved on the top on Table top	☐
Dust collection		under the table top	Matel sheet tray with slide rails	☑
Power Outlet		Extension Boards	attched on the side legs ,	☐

Provisions Mapping

After finalizing the product categories for each zone, the next step was to define detailed provisions

Mobile Storage Trolly				
Tote Storage		Different size Totes	Tote 75H, Tote 100H	☑
Peg Board		Peg board on the side for hanging tools	Metal Perforated sheet	☑
Peg Hooks		Customised Hooks for tools hanging	Sheet Bended Hooks, Flat Hooks	☑
Sheet roll Storage		Storage for sheet rolls on peg board	storage that can hold 4-5 sheet rools	☑
Hardware Storage		storage for pegboard	Different Sizes storage as per usaboility	☑

Final Design Brief

Designing Product Systems for Practical Learning in School Makerspaces (Grades 6–12)

Objective

To design a range of user-centered, modular, and manufacturable products that support practical learning in school classrooms through a structured makerspace. These products aim to enable students from Grades 6 to 12 to explore, create, and apply knowledge through hands-on activities integrated with their academic curriculum.

Target Users:`
Primary: Students (Grades 6–12)
Secondary: Teachers, School Administrators, and Facilitators

Success Indicators:

- Improved student engagement and interaction with subjects through hands-on tools.
- Teacher feedback on usability and curricular integration.
- Product functionality and durability post-prototyping.
- Scalability across schools with varying resources.

Manufacturing Capabilities

To ensure design feasibility, the ideation and prototyping phases were informed by the manufacturing capabilities available at the company's in-house units. Understanding these production processes helped define the physical characteristics of each product

Understanding these processes early in the design journey ensured:

- Designs were production-ready and within fabrication limits.
- Provisions could be aligned with existing company infrastructure.
- Prototypes could be built quickly, reducing lead time between ideation and testing.

1. CNC Panel Cutting

- Uses computer-controlled machinery to precisely cut wooden or MDF panels into custom shapes.
- Allows for high precision and repeatability in furniture component production.
- Ideal for mass production of tabletops, modular panels, and flatpack components.



2. Edge Bending

- A post-CNC process that applies edge tape to panel sides, increasing durability and aesthetics.
- Protects raw edges from chipping and wear, especially in high-use areas.
- Available in different finishes and materials (PVC, ABS), suited for school use.



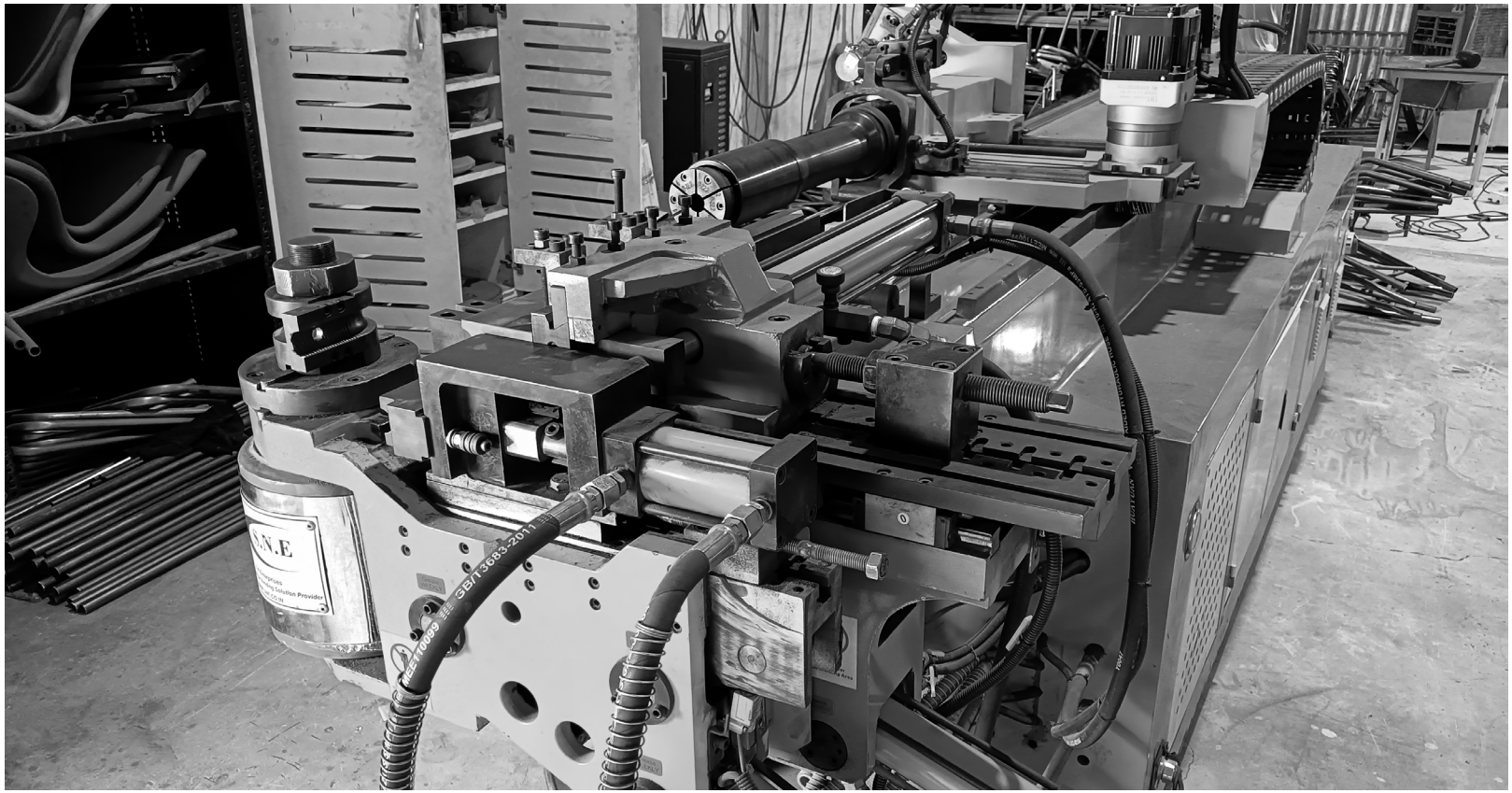
3. Metal Fabrication

- Involves cutting, welding, and assembling metal components such as frames or joints.
- Used to build strong, structural elements like benches, racks, and tool supports.
- Supports both prototyping and bulk production, depending on the complexity.



4. Pipe Bending

- Bends hollow or solid pipes into specific angles or curves using hydraulic or mechanical tools.
- Enables ergonomic designs for stools, frames, or structural furniture.
- Creates durable and seamless joints without excessive welding.



5. 7-Tank Process (Pre-Treatment for Metal)

- A surface preparation method for metal parts before coating, involving degreasing, derusting, and phosphating.
- Improves paint adhesion and prevents corrosion on fabricated metal.
- Critical for long-term performance of products used in school environments.



6. Powder Coating

- Bends hollow or solid pipes into specific angles or curves using hydraulic or mechanical tools.
- Enables ergonomic designs for stools, frames, or structural furniture.
- Creates durable and seamless joints without excessive welding.



7. Baking (Post-Powder Coating Cure)

- Involves placing powder-coated parts in an oven to fuse and cure the finish.
- Enhances durability, finish uniformity, and UV resistance.
- Ensures products meet safety and hygiene standards for educational use.



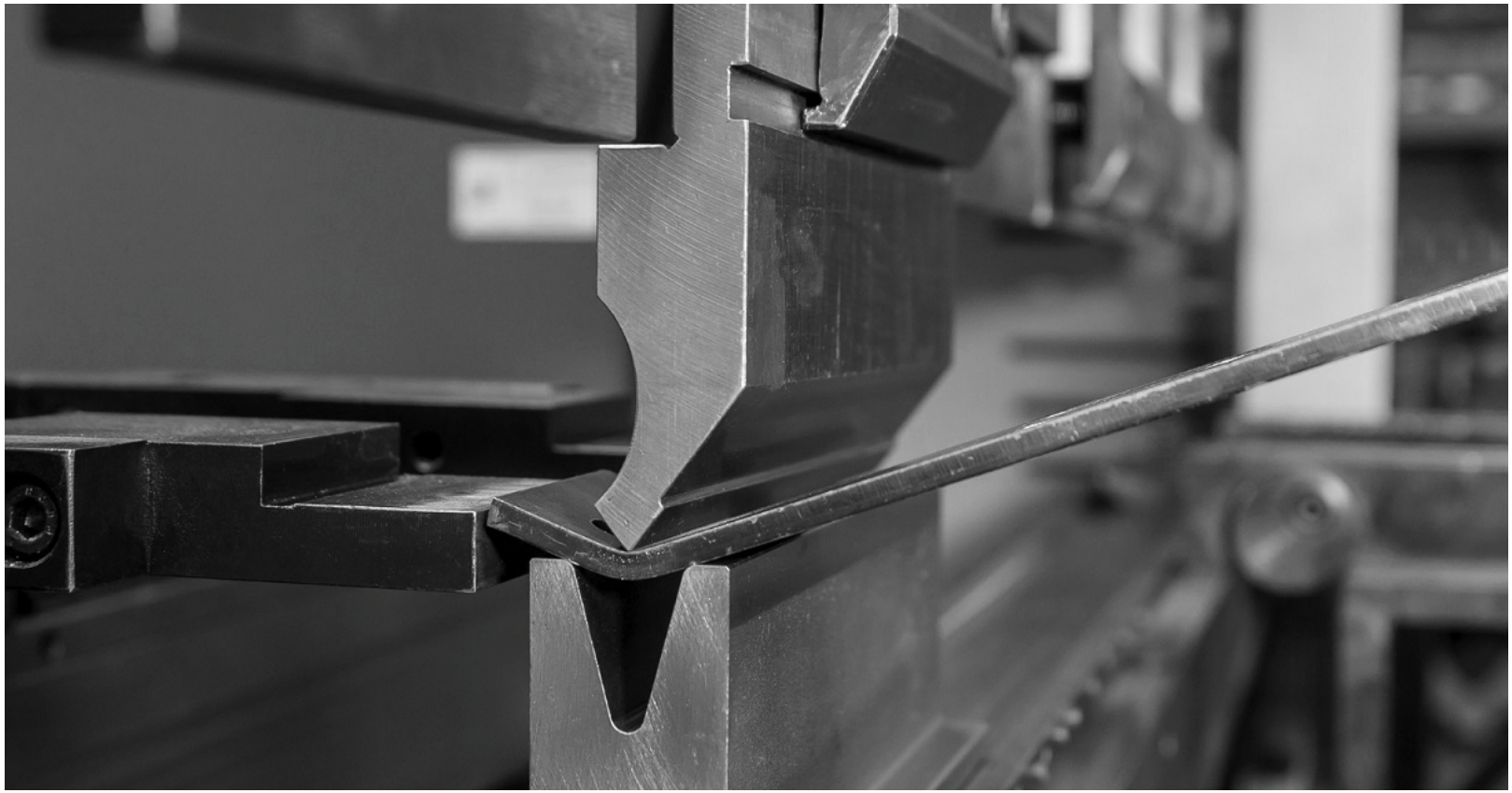
8. Laser Cutting

- Offers high-precision cutting for metals, acrylics, or wood using a focused laser beam.
- Useful for intricate shapes, labels, nameplates, tool organizers, and templates.
- Great for rapid prototyping and customizing elements per zone needs.

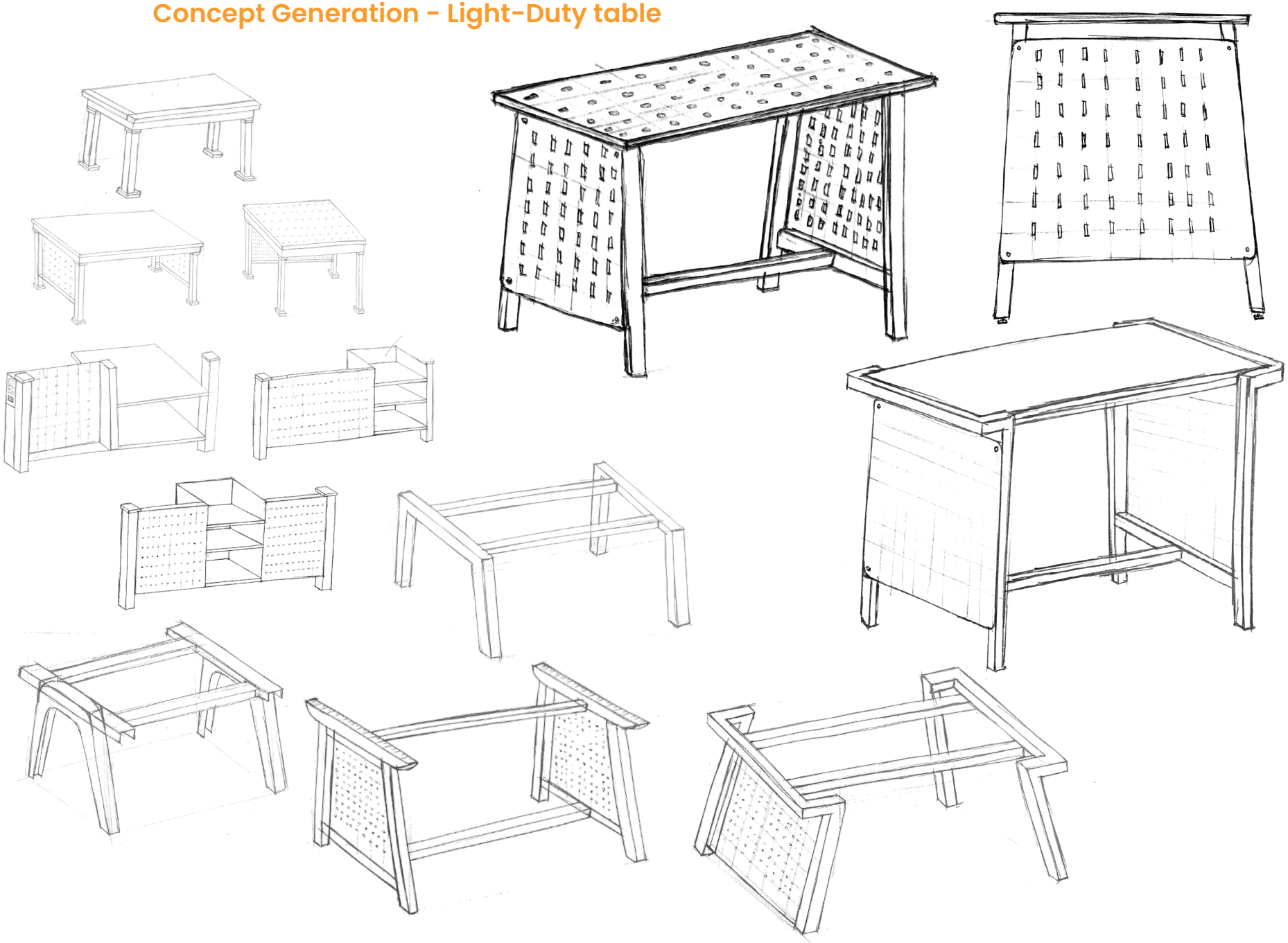


9. Sheet Bending

- Forms flat metal sheets into U, V, or custom shapes using press brakes or folding tools.
- Allows the creation of drawers, shelves, trays, and structural panels.
- Supports functional and aesthetic aspects of zone furniture



Concept Generation - Light-Duty table



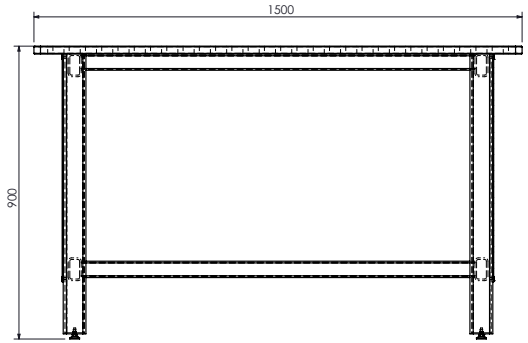
Final Concept 1 - Light-Duty table 1

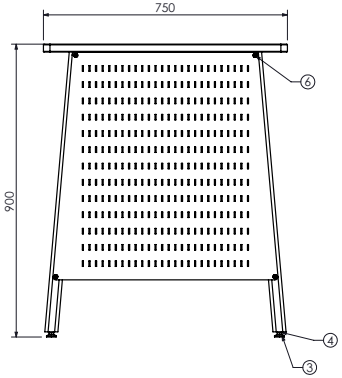


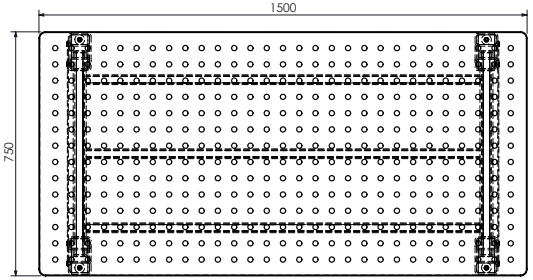


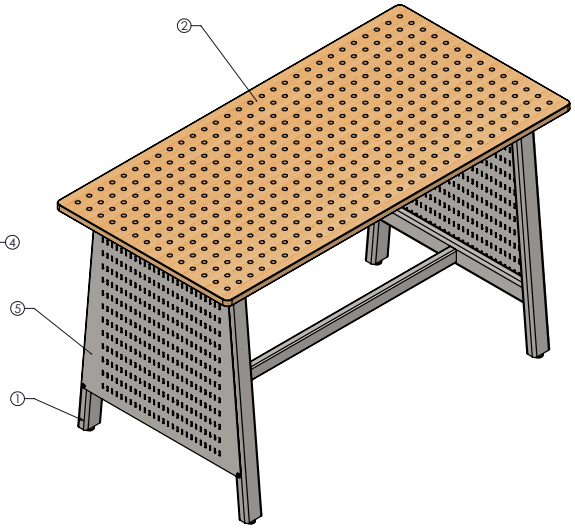
Technical Drawings - Light-Duty table 1

ITEM NO.	PART NUMBER/SAP CODE	DESCRIPTION	QTY.	StockSize	Material	Weight	EB IN RMT
1	Table structure	Table Structure	1	1320WX741.5DX860H	Plain Carbon Steel	52.57	
2	Table Top	Table Top	1	1500xW750DX24THK.	Beech	14.01	
3	PSB-624	LEVELER M6	4	M6X34	Nylon 101	6.74	
4	RN-M6	RIVET M6	4	M6X16	Brass	5.26	
5	Perforation Panel Final	Metal Perforation	2	693.5WX700X1.6THK.	Plain Carbon Steel	9.88	
6	BOLT2-M6x15		8				









NOTE :
1. DO NOT SCALE DRAWING.
2. TOLERANCES : +/- 1mm UNLESS OTHERWISE INDICATED

COMP. NAME:		SIZE :	
PROD. NAME :		MATERIAL :	
PART NUMBER : Octo Table		QTY. :	
		WEIGHT (in kg.) :	
		REV. :	DATE : 16-06-2025
CIVOM	SCALE : 1:15	SHEET NO. : 1 OF 1	A4
	ALL DIMENSIONS ARE IN MM		
UWC AND CT VENTURES PVT. LTD. INDORE		NAME	DATE
		DRW'N BY	
		CHKD. BY :	
		APPD. BY :	

Prototype & Testing

The prototyping phase translated selected design ideas into physical form to test their feasibility, usability, and impact.

- Evaluate usability and safety of designs
- Verify scale and ergonomics in real environments
- Test material behavior during actual usage
- Identify improvement areas for final production



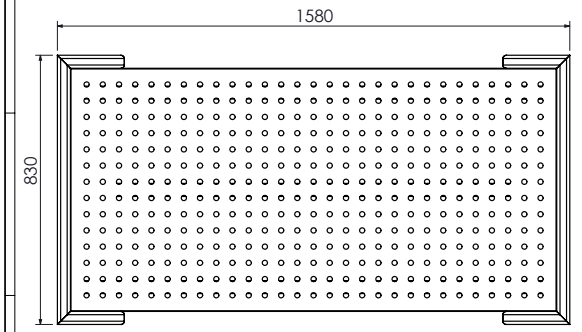
Final Concept 2 - Light-Duty table 2

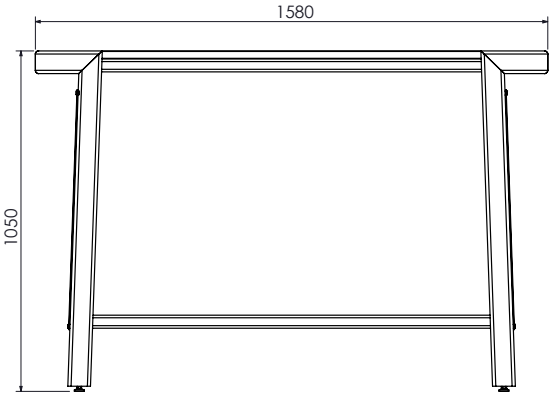


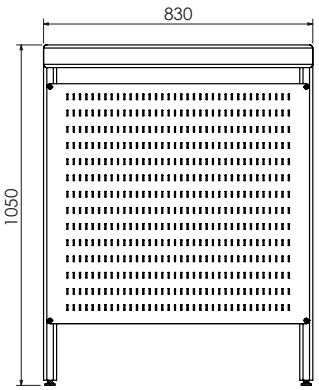


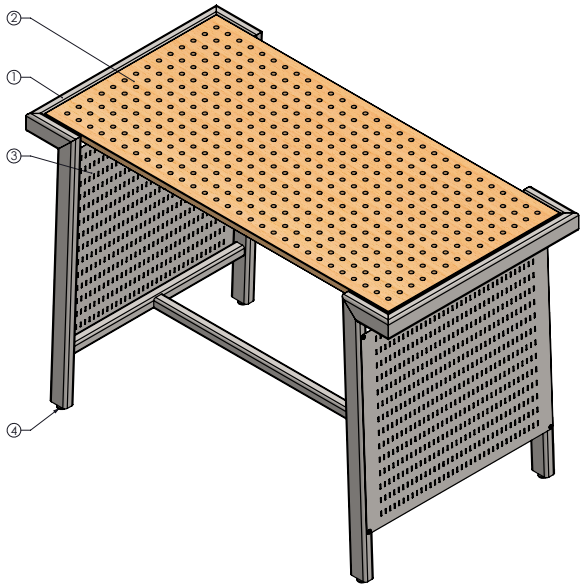
Technical Drawings - Light-Duty table 2

ITEM NO.	PART NUMBER/SAP CODE	DESCRIPTION	QTY.	StockSize	Material	Weight	EB IN RMT
1	MS-TS-001	Table Structure	1	1580WX830DX1034H	Plain Carbon Steel	69.24	
2	MS-TT-001	Maker's Table Top	1	1500WX750DX25THK.	Beech	14.60	
3	MS-TTP-001	Table Side Perforation	2	810WX740HX3THK.	Plain Carbon Steel	7.10	
4	PSB-624	LEVELER M6	4	M6X34	Nylon 101	6.74	
5	BOLT2-M6x20	Flat Head Allen Bolt	8	M6X20	ASTM A36 Steel	5.62	
6	RN-M6	RIVET M6	12	M6X16	Brass	5.26	









NOTE :
1. DO NOT SCALE DRAWING.
2. TOLERANCES : +/- 1mm UNLESS OTHERWISE INDICATED

COMP. NAME: Maker's Table	SIZE : 1580WX830D1050H
PROD. NAME : Maker's Table	MATERIAL : Material <not specified>
PART NUMBER : MS-TBL-001	QTY. : 1
	WEIGHT (in kg.) : 98.18
	REV. : R0 DATE : 16-06-2025

CIVOM

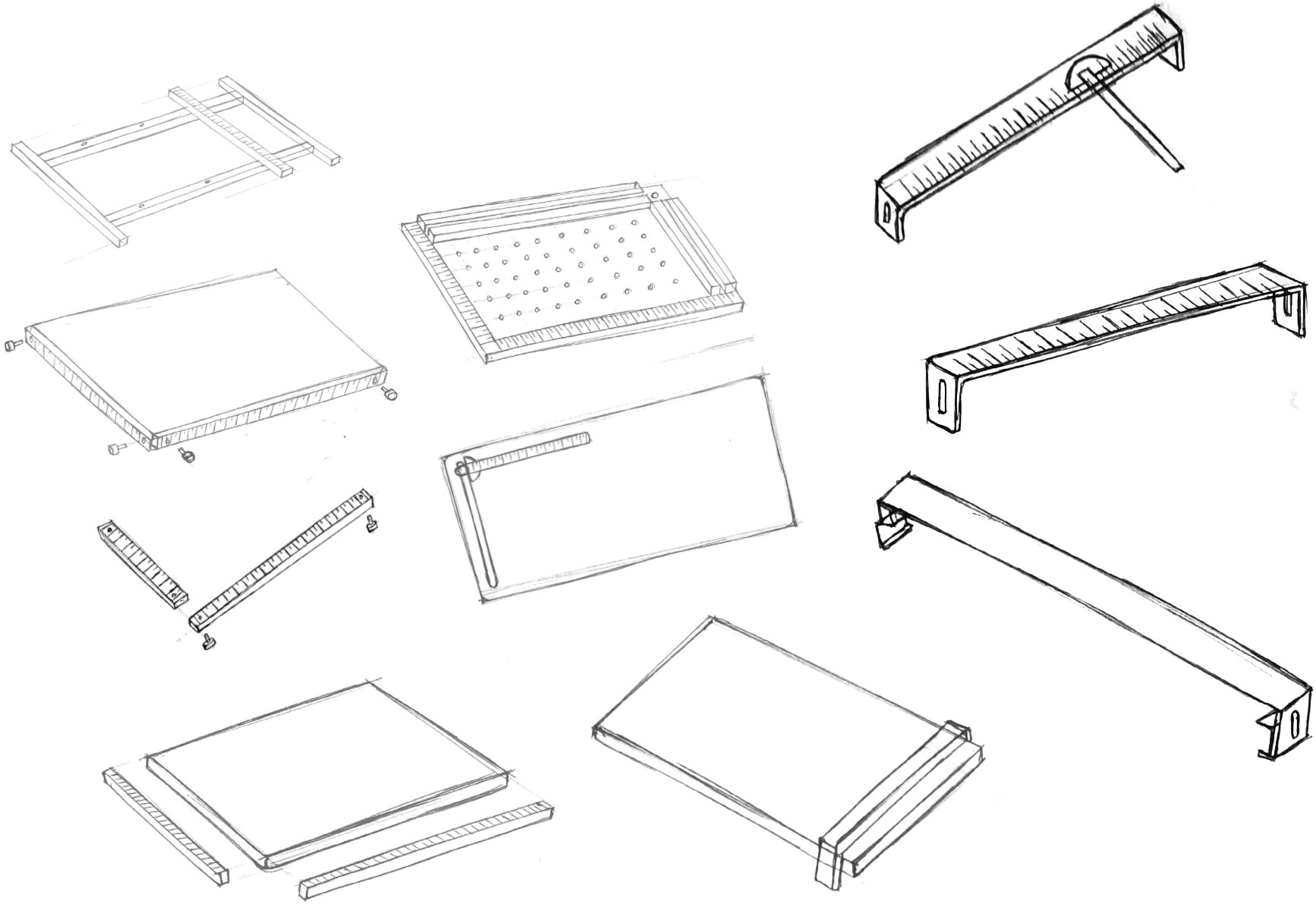
SCALE : 1:15
ALL DIMENSIONS ARE IN MM

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SHEET NO. : 1 OF 1 A4

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APPD. BY :		

Concept Generation - Table Ruler



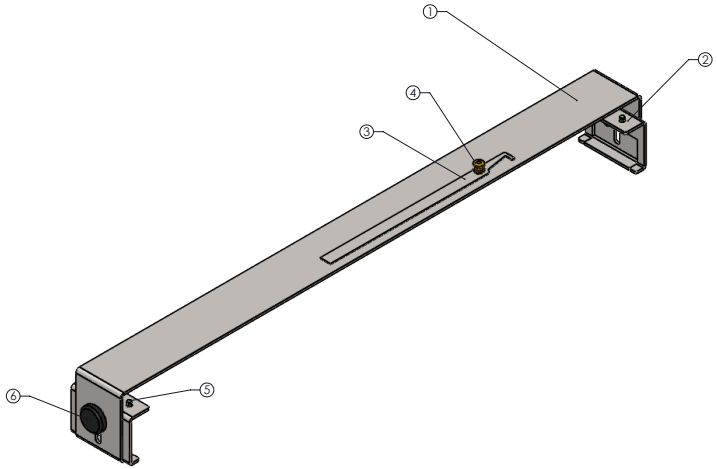
Final Concept - Table Ruler



Technical Drawings - Table Ruler

ITEM NO.	PART NUMBER/SAP CODE	DESCRIPTION	QTY.	StockSize	Material	Weight	EB IN RMT
1	Table Ruler 756	Ruler	1	756WX65DX87H	Plain Carbon Steel	1427.65	
2	Ruler Attachment 756	Ruler Attahment	2	85WX30DX60H	Plain Carbon Steel	122.02	
3	Angle Scale	Angle Ruler	1	215WX15DX1.2THK.	Plain Carbon Steel	35.03	
4	Rivit	Rivet	1	13HXØ12	Material <not specified>	6.19	
5	BOLT2-M4x15	Flat head Allen Bolt	4	M4X15	ASTM A36 Steel	2.26	
6	Leveler M8	M8 LEVELER	2	Ø32 x 37H	Nylon 101	9.66	





NOTE :
1. DO NOT SCALE DRAWING.
2. TOLERANCES : +/- 1mm UNLESS OTHERWISE INDICATED

COMP. NAME: Table Ruler	SIZE : 780WX85DX87H
PROD. NAME : Table Ruler	MATERIAL : Material <not specified>
PART NUMBER : Table Ruler assembly 756	QTY. : 1
	WEIGHT (in kg.) : 1741.26
	REV. : R0 DATE : 16-06-2025

CIVOM

SCALE : 1:5
ALL DIMENSIONS ARE IN MM

UWC AND CT VENTURES PVT. LTD. INDORE

SHEET NO. : 1 OF 2 A4

	NAME	DATE
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CHKD. BY :		
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Final Concept - Table Ruler



Prototype & Testing

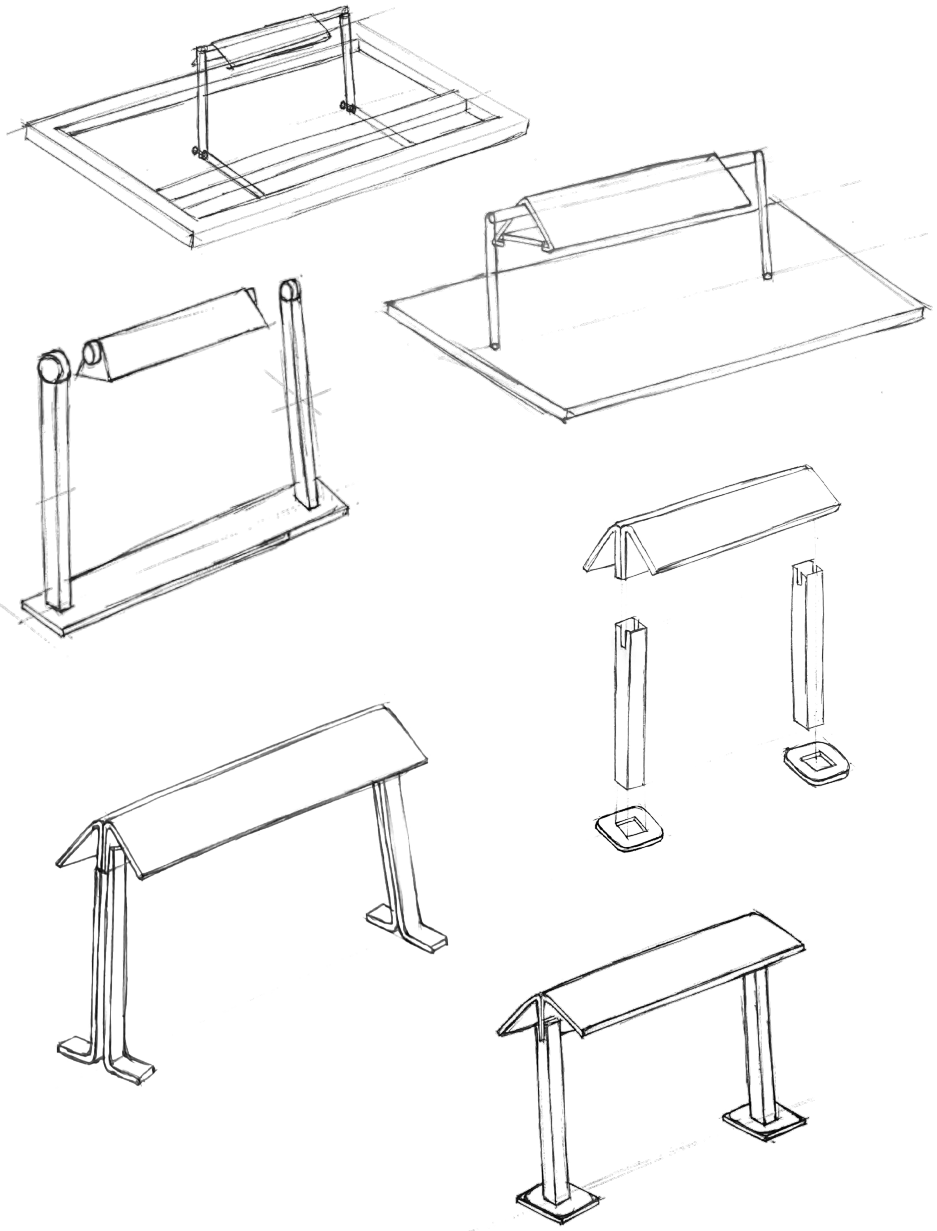
After ptorotyping and testing

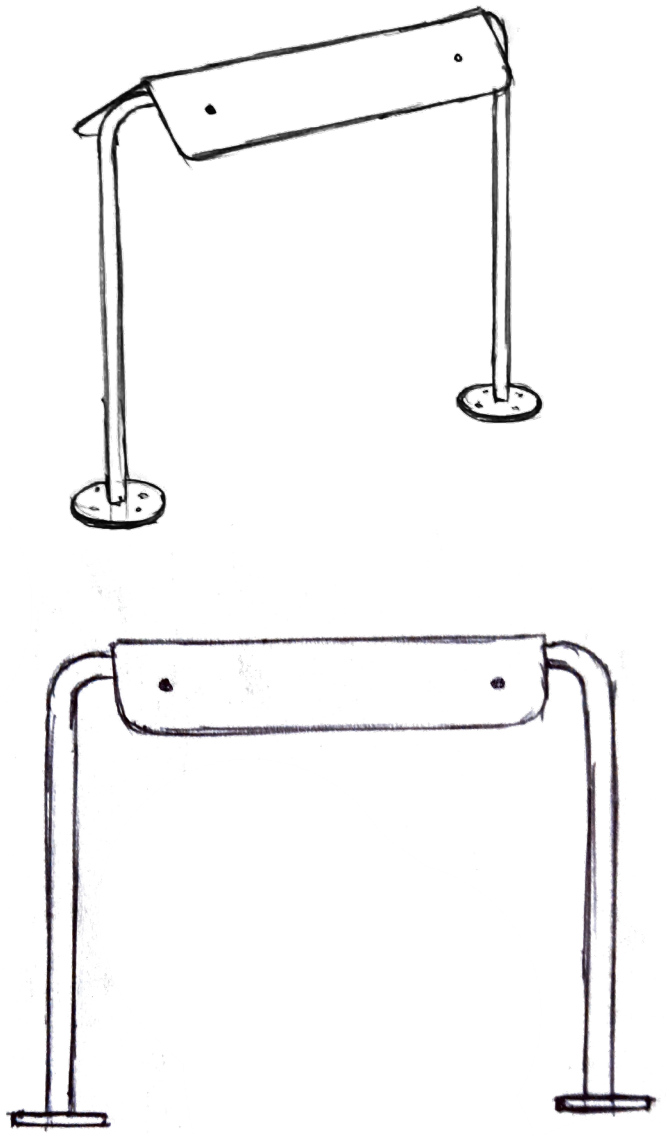
- The thickness of the metal sheet was 1.6mm and its not enough to hold the scale Straight.
- some of the edges were sharp and not safe to work with





Concept Generation - Table Lamp





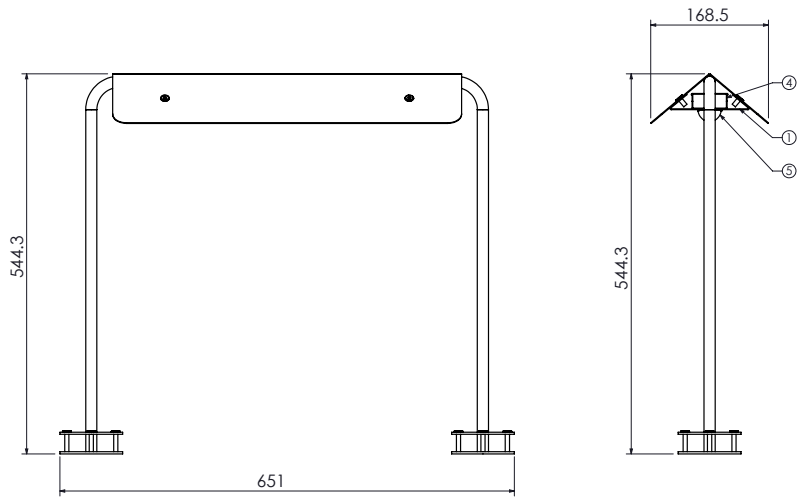
Final Concept - Table Lamp

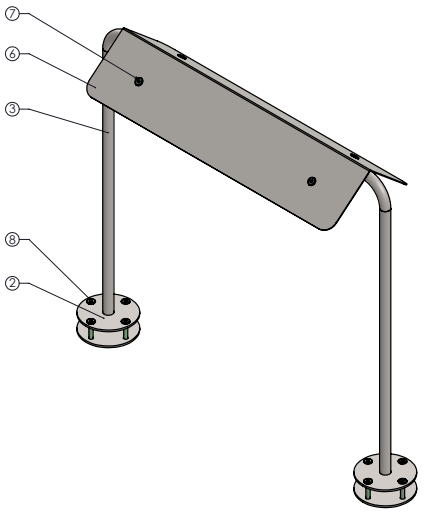




Technical Drawings -Table Lamp

ITEM NO.	PART NUMBER/SAP CODE	DESCRIPTION	Default/QTY.	StockSize	Material	Weight	Total Area Sqft	EB IN RMT
1	light plate		1				0	
2	Base Plate	BASE PLATE	4	Ø90	Plain Carbon Steel	140.26	0	
3	TL-BP-001	TABLE LAMP PIPE	2	538HX185DXØ16	Plain Carbon Steel	389.47	0	
4	adaptor 2	Light Adaptor	1	140WX50DX22H	Material <not specified>	17.92	0	
5	Light Profile Assembly	Light Profile	2	402WX16DX16H	Material <not specified>	49.63	0	
6	Top Metal Sheet 3.1	Top Lamp Sheet	1	500WX168WX69H	Plain Carbon Steel	1571.19	0	
7	BOLT2-M6x15	Flat Head Allen Bolt	4	M6X15	ASTM A36 Steel	4.51	0	
8	BOLT2-M6x20	Flat Head Allen Bolt	8	M6X20	ASTM A36 Steel	8.29	0	





NOTE :
1. DO NOT SCALE DRAWING.
2. TOLERANCES : +/- 1mm UNLESS OTHERWISE INDICATED

COMP. NAME:	SIZE :
PROD. NAME :	MATERIAL :
PART NUMBER : METAL lAMP	QTY. :
	WEIGHT (in kg.) :
	REV. : DATE : 16-06-2025

CIVOM

SCALE : 1:7
ALL DIMENSIONS ARE IN MM

UWC AND CT VENTURES PVT. LTD. INDORE

SHEET NO. : 1 OF 1 A4

	NAME	DATE
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APPD. BY :		

Final Concept - Table Lamp

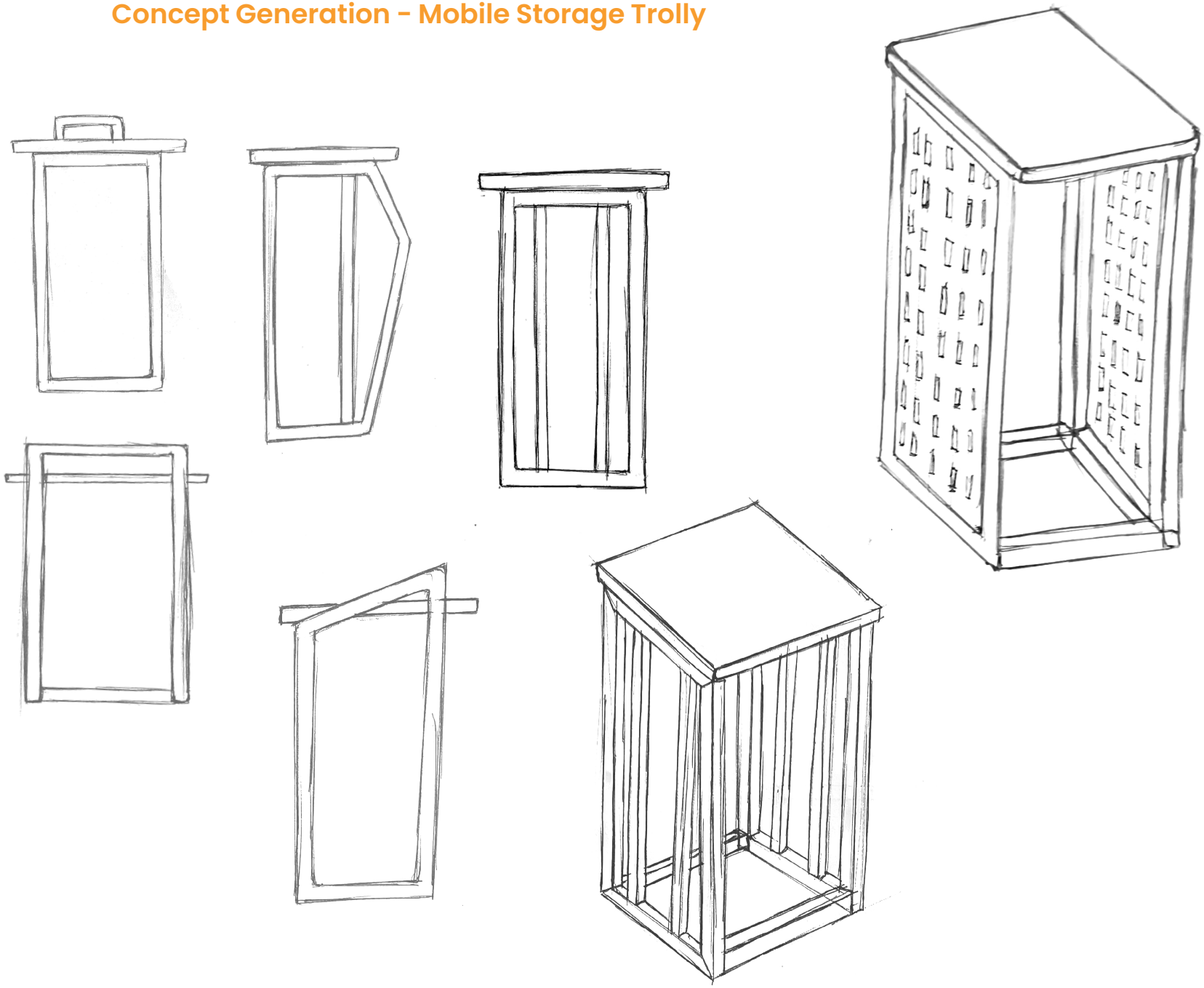


Prototype & Testing

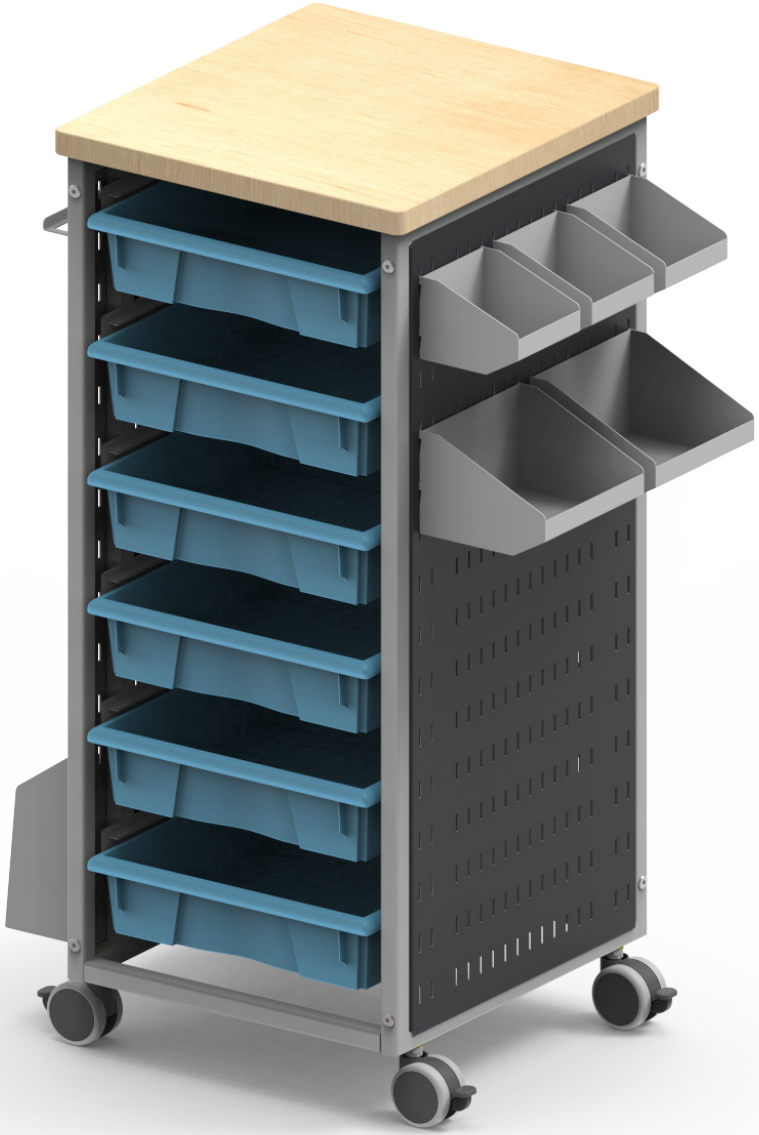


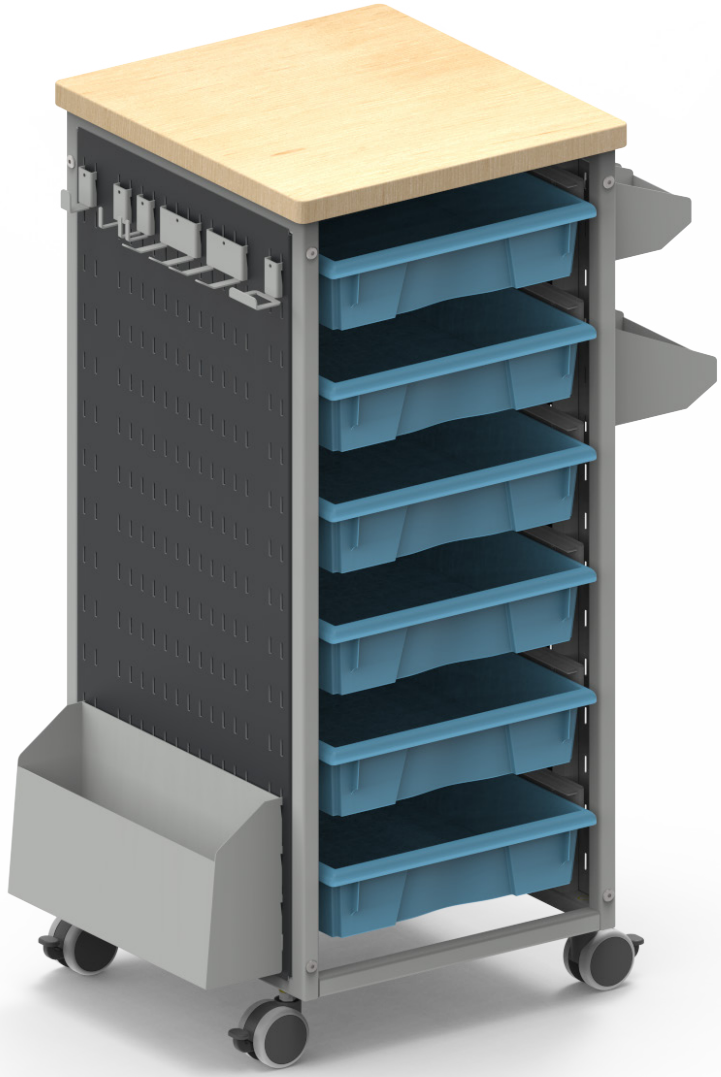


Concept Generation - Mobile Storage Trolly



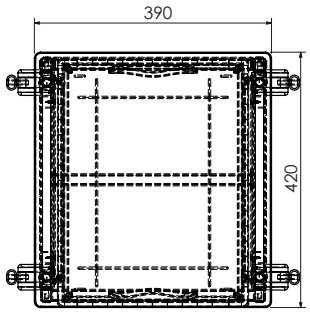
Final Concept - Mobile Storage Trolly

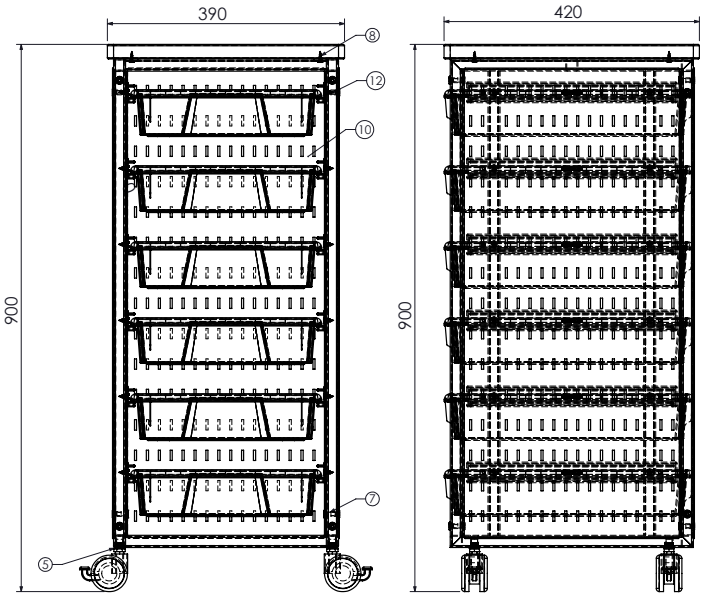


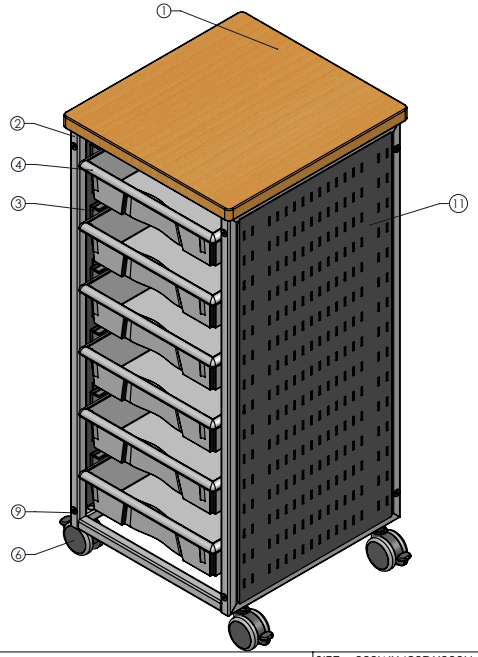


Technical Drawings - Mobile Storage Trolly

ITEM NO.	PART NUMBER/SAP CODE	DESCRIPTION	QTY.	StockSize	Material	Weight	Total Area Sqft	EB IN RMT
1	MS2-BO-003	TOP PANEL	1	390DX420WX24THK.	Birch	2.20	1.82	
2	MS2-FR-003	STORAGE METAL FRAME	1	400D X 370W X 803.4H	MS-CR (POWDER COATED)	7.83	1.64	
3	HA0747	Plastic Tote Channel	12	346W X 34D X 15.3H	PP Copolymer	0.06	1.56	
4	HA0948 - 75H Tote Lime Green	TOTE 75H - LIME GREEN	6	410W X 315D X 75H	PP Film	0.38	8.64	
5	RN-M10	RIVET NUT M10	4	M10 X 21	Brass	10.14	0	
6	HA0906-Castor Ø60(Regal) TH	CASTOR Ø50X64L (THREADED-BREAK)	4	Ø50X64L	NYLON	114.33	0	
7	BOLT2-M6x20	FLAT ALLEN HEAD BOLT	12	M6 x 20	ASTM A36 Steel	5.62	0	
8	PCBS 4016	PAN HEAD CHIPBOARD SCREW	4	M4x16	ZINK PLATED	1.29	0	
9	HA0435 - CN-M6	SLEAVE NUT M6	12	M6 X 15	AISI 316 Annealed Stainless Steel Bar (SS)	0.01	0	
10	MS2-PB2-006	BACK PERFORATION	1	324WX774.0HX1.60THK.	Plain Carbon Steel	3.30	0	
11	MS2-PB2-005	SIDE PERFORATION	2	354WX774.0HX1.60THK.	Plain Carbon Steel	3.59	0	
12	HA0257-CBSS4016	CHIPBOARD SCREW	24	M4X16	ZINK PLATED	1.00	0	







NOTE :
1. DO NOT SCALE DRAWING.
2. TOLERANCES : +/- 1mm UNLESS OTHERWISE INDICATED

COMP. NAME: Maker's Storage	SIZE : 390WX420DX900H
PROD. NAME : Maker's Storage	MATERIAL : Material <not specified>
PART NUMBER : MS2-AS-003	QTY. : 1
	WEIGHT (in kg.) : 24.14
	REV. : R0 DATE : 16-06-2025

CIVOM

SCALE : 1:8
ALL DIMENSIONS ARE IN MM

UWC AND CT VENTURES PVT. LTD. INDORE

SHEET NO. : 1 OF 2 A4

	NAME	DATE
DRW'N BY	A. Jain	
CHKD. BY :		
APPD. BY :		

Prototype & Testing





Prototype & Testing





Product Extensions - Storage Trolly



Product Extensions - Storage Trolly



Reflection

This project has been a deeply enriching journey, not just from a design standpoint but also from an educational and human-centered perspective. As I navigated through various stages—from understanding human development to mapping curriculum, conceptualizing learning zones, and prototyping furniture—I gained a clearer appreciation for how space, tools, and design can fundamentally influence how students learn.

The research phase exposed me to the complexity of developmental psychology and the importance of aligning product design with the emotional, cognitive, and physiological needs of specific age groups. Understanding the curriculum and mapping it to activities taught me how much potential exists within the current system to incorporate hands-on learning—yet how underutilized that potential is.

Applying the AEIOU framework to design the learning zones helped me take a systems thinking approach. It allowed me to view the classroom as a dynamic ecosystem rather than a static room, enabling more holistic product decisions. Each product category emerged from genuine user needs—be it the need to explore, to collaborate, or to create with freedom.

Visiting Civom's manufacturing facilities was another pivotal moment. It grounded my ideation with real-world constraints—material behavior, cost considerations, and production capabilities. This made me more intentional in every design decision, choosing not just what would look or function well, but what could actually be made and scaled within a school environment.

Prototyping some of the products validated many of my ideas, but it also exposed areas for improvement. It was a reminder that design is an iterative process, and testing with real users is crucial to refining ideas.

Most importantly, this project has shown me that good design for education is never just about objects—it's about empowering people to grow, learn, and discover in ways that are meaningful and lasting.

Conclusion & Future Scope

This project started with a simple brief: to design products that encourage practical learning in school settings. However, the journey evolved into a complex, layered exploration of human development, learning behavior, curriculum structure, and manufacturing feasibility.

The final outcome is not just a product line or a spatial layout—it is a system of engagement. A makerspace is not simply a room filled with tools. It is a curated environment designed to ignite curiosity, enable exploration, and support learning by doing. By addressing both developmental and curricular needs, the products and zones proposed in this project aim to integrate seamlessly into real classrooms while transforming them into active learning hubs.

As education continues to shift toward interdisciplinary, skills-based, and experiential learning, there is immense scope to build upon this foundation. In the future:

- The makerspace system can be expanded to primary grades with simpler tools and activities.
- Digital integration (e.g., AR/VR, coding kits) can be layered onto physical learning tools.
- Teacher training modules can be developed to guide effective usage of the space.
- Feedback from pilot implementations can further refine the system for mass adoption.