TRAIN THE TRAINERS WORKSHOP AND STEM COORDINATOR MEETING OF THE ERASMUS+ KA2 PROJECT
598367-EPP-1-2018-1-SE-EPPKA2-CBHE-JP
"INTEGRATED APPROACH TO STEM TEACHER TRAINING", STEM

22-25 October 2019

University of Helsinki

Exactum-building, Pietari Kalmin katu 5, Helsinki, Finland.

Creative and Critical Thinking skills in STEM focusing on Technology Education

Keelin Leahy

University of Limerick

Ireland

UNIVERSITY OF **LIMERICK**
OLLSCOIL LUIMNIGH

What is "STEM" education?

Increasing levels of integration: Which level applies in your context?

Form of integration	Features
1. Disciplinary	Concepts and skills are learned separately in each discipline.
2. Multidisciplinary	Concepts and skills are learned separately in each discipline but within a common theme.
3. Interdisciplinary	Closely linked concepts and skills are learned from two or more disciplines with the aim of deepening knowledge and skills.
4. Transdisciplinary	Knowledge and skills learned from two or more disciplines are applied to real-world problems and projects, thus helping to shape the learning experience.

Technological capability

To perform, to originate, to get things done, to make and stand by decisions.

Technological sensitivity

Technological perspective

Technological confidence

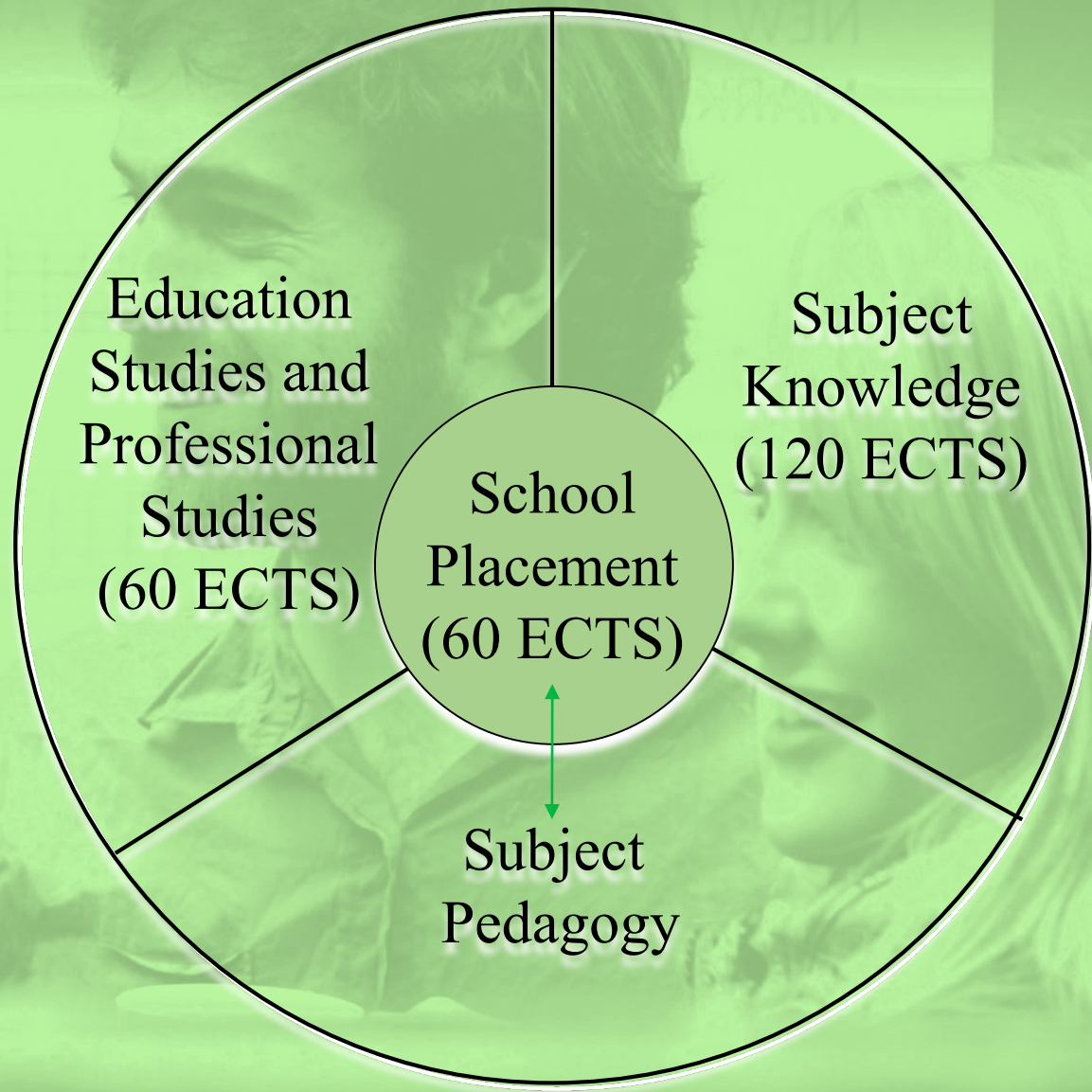Technological creativity

Teacher Education Programmes

School of Education

Faculty of Education & Health Sciences

ITE Undergraduate Programmes

- Architectural Technology **Education.**

- Engineering **Education.**

- Biological Science (+ *Chemistry or Physics or Agricultural Science*) **Education.**

- Physics and Chemistry **Education.**

- Physical **Education** with Elective.

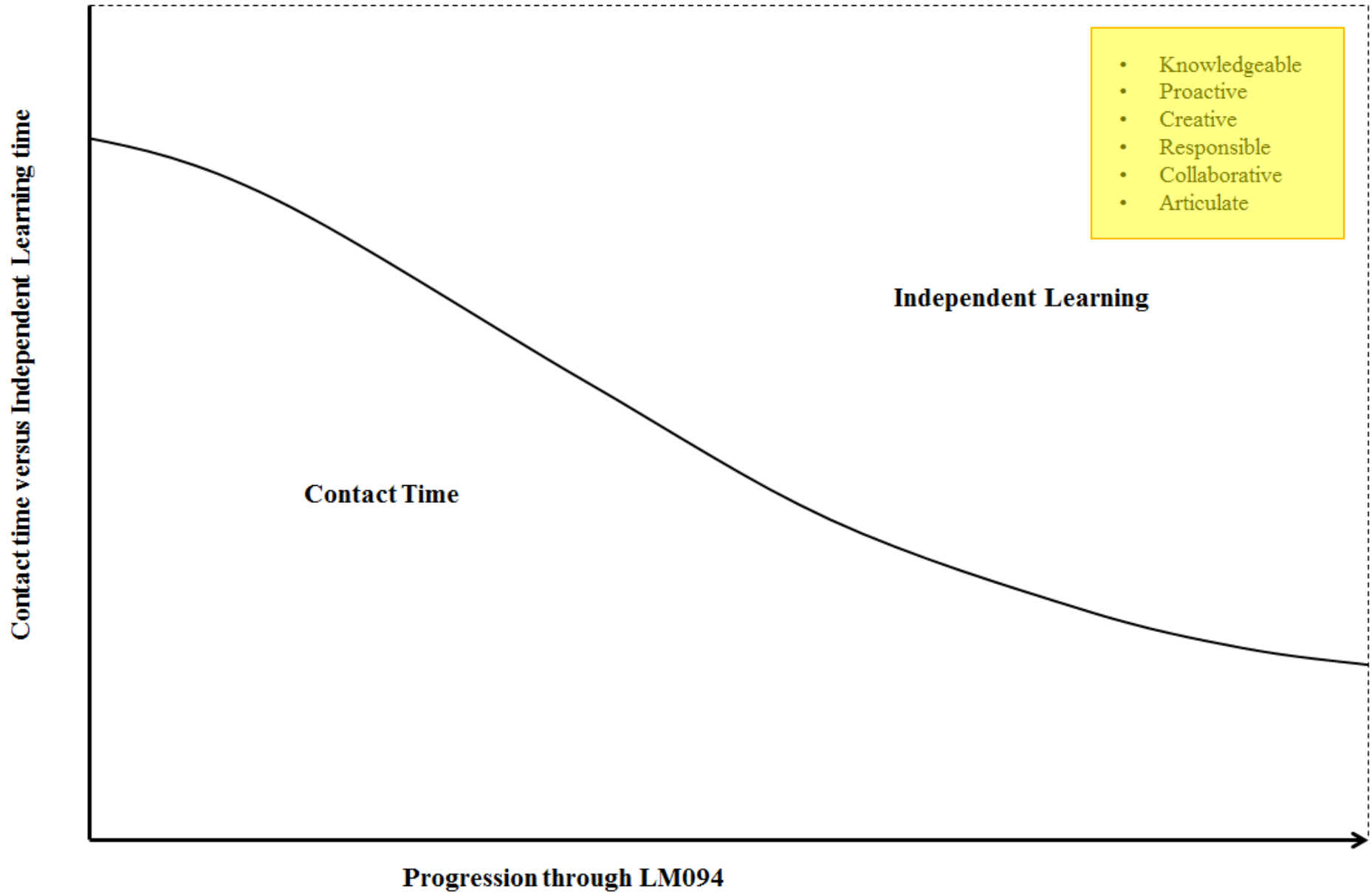- Mathematics and Computer Science **Education.**

- Language **Education**

Structure of the Courses

Education Studies and Professional Studies (60 ECTS)

Subject Knowledge (120 ECTS)

School Placement (60 ECTS)

Subject Pedagogy

SCHOOL OF EDUCATION
UNIVERSITY OF LIMERICK

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LM094 Programme Modules

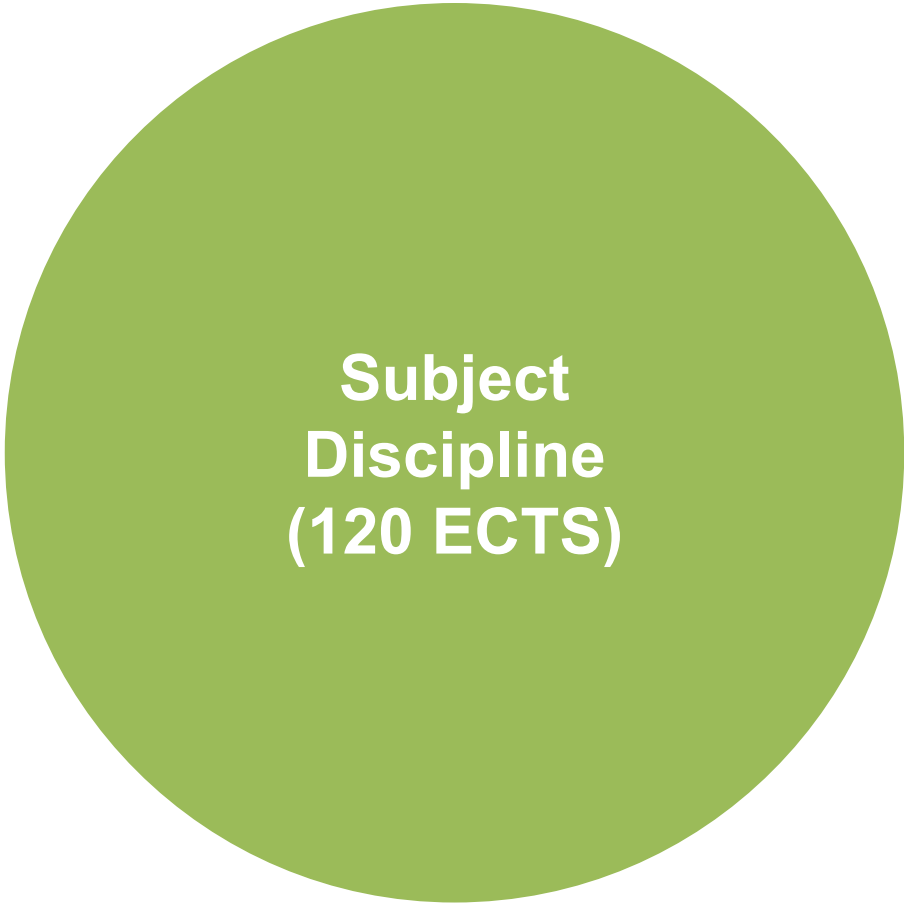| Semester 1	Semester 2
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PN4021 - Process Technology 1	WT4002 – Design and Technology 1
MA4701 – Technological Maths 1	WT4102 – Wood Science 1
ET4003 – Electro Technology (Ed)	EN4022 - Educational Technology for Teaching and Learning
EN4041 - Contemporary Understandings and Thinking on Education	EN4032 - Understanding Young People and how they Learn
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EN4033 - Planning for Learning	
Semester 5	**Semester 6**
PN4025– Design and Communication Graphics 4	PN4036– Design and Communication Graphics 5
WT4015 – Architectural Technology 1	EY4066 – Subject Pedagogics 2 (LM094)
WT4025 – Wood Technology and Design 2	WT4026 – Architectural Technology 2
EN4015 - Curriculum and Policy Studies	WT4036 – Architectural Technology 3
EN4025 - Inclusive Education 1: Contemporary Perspectives	EN4026 - Inclusive Education 2: Special Educational Needs
	GA4006 - An Ghaeilge Ghairmiuil (elective / optional)
Semester 7	**Semester 8**
TP4027 - School Placement 2	PN4038– Design and Communication Graphics 6
	PN4048 – Technology Teacher as Innovator
	WT4028 – Wood Technology and Design 3
	WT4048 – Health and Safety
	EN4018 - Teacher as Professional

Towards developing the UL Graduate Attributes

Contact time versus Independent Learning time

Progression through LM094

- Knowledgeable
- Proactive
- Creative
- Responsible
- Collaborative
- Articulate

Independent Learning

Contact Time

Education and Professional Studies (60 ECTS)

LM094 Programme Modules

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**Subject
Discipline
(120 ECTS)**

LM094 Programme Modules

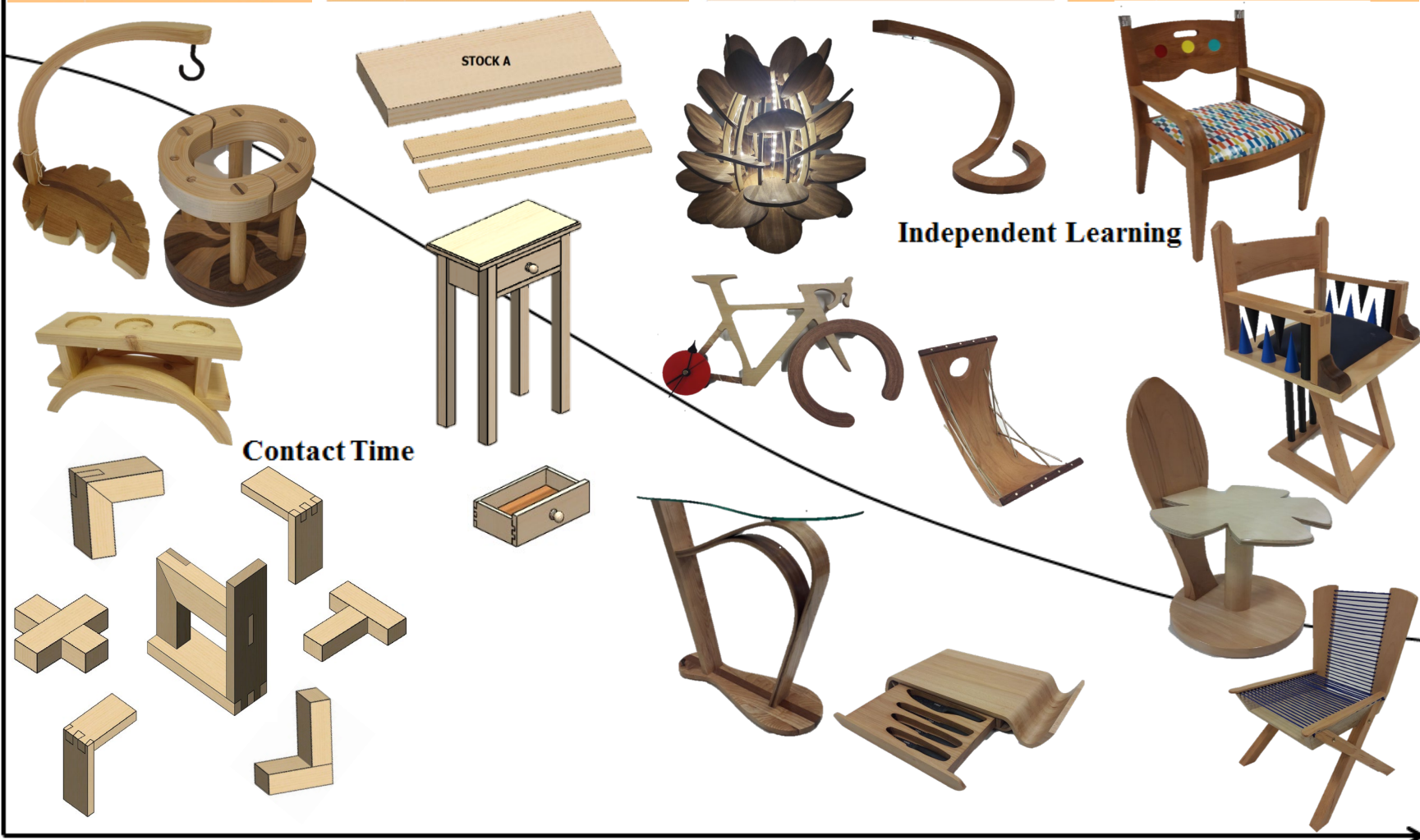| Semester 1	Semester 2
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LM094 - Design and Communication Graphics modules

Contact time versus Independent Learning time (vertical axis)

Independent Learning
- Knowledge development
- Skill refinement
- Self-directed exploration
- Synthesis of graphical principles

Spatial Visualization
Graphical Communication
Geometric Principles

Development of Spatial Skills
- Rotation and manipulation
- Physical and mental

Cognitive Flexibility & Problem Solving Skills
- Developing understanding of fundamentals
- Manipulating regular geometries
- Solving defined and ill-defined problems
- Concept generation and ideation

Graphics within the education system and links across a range of disciplines
- Analysis of syllabi
- Creating links with other subjects
- Relating to real life applications

Understanding cognitive development underpinning graphical capability
- Cognitive architecture
- Human memory systems
- Visuospatial sketchpad
- Graphical libraries

Ability to communicate and externalise graphical information
- Freehand sketching
- Digital media
- Articulation
- Gestures
- Physical modelling

Scaffolding the development of graphical understanding and skills
- Resource development
- Questioning strategies
- Stimulating interest
- Catering for mixed abilities

Strategies for assessing pupil development
- Understanding measurement
- Validity and reliability of assessment
  Task design
  Formative assessment methods

AUTOCAD   SketchUp   SOLIDWORKS

Building   *Manipulating*   *Synthesising*

Progression through LM094 (horizontal axis)

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Towards developing the UL Graduate Attributes

	Semester 2		Year 2	Semester 3		Year 3	Semester 5			Semester 8
WT4002	Wood Technology & Design 1		WT4013	Wood processing Practice and Safety		WT4025	Wood Technology and Design 2		WT4028	Wood Technology and Design 3

STOCK A

Independent Learning

Contact Time

Contact time versus Independent Learning time

Progression through LM094

School Placement (60 ECTS)

LM094 Programme Modules

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TP modules - School Placement

TP modules - School Placement LAG

School Placement – Tutor Report
Lesson Appraisal Guide

Autumn ☐ Repeat ☐ Visit Number for this Tutor ☐

School		Student Teacher	
Class/Year Taught		Date	
Course		Tutor	

School Placement Criteria	Comments/Suggestions
1. SP File/Folder File is available and complete. Adherence to SP Handbook and Planning Document.	
2. Coherence and Quality of Planning Lesson plan available and contains essential detail. Planning for classroom management, teaching, learning and assessment. Aims and objectives to guide teaching and learning. Coherence of schemes and lesson plans. Balance between teacher activities and learner activities. Resources and use of technology. Planning for differentiation *	
3. Management of Learning Environment Communication of learning expectations. Communication of classroom rules, procedures and sanctions. Personal enthusiasm. Motivation of learners. Organisation of resources. Safe working environment. Supervision of the lesson. Promotion of learner responsibility *	
4. Subject and Procedural Knowledge Knowledge and understanding of topic(s) taught. Student teacher understanding and development of activity, topic and concept. Appropriateness of learning to learner age and ability. Logical sequencing/progression within and between lessons. Mastery of the procedures relevant to discipline. Discipline specific teaching strategies (e.g. use of target language, safe working procedures, effective demonstration procedures, skill/knowledge development with learners).	
5. Effectiveness of Teaching Strategies Appropriate use of a range of teaching strategies. Balance between teacher activities and learner activities. Explanations and instructions. Probing, redirection of questions and feedback. Going beyond information to concepts, attitudes and principles. Use of higher order questioning (application, analysis, synthesis and evaluation). High expectations of self and learners. Forges cross-curricular links * Application to relevant local and global development issues, e.g. sustainability, social justice, poverty *	

* While all students are expected to show awareness of this criterion, it is of particular importance in the case of Fourth Year and PME students on second block placement

School Placement – Tutor Report
Lesson Appraisal Guide

School Placement Criteria	Comments/Suggestions
6. Teaching in Diverse Settings Awareness of diverse learners (gender, ethnicity, culture, ability, etc.). Creative learning experiences for *all* learners * Provision for mixed-ability learners * Ability to respond to and challenge all learners *	
7. Coherence of Lesson Linkage between parts of the lesson. Linkage between lessons. Transition within the lesson. Pacing of tasks and activities.	
8. Integration of Literacy and Numeracy Literacy / Numeracy. Integration of literacy and numeracy within the lesson. Responsiveness to literacy/numeracy issues.	
9. Quality Assessment of / for Learning Evidence of assessment *of* learning in relation to a wide range of outcomes including skill acquisition, concept acquisition and attitudes. Evidence of assessment *for* learning in relation to a wide range of outcomes including skill acquisition, concept acquisition and attitudes. Variety of assessment instruments (criteria-referenced practicals, multiple-choice theory, profiling, etc.)	
10. Quality of Relationships Evidence of caring attitude toward all learners. The nature of teacher-learner and learner-teacher relationships. Encourages learner-learner interaction. Learners' enjoyment of learning. Use of learners' names. Professional relationships with learners.	
11. Reflective Practice Identification of strengths and deficiencies. Realistic responses to problems experienced. Willingness to pursue particular issues and/or problems over a series of lessons and draw meaningful conclusions. Learning from good practice of others. Response to tutor(s). Responsibility for own professional development* Critical reflection supported with literature *	
12. Professional Conduct and Practice Respect for learners and all members of the school community. Exercise of duty of care. Ownership and responsibility for decisions. Evidence of maturity and confidence.	

* While all students are expected to show awareness of this criterion, it is of particular importance in the case of Fourth Year and PME students on second block placement

Post Lesson Appraisal

Strengths

Areas for development

Assessment To close this meeting the tutor will share his/her provisional rating of this lesson.

	Tutor Rating
Excellent	
Very Good	
Good	
Satisfactory	
Unsatisfactory	

Concluding the Visit

Following discussion, both the student teacher and the tutor acknowledge that they have reviewed feedback contained in this document.

Student Teacher Signature   Countersigned by Tutor

* While all students are expected to show awareness of this criterion, it is of particular importance in the case of Fourth Year and PME students on second block placement

Technology Education; supported by STEM

- While we aimed for horizontal and vertical integration of the course modules this was in best practice, but not always feasible in implementation.

- However, within some modules, there is an problem-based learning approach, which fosters STEM in the context of real-world problems.

TALLIS HABITS

"Learning to understand the world and change it for the better"

INQUISITIVE:
Wondering & questioning
Exploring & investigating
Challenging assumptions

COLLABORATIVE:
Co-operating appropriately
Giving & receiving feedback
Sharing the product

PERSISTENT:
Sticking with difficulty
Daring to be different
Tolerating uncertainty

DISCIPLINED:
Crafting & improving
Reflecting critically
Developing techniques

IMAGINATIVE:
Using intuition
Making connections
Playing with possibilities

An exploration of…

WT4025 - WOOD TECHNOLOGY & DESIGN 2
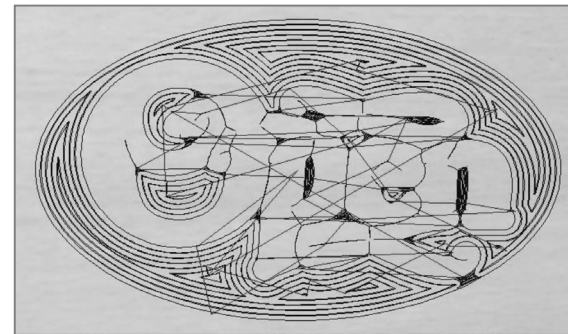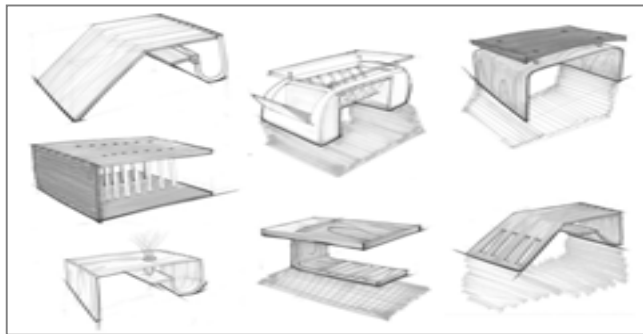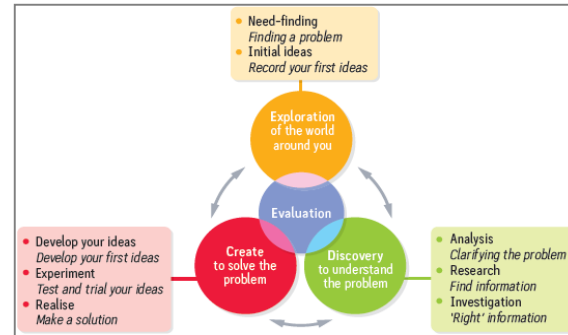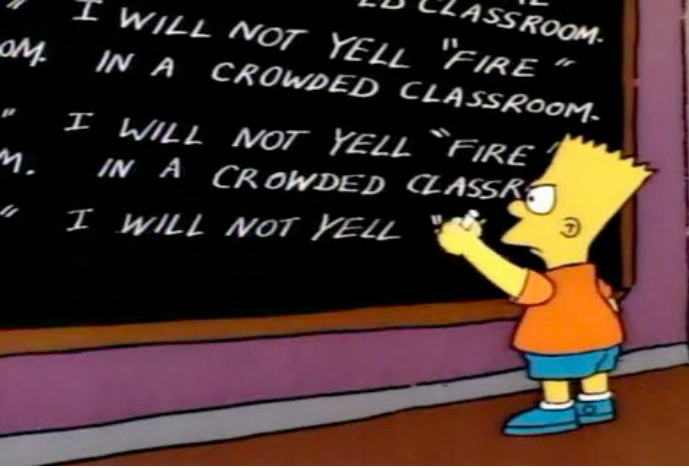
STUDENT

EDUCATOR

DESIGNER

Hours per Week:

Lecture	Lab	Tutorial	Other	Private
2	4	0	0	4

Grading Type: N

Prerequisite Modules: WT4013

Rationale and Purpose of the Module:
This module will develop advanced manufacturing processing techniques for wood and wood composite based materials. Student's knowledge and skills will be developed through an introduction to contemporary trends and concepts utilised to add value to wood as a manufacturing material. Through design for context activity the properties, advantages and limitations of wood as a manufacturing material will be explored. Students will explore how modern wood processing and jointing techniques can be utilised to promote the use of wood in competition with other materials. The module will examine how the properties of solid wood and wood-composites influence product/component design. Students will experience the complexities of designing with wood through a series of tests and experiments that will examine the suitability of the material for the end use environment.

Syllabus:
Mechanical Properties of Wood: Natural characteristics, knots, rate of growth, slope of grain, specific gravity, elasticity. Grading: Strength classification, visual grading, and general structural and special structural grading parameters. Effects of machining and service environments: Moisture Content, Temperature, Deflection, Fatigue, Fire. Wood technology: Bending and Lamination, Form work, Jig and template design. Radio-frequency bonding, CNC manufacture, traditional and contemporary jointing techniques. Framing and assembly exercises. Strategic planning for manufacture and assembly of wooden artefacts/components. Programming and operation of CNC equipment. Data transfer from CAD systems. Design, realisation and testing. Physical and virtual (CAD) modelling of design solutions. Ecological impact of materials and processes. Analysis of the application of these technologies in the second level school setting.

Learning Outcomes:
Cognitive (Knowledge, Understanding, Application, Analysis, Evaluation, Synthesis)
• Explain the factors that influence the mechanical properties of wood and wood composite materials.
• Analyse the in-service requirements for a product or component that will be manufactured from wood or wood composite material and apply knowledge of material properties and characteristics to formulate a design specification.
• Select or create appropriate modelling/prototyping/testing activities that will inform and evaluate the effectiveness

Rationale and Purpose for the Module

TECHNOLOGY   **ENGINEERING**

This module will develop advanced manufacturing processing techniques for wood and wood composite based materials. **SCIENCE** Student's knowledge and skills will be developed through an intr**TECHNOLOGY** contemporary trends and concepts utilised to add value to wood as a manufacturing material. Through *design for context* activity the properties, advantages and limitations of wood as a manufa**ENGINEERING**erial will be explored. Students will ex**SCIENCE** how modern wood processing and jointing techniques can be utilised to promote the use of wood in competition with other materials. The **ENGINEERING** examine how the properties of solid wood and wood-composites influence product/component design. Students will experience the complexities of designing with wood through a series of tests and experiments that will examine the suitability of the material for the end use environment. **MATH**

'Education for Sustainability'

The National Strategy on Education for Sustainable Development in Ireland, 2014-2020

A N   R O I N N | DEPARTMENT OF
OIDEACHAIS | **EDUCATION**
AGUS SCILEANNA | **A N D   S K I L L S**

July 2014

Box 1: Objective of National Strategy
The National Strategy on Education for Sustainable Development aims to ensure that education contributes to sustainable development by equipping learners with the relevant knowledge (the 'what'), the key dispositions and skills (the 'how') and the values (the 'why') that will motivate and empower them throughout their lives to become informed active citizens who take action for a more sustainable future.

Real-world problem(s)

- Provide a context and relevance

- To shape the learning experience

- Integrate Head, Heart and Hand

Design for context

Preamble…

The UN Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all.

Through an exploration of the 17 UN SDG observe the world around you, identify a development issue that needs to be addressed in a specific context.

"The world's biggest challenges"

Development issue that needs to be addressed in a specific context.

Specific context

Three dimensions in sustainable development:

Campaigns ⌄

Climate

Gender

Water

Youth

Exploring contexts

- Look at contexts - through problem/project-based learning.

- Explore other contexts within ones own culture or indeed the context of those in other cultures (handle with care).

- Considering the needs of others is an important part of developing an understanding of how products and technological systems come about.

- Adopt a values perspective as a state of mind and as a way of operating in the world.

- Technological literacy - understanding of technology and how we value it's use and are aware of the consequences of its existence through the effects on others and the environment.

Problem / Project-based context

CAD – Computer Added Design

3D CAD or 2D CAD
Parametric / Direct

SolidWorks

SketchUp

AutoCAD

Autodesk

360

Inventor

CAD – Paper to computer

*File Type – Depends on manufacturing technique

Additive Manufacturing

3D Additive
STL / VRML

Subtractive Manufacturing

3D Subtractive
STL / OBJ / PLY

2D Subtractive
DXF / DWG

CAM – Machine code generator

CAM – Computer Added Manufacturing
*Software – Depends on machine make model and type!

Slic3r
Pronterface

VCarve
Alpha Cam
Smart Cam

CNC – Computer Numerical Control

G code
M code
S code
Etc.

Problem / Project-based context

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3D CAD or 2D CAD
Parametric / Direct

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Slic3r
Pronterface

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Smart Cam

CNC – Computer Numerical Control

G code
M code
S code
Etc.

CNC - **Computer Numerical Control**

1.CAD

2.CAM

3.CNC

*Computer **converts the design** produced by CAD / CAM software **into numbers**.*

Computer controls the cutting and shaping of the material.

*Numbers -> considered to be the **coordinates** of a graph -> control the **movement of the cutter**.*

Problem / Project-based context

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Parametric / Direct

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Autodesk
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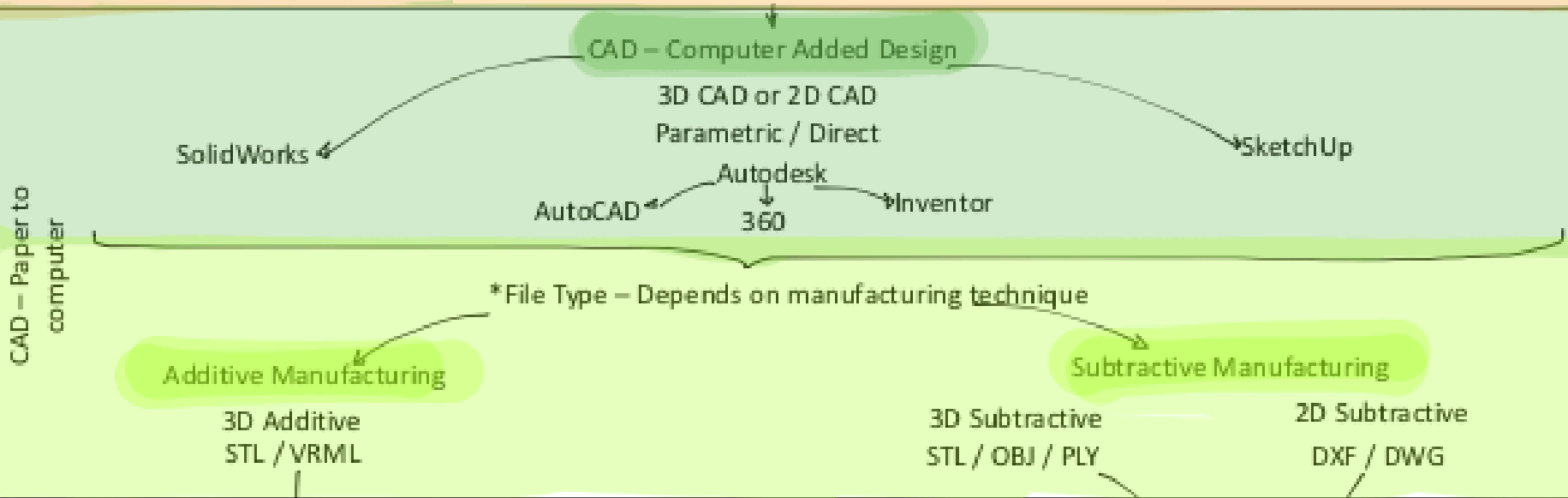
Spindle speed (**7,000rpm** to **18,000rpm**) is directly related to the **feed rate or surface speed**, which most machines are capable of doing up to about **200ipm**.

The two other variables, **step-down** and **step-over** should be kept so that the **cross-sectional area** engaged with the material is **no more than the radius times the diameter of the bit**. This is a rule of thumb, but it's a good starting point for **feed and speed calculations**.
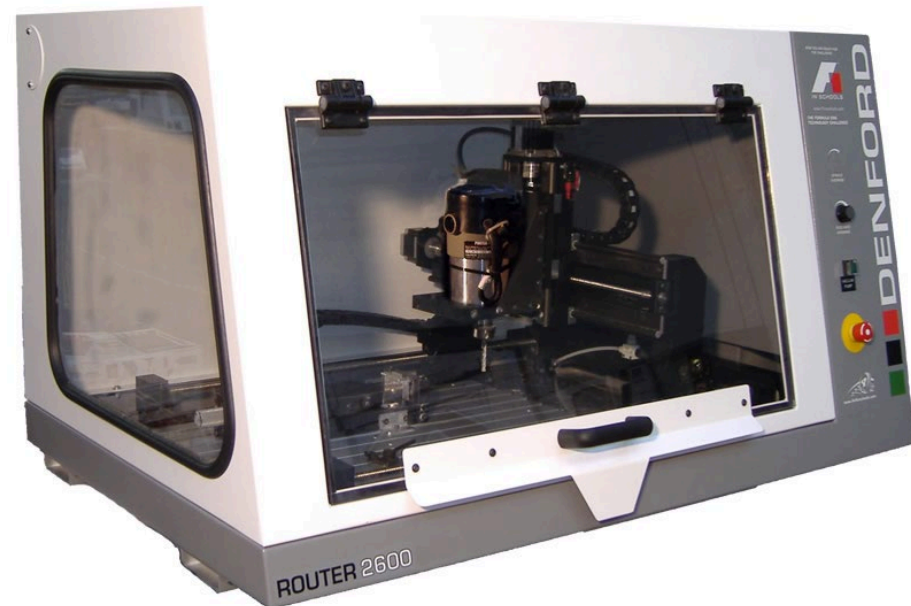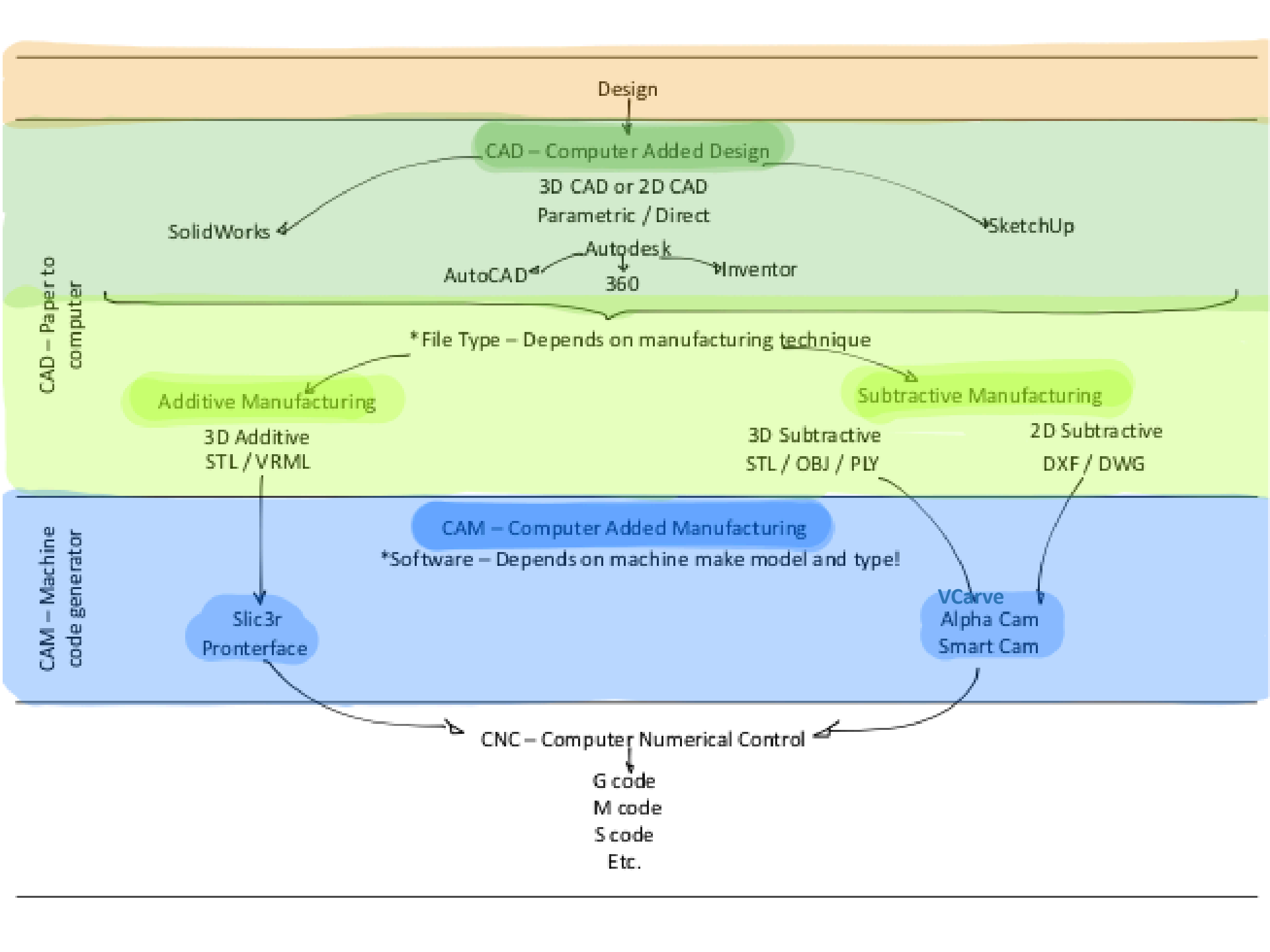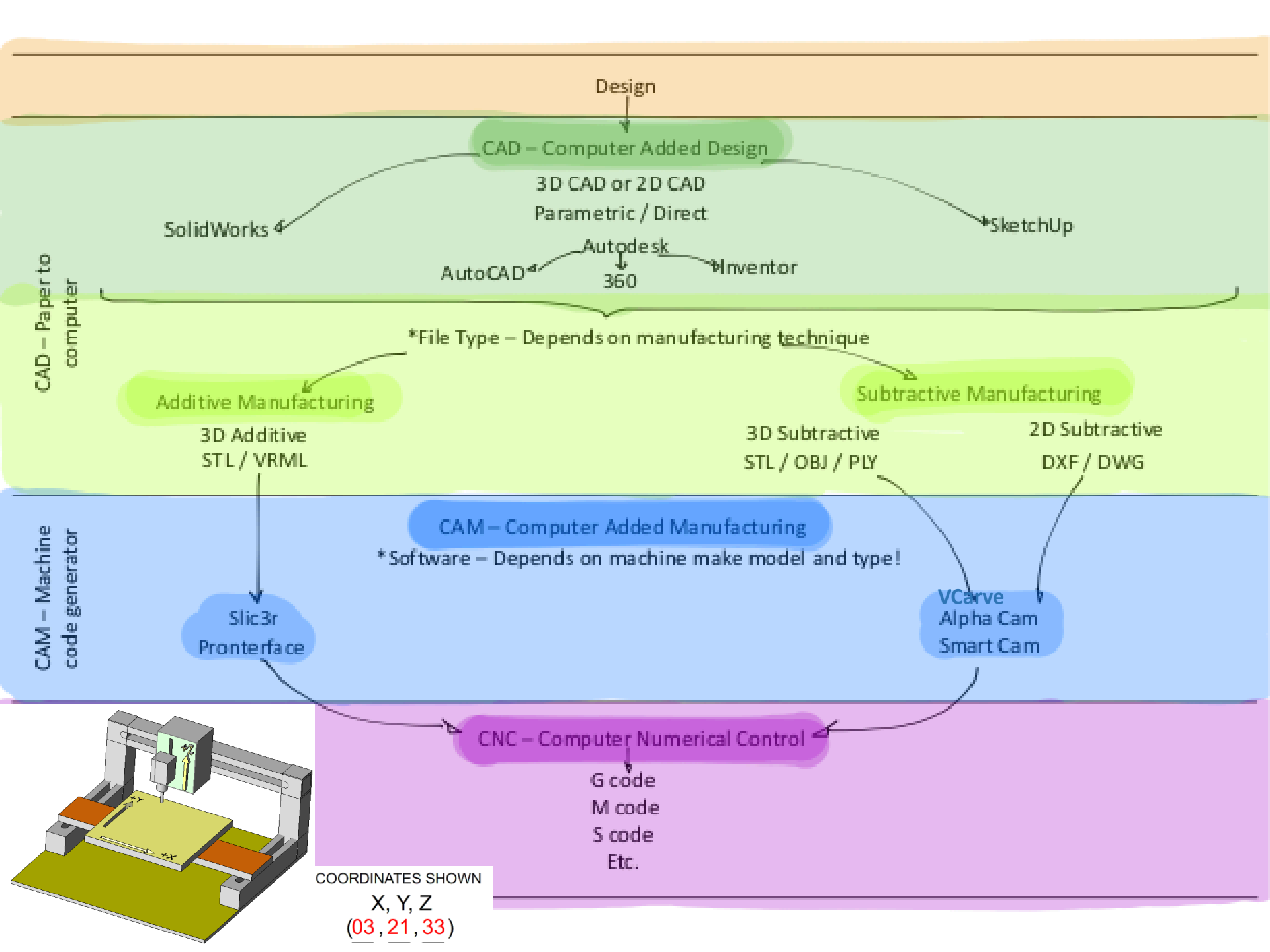
Design

CAD – Computer Added Design

3D CAD or 2D CAD
Parametric / Direct

SolidWorks

SketchUp

Autodesk

AutoCAD

Inventor

360

*File Type – Depends on manufacturing technique

Additive Manufacturing

Subtractive Manufacturing

3D Additive
STL / VRML

3D Subtractive
STL / OBJ / PLY

2D Subtractive
DXF / DWG

CAM – Computer Added Manufacturing

*Software – Depends on machine make model and type!

Slic3r
Pronterface

VCarve
Alpha Cam
Smart Cam

CNC – Computer Numerical Control

G code
M code
S code
Etc.

CAD – Paper to computer

CAM – Machine code generator

Design

CAD – Computer Added Design

3D CAD or 2D CAD
Parametric / Direct

SolidWorks

Autodesk

AutoCAD

360

Inventor

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Additive Manufacturing

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Pronterface

VCarve
Alpha Cam
Smart Cam

CAM – Machine code generator

CNC – Computer Numerical Control

G code
M code
S code
Etc.

COORDINATES SHOWN
X, Y, Z
(03 , 21 , 33)
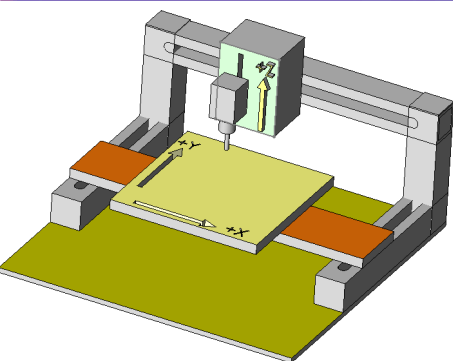
Back to Problem / Project-based context…
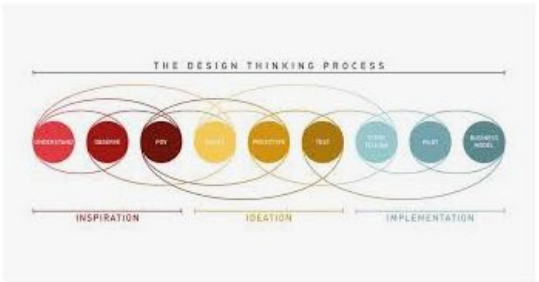
Design Thinking: A Quick Overview …
interaction-design.org

The Design Thinking Move…
medium.com

Design Thinking | Oceanit
oceanit.com
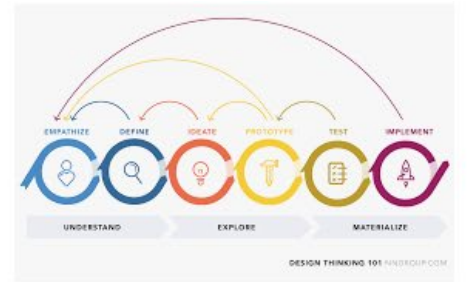
What is Design Thinking? (And What Are …
medium.com

A Response to the Stanford d.school'…
blog.usejournal.com
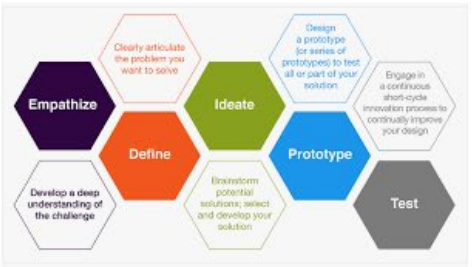
Design Thinking
citl.illinois.edu

What is Design Thinking? | Interaction …
interaction-design.org
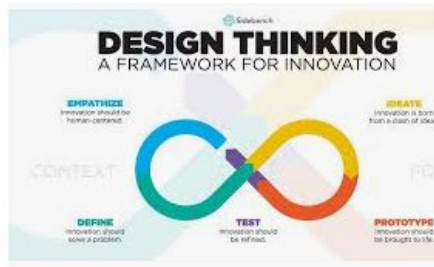
Design Thinking Isn't Just For Your …
productcoalition.com
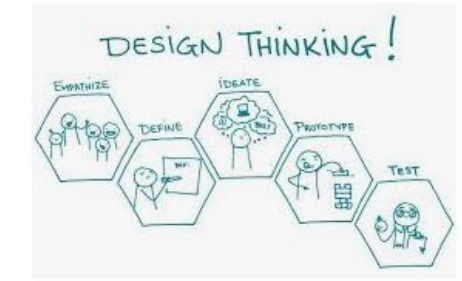
Design Thinking For Software Developers …
medium.com
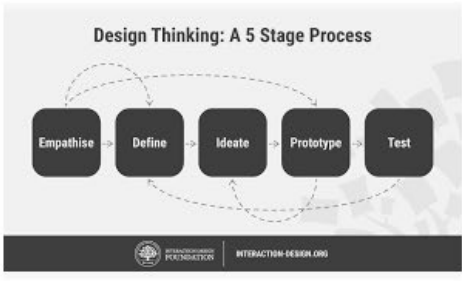
5 Stages in the Design Thinking Process …
interaction-design.org

implement Design Thinking …
baybridgedigital.com
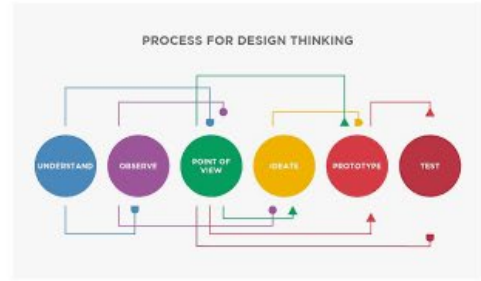
Design Thinking for Startups – Hacker Noon
hackernoon.com

Design T
navigate

Problem solving
is
for something,
for someone,
for some purpose

Addressing / considering the SDG's

- **Need-finding**
  Finding a problem
- **Initial ideas**
  Record your first ideas

Exploration of the world around you

Evaluation

- **Develop your ideas**
  Develop your first ideas
- **Experiment**
  Test and trial your ideas
- **Realise**
  Make a solution

Create to solve the problem

Discovery to understand the problem

- **Analysis**
  Clarifying the problem
- **Research**
  Find information
- **Investigation**
  'Right' information

UNCERTAINTY / PATTERNS / INSIGHTS

CLARITY / FOCUS

YOU ARE HERE

INNOVATION

Exploration

Of the world around you

Why?

Need finding
For a problem
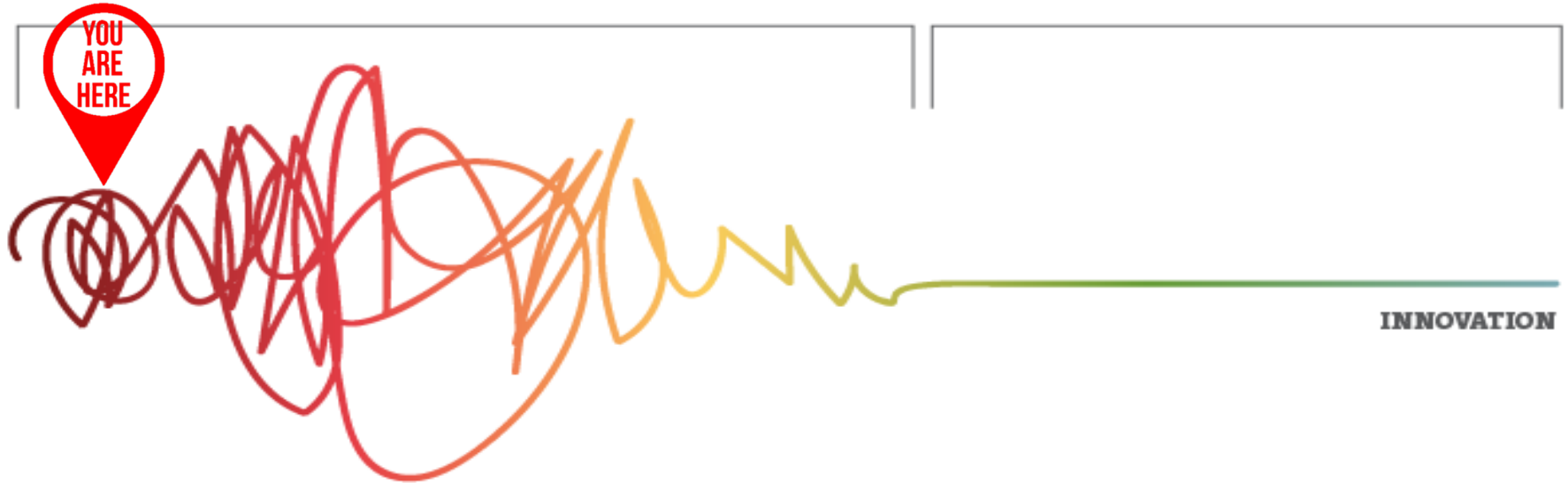
LOOKING FOR INSIGHTS and INSPIRATION (UN SDG)

IN CONTEXT OF YOUR INSPIRATION (UN SDG) IS THERE A PROBLEM OR NEED THAT COULD BE ADDRESSED?

Exploration – *Intuitive!*

Initial ideas
Record your first ideas

How can you solve the development issue?
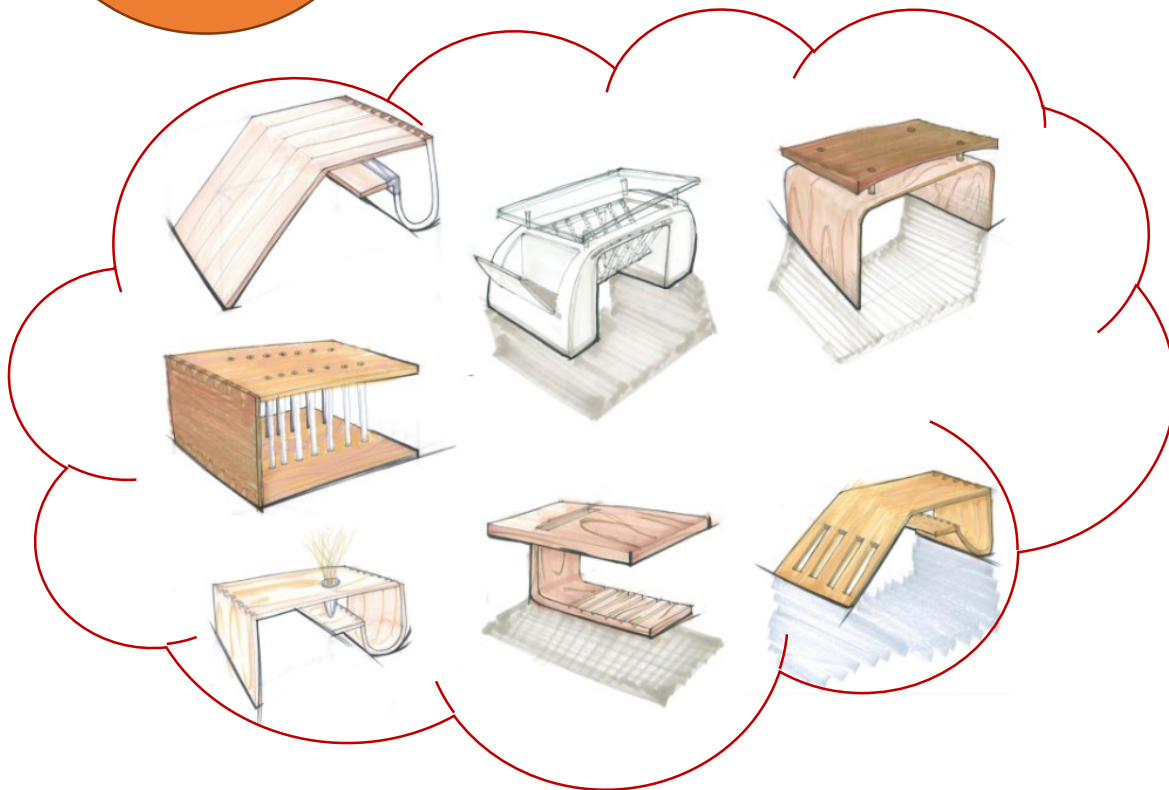
Generate and illustrate ideas from *your head* based on your Exploration phase.

Discovery – *Understanding!*

Analysis
Clarify the problem

Research

Investigation

Research

Find information

o **Research, *finding the right information:***

- *Problem requirements*
- *Wood in competition with other materials (Use of wood and wood composite materials)*
- *Complexities of design with wood (influences on component / artefact design)*
- *Advanced manufacturing processing techniques.*

| Need-finding | Finding a problem |
| Initial ideas | Record your first ideas |

Exploration of the world around you

Evaluation

Create to solve the problem

Discovery to understand the problem

- Develop your ideas
  Develop your first ideas
- Experiment
  Test and trial your ideas
- Realise
  Make a solution

- Analysis
  Clarifying the problem
- Research
  Find information
- Investigation
  'Right' information

Initial ideas

Developed ideas

Evaluated idea(s) using 10 Commandments of Good Design

DIVERGE

CONVERGE

CREATE CHOICES

MAKE CHOICES

01 *Innovative*	02 Useful	03 *Aesthetic*
10 *Little design as possible*	**Proposed final idea**	04 Helps Understand
09 CONCERN FOR ENVIRONMENT	*(Note this is not your final idea, but the idea you will refine further using the 10 commandments)*	05 *Unobtrusive*
08 *Consistent in all detail*	07 **Ageless**	06 *Honest*

IDEA GENERATION LEADs TO INNOVATION
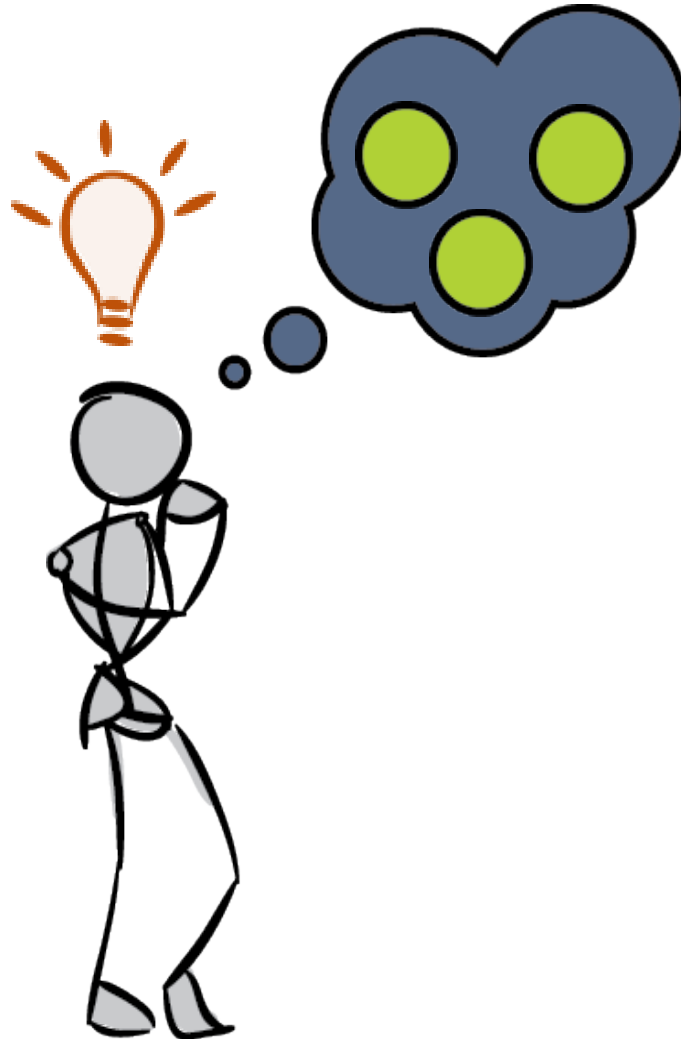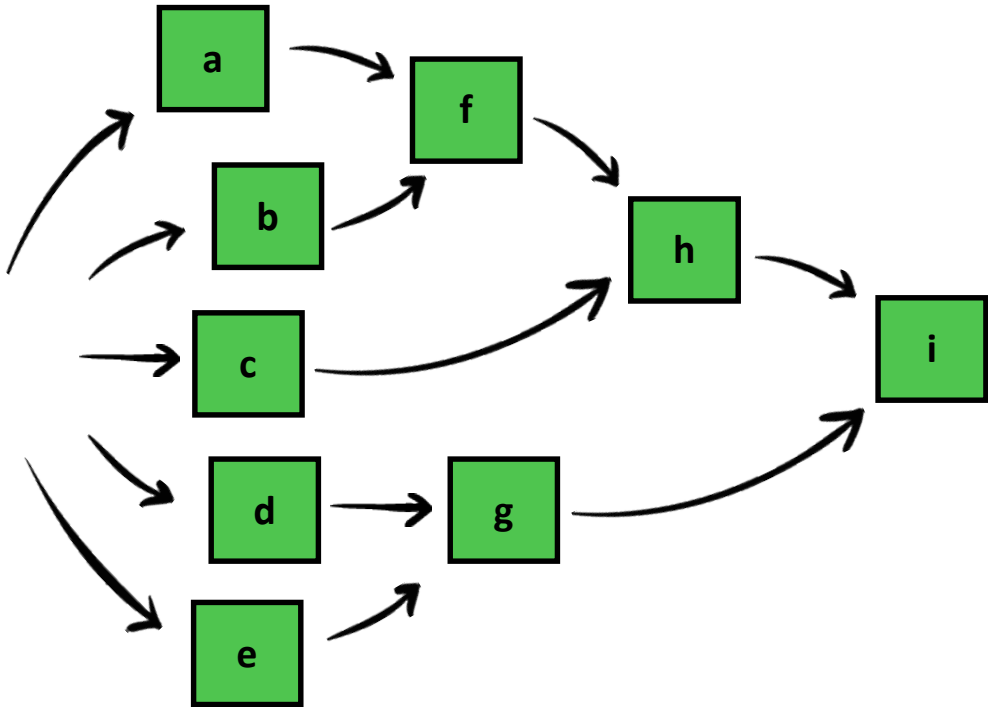
Challenges - Creative Idea Generation

Real-world problem

Ideation space / exploration

→ **c**

Narrow design space
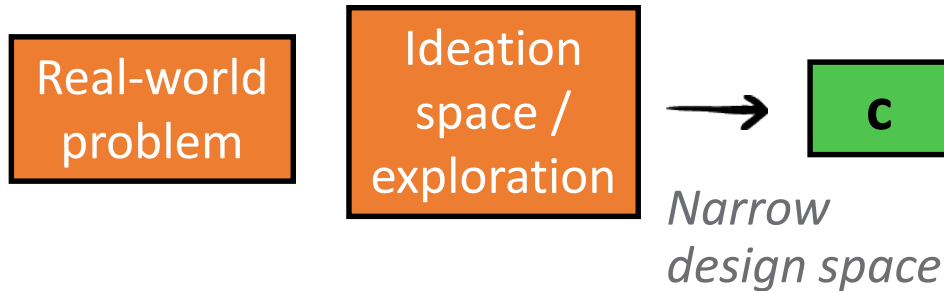
- Lack of strategies for multiple and diverse idea generation

- Fixation
  - existing products
  - previous experiences
  - first idea

How to promote creative idea generation?

a
b
c
d
e

Real-world Problem

Ideation space exploration

Creative Ideation fostered via:

- Design Heuristics
- SCAMPER
- 16 Squares
- Train of Thought
- Likes / Dislikes
- Ask the right questions
- Brainsketching
- Idea grid
- Random inputs
- Biomimicry

Cognitive heuristics

Reasoning processes that do not guarantee the best solution, but often lead to potential solutions by providing a short-cut.

↓

Design heuristics

Concept modifiers that quickly lead to a potential solution, providing the opportunity for a novel design to occur.

DESIGN SOLUTION SPACE
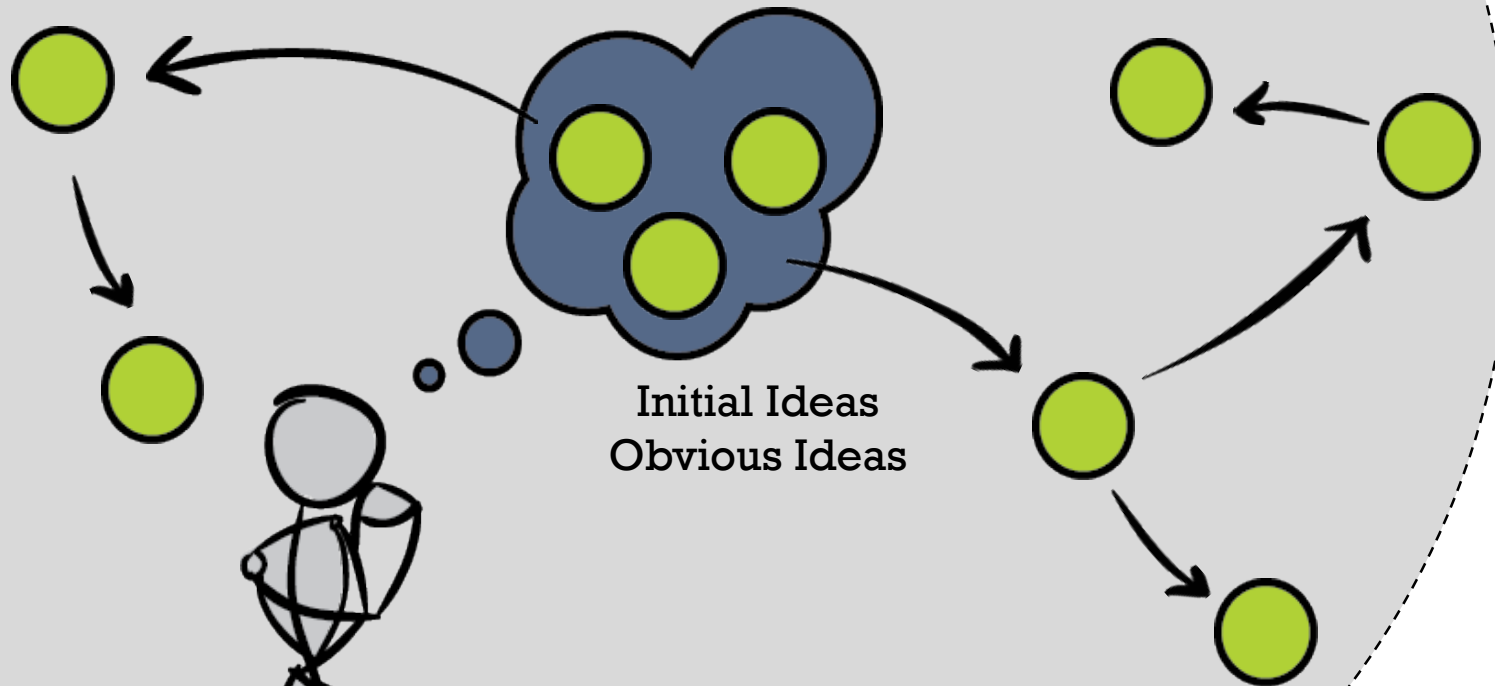
Initial Ideas
Obvious Ideas

Design Heuristics push you to
more fully explore the potential
solution space.

46 Design Heuristics: Creativity Unfolded

Example of one Design Heuristic

Title

REDUCE MATERIAL

Abstract Image

Descriptive Text

Use less material.

DH53
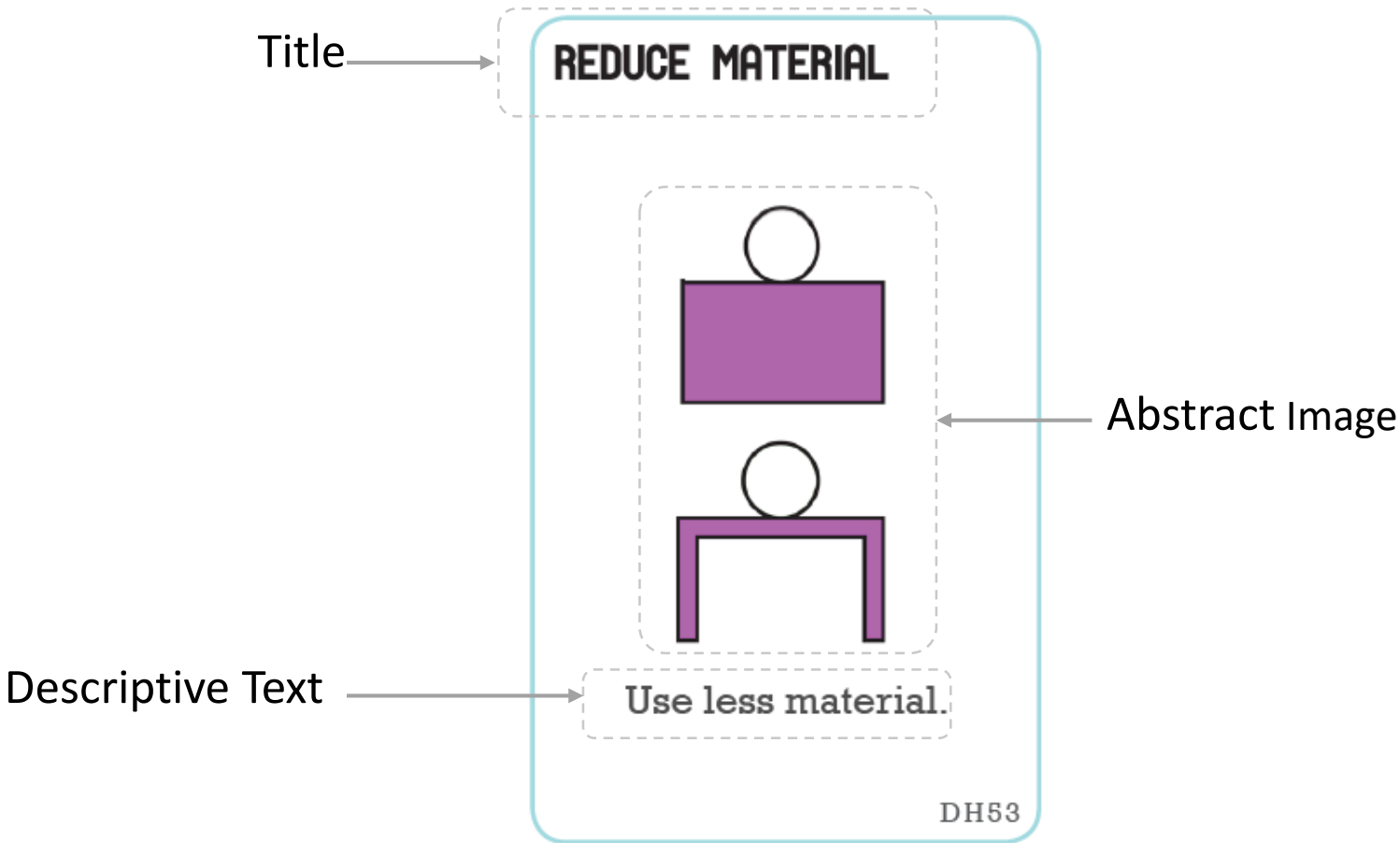
Ways to use the Design Heuristics

There are no rules or guidelines!

- Use one card to generate many ideas.
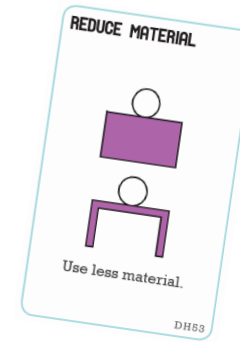
- Use many cards to generate one idea.
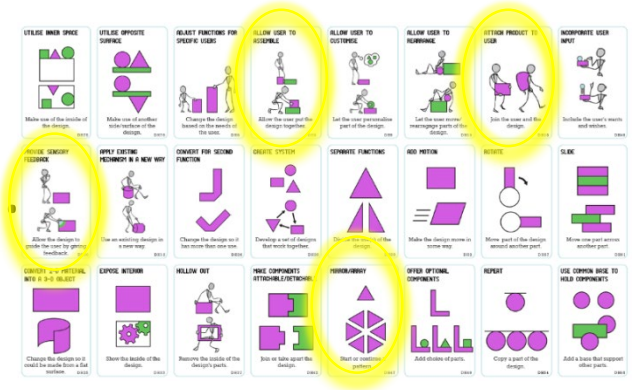
- Use any feature of a card; title, image, or descriptive text.
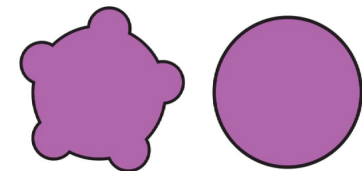
Design Heuristics evolving ideas
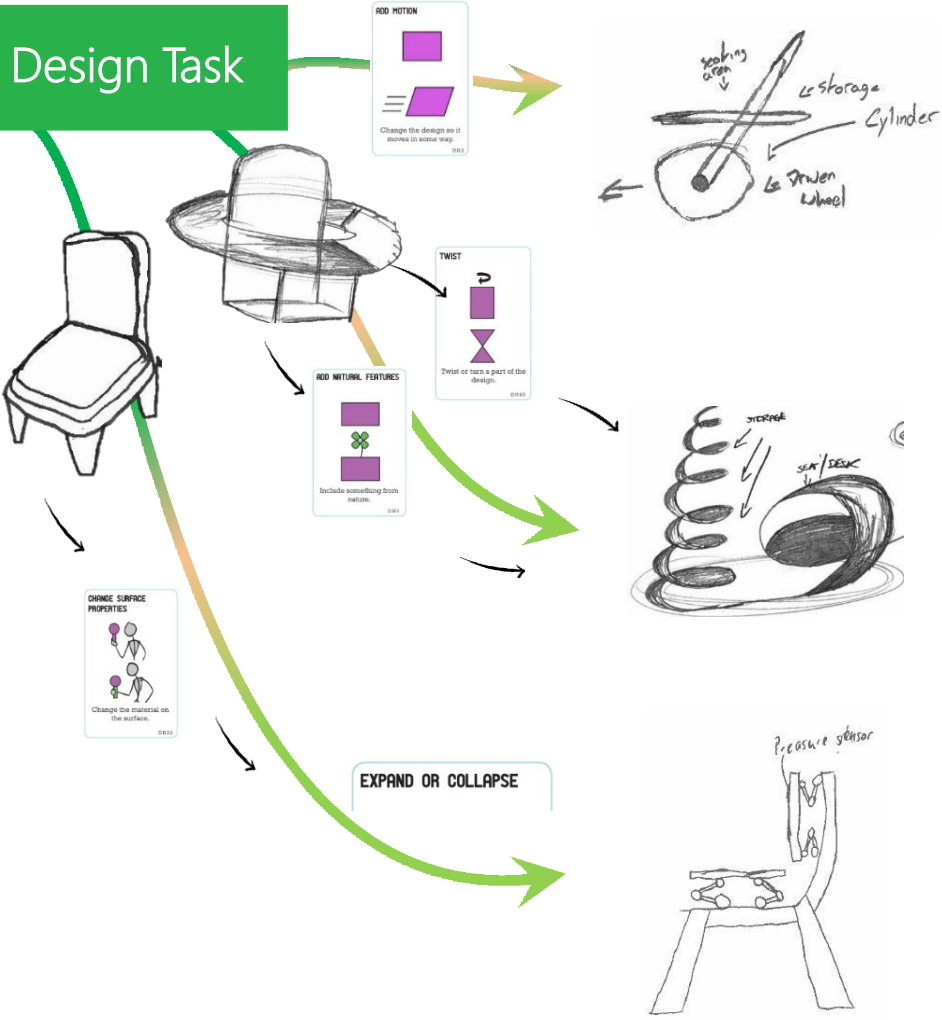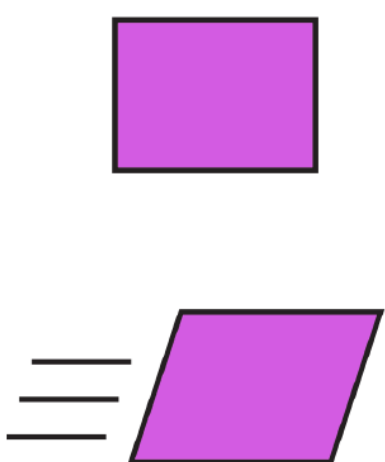
46 Design Heuristics tool can support creativity in the context of:

- Generate a new idea.

- Develop an existing idea

- Develop part of an existing idea.

Design Heuristics initiating an idea
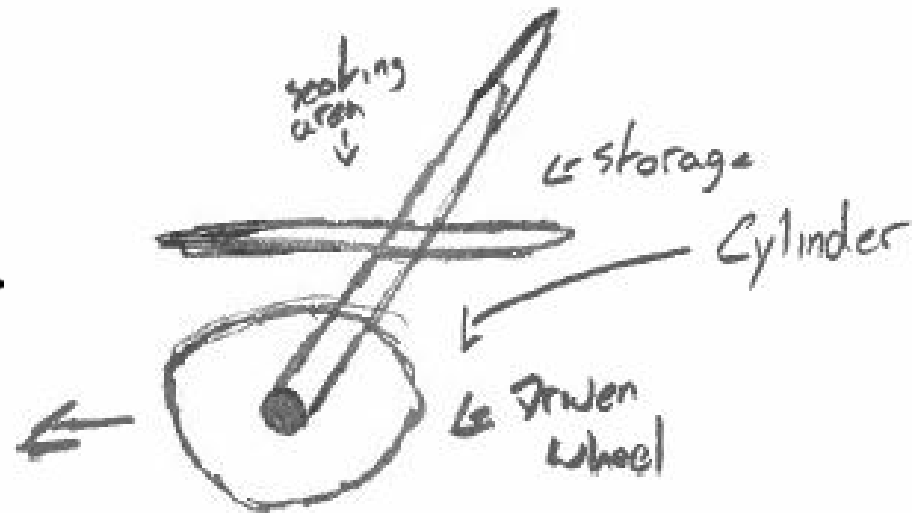
Design Heuristic transforming an idea
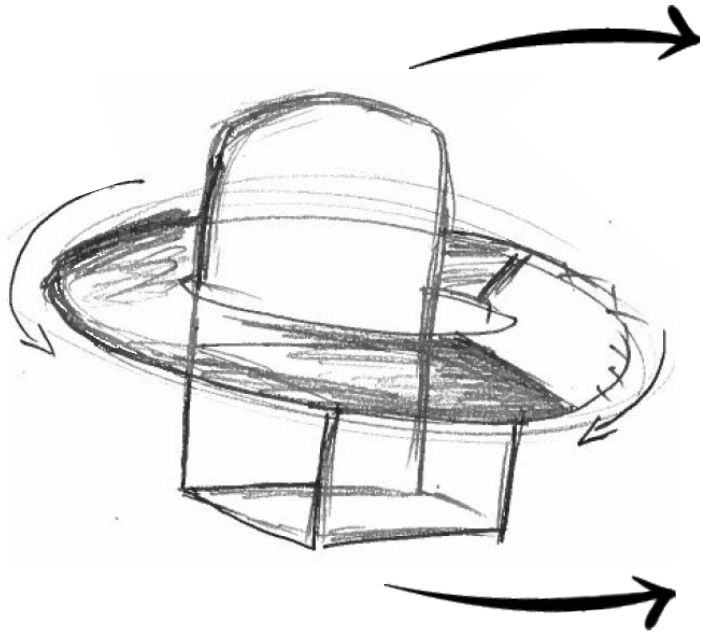
ADD NATURAL FEATURES

Include something from nature.

DH3

TWIST

Twist or turn a part of the design.

DH66

STORAGE

SEAT/DESK
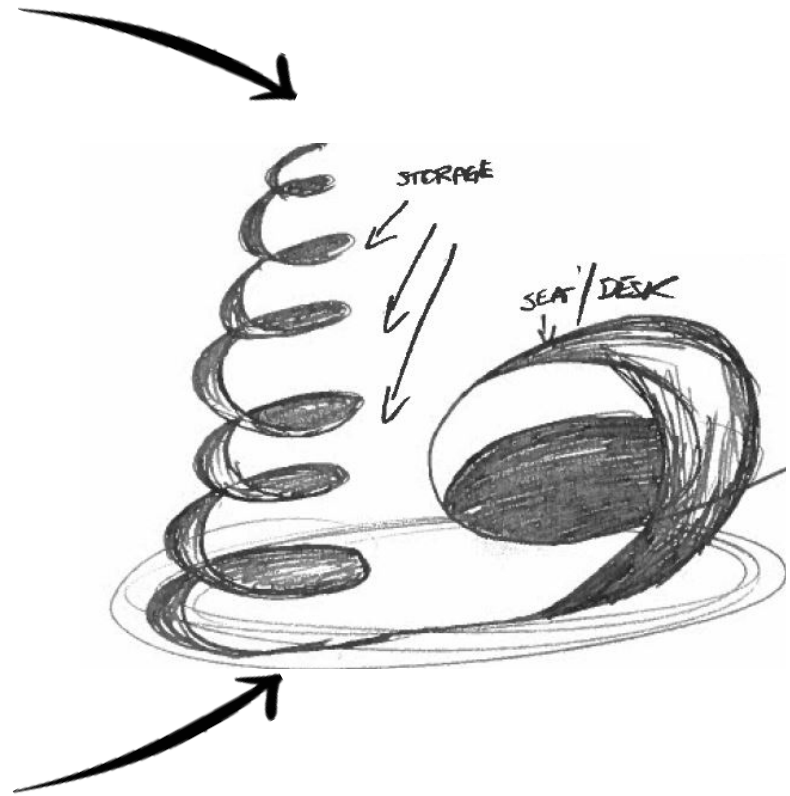
Design Heuristics developing parts of ideas
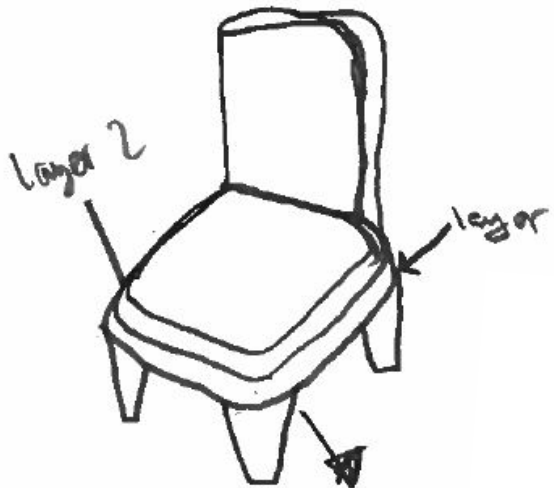
CHANGE SURFACE PROPERTIES
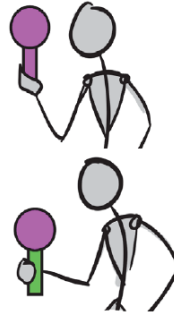
Change the material on the surface.

DH22

EXPAND OR COLLAPSE

Layer 2

layer

Pressure sensor
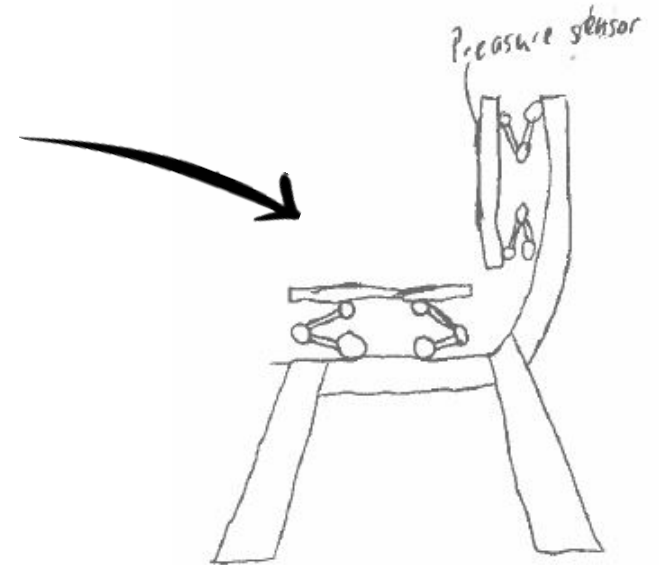
Using Design Heuristics

Idea Initiation

DESIGN TASK
Design products that utilise sunlight for heating and cooking food.
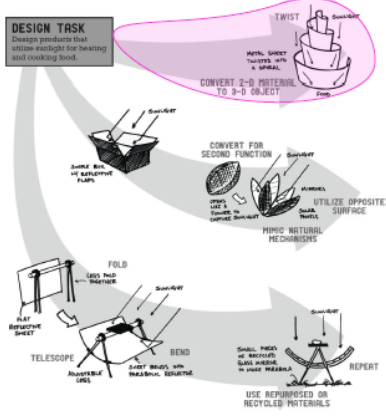
Idea Initiation generate id...

- It can be difficult to generate ideas from the 'top of our [...]
- We often have one idea, and find it difficult to think of m[...]
- We often look at existing solutions or ideas to help us ge[...]
- We often fixate (become obsessed) with:
  - Existing ideas
  - Existing solutions/products
  - Prior experience.

Think like a designer with Design Heuristics
Design Heuristics are idea modifiers, which:
- Offer an exciting means of generating a initial ideas duri[...] the idea generation process.
- Help us when we cannot think of initial ideas.
- Prompt us when we are stuck for ideas.

Design Heuristics are represented on cards.
- Use any part of a card to generate a new idea
- Generate new ideas by applying a card to a previous idea
- Use the abstract image to inspire ideas
- Use the title to inspire ideas
- Use the description to inspire ideas

Idea Transformation

DESIGN TASK
Design products that utilise sunlight for heating and cooking food.
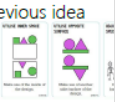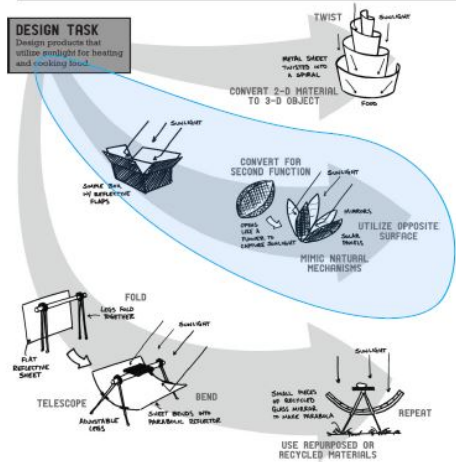
Transformations:
- It is very difficult to design from scratch, or from n[...]
- Many new products are developed from existing p[...] that need to be improved for the user.
- Transform ideas by pushing your thinking a little fu[...]

Generate multiple ideas through transformations

Initial dea transformation

A → F
B → H
C
D → G
E

Subcomponent Design

DESIGN TASK
Design products that utilise sunlight for heating and cooking food.
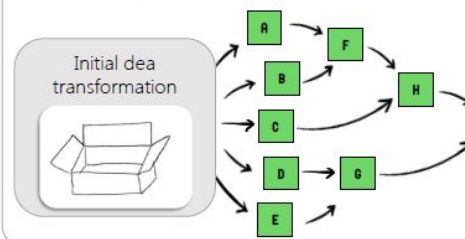
Subcomponent Design
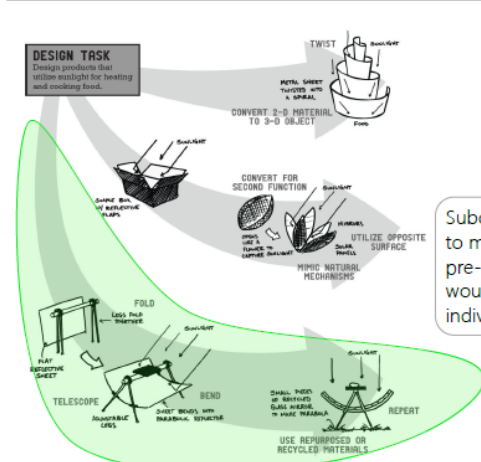
Subcomponent design can be used to modify individual components of pre-existing whole products. This would enable designers to improve individual component(s) of a design.
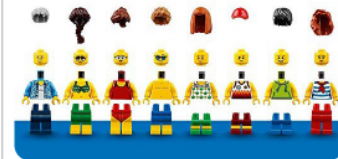
Subcomponent design
- Design by parts or components is a method which comes from engineering.
- It allows you to think of a product or idea in terms of the use of its many parts or components.
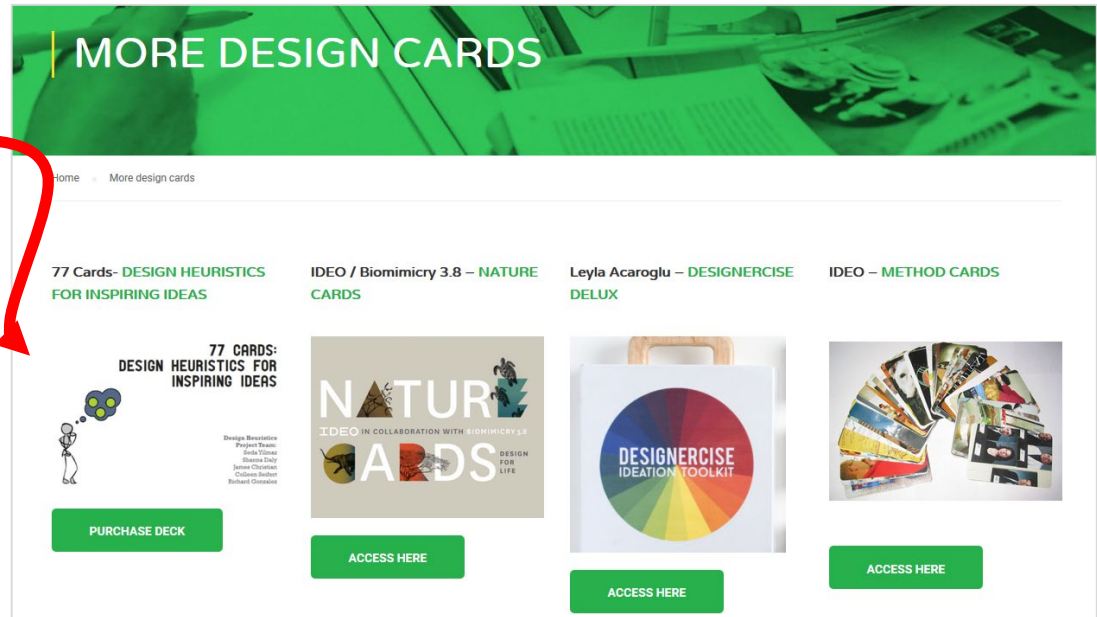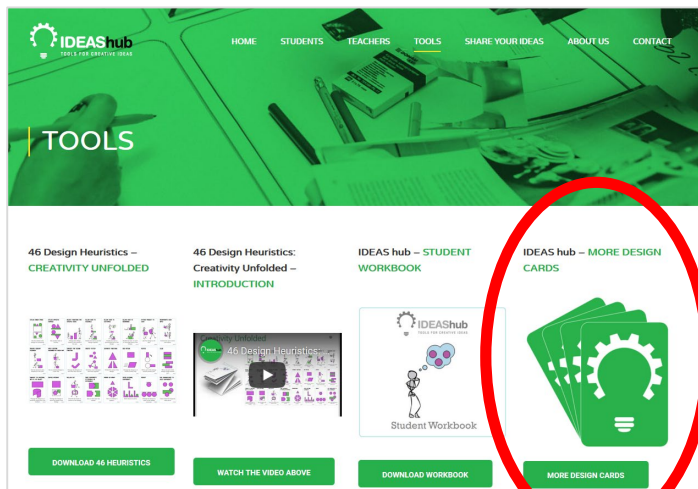

Subcomponent design can involve two main activities:

Decomposition is the process of breaking something apart into smaller parts.

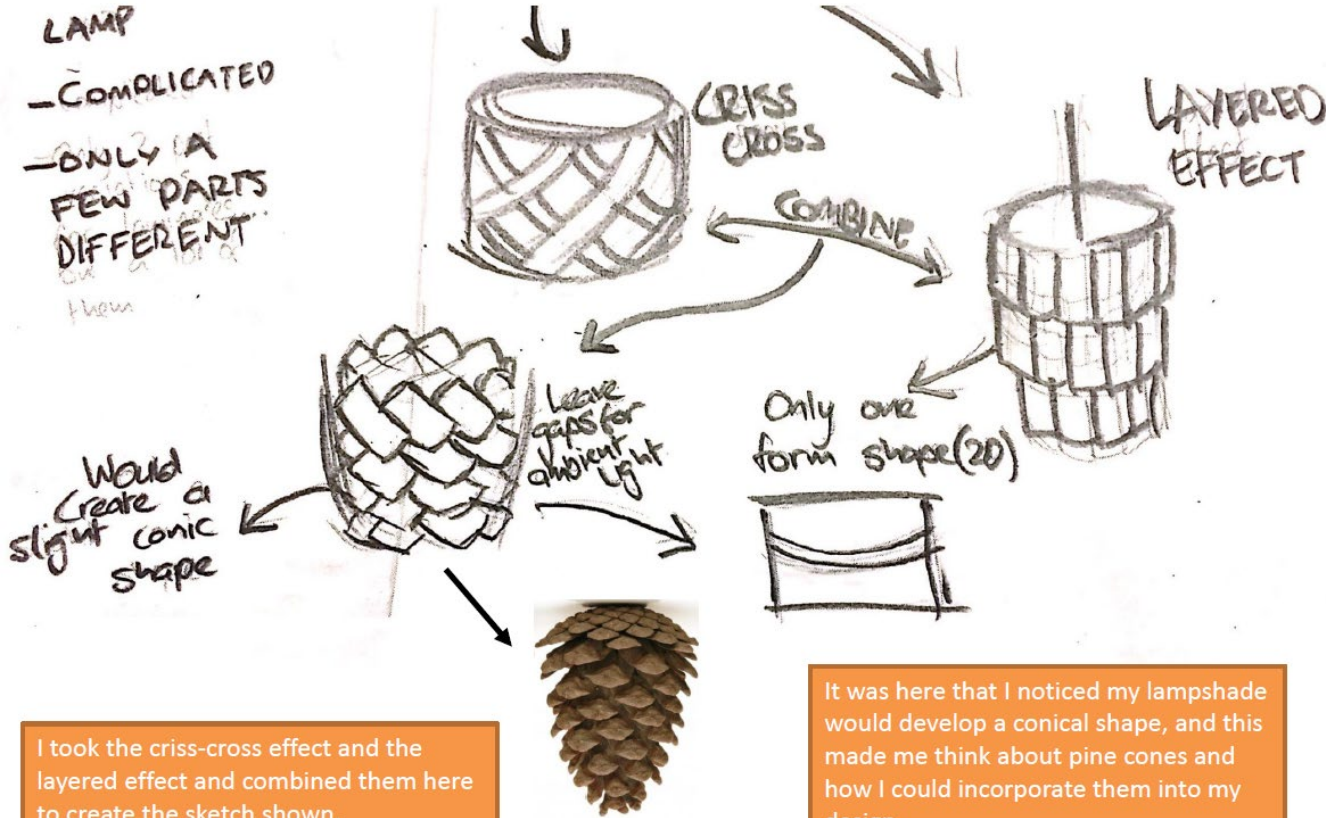**Recomposition** is the process of putting the redesigned parts back together into one designed product.

www.IDEAShub.eu - Website

CLUSTER FAVOURITE IDEAS

Sketch to think

LAMP
- COMPLICATED
- ONLY A FEW PARTS DIFFERENT

them

CRISS CROSS

COMBINE

LAYERED EFFECT

Leave gaps for ambient light

Would create a slight conic shape

Only one form shape (20)

I took the criss-cross effect and the layered effect and combined them here to create the sketch shown.

It was here that I noticed my lampshade would develop a conical shape, and this made me think about pine cones and how I could incorporate them into my design.

REFLECT

PROBLEM CONTRAINTS

WHAT TO INCLUDE / ADD

01 *Innovative*
Inspired by pine cones and transforming lamp shades, the artefact is definitely unique.

02 USEFUL
The point of a lamp is that it emits light. The support structure of this model doesn't allow much light to escape.

03 *Aesthetic*
The lamp has a unique aesthetic, but needs to be refined somewhat in my opinion to closer resemble a pine cone.

10 *Little design as possible*
Although the lamp may look complex, it only has 4 different parts. I think it is simple yet bespoke.

04 Helps Understand
The lamp could be used to show people how pine cones work and release their seeds. The opening/closing feature allows us to see how this happens.

09 CONCERN FOR ENVIRONMENT
The lamp will use LED strips instead of a regular lightbulb. (Average 85% more efficient)
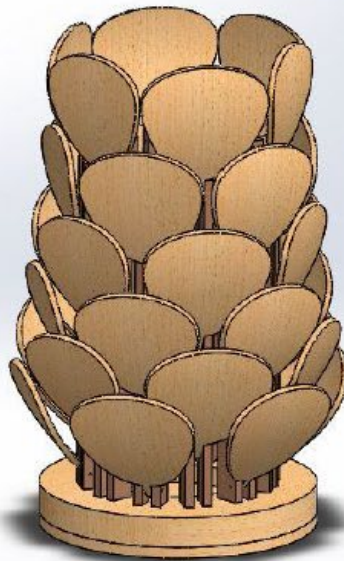
05 *Unobtrusive*
The lamp is small and compact. With some refinements to the chosen material and overall aesthetic it will become unobtrusive.

FULFILLED   NEEDS WORK

08 *Consistent in all detail*
I feel as though this design is lacking consistency through all parts, but is consistent in some.

07 Ageless
Again the nature element helps make this design ageless as pine cones have and will always exist.

06 *Honest*
There is honesty in this design as it takes its inspiration from nature as well as modern designers.

DESIRABILITY VIABILITY
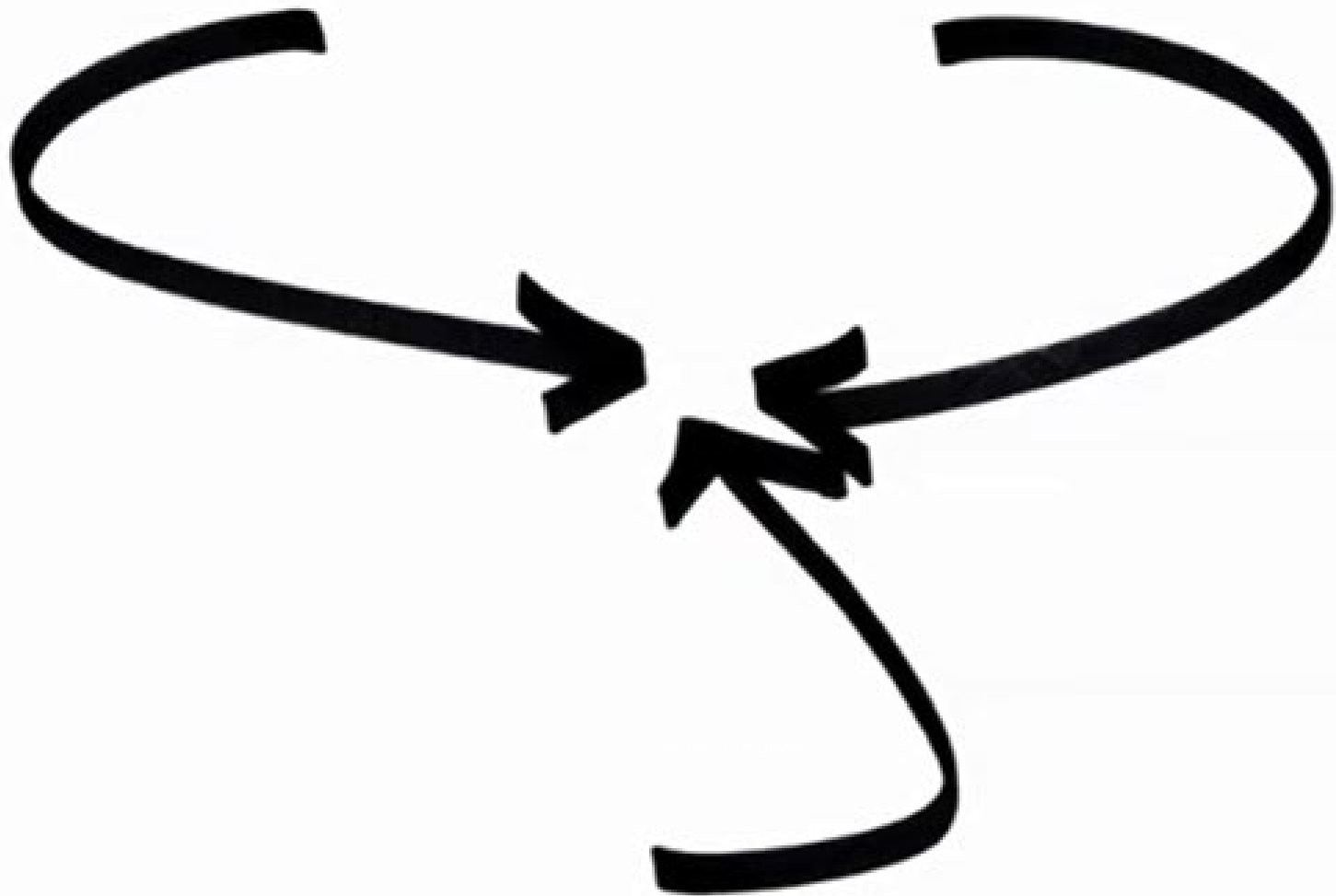
FEASIBILITY

Critical Thinking: Reflection of / for the 'right' information

Investigation shows your ***critical thinking*** in the context of the <u>relevant</u> information to solve the problem.

Bringing Research and Investigation together

Information on:	Information I have to date:	I have the right information	I need more information
Safety			
The user			
Ergonomics			
Sizes			
Materials			
Existing products			
Manufacture			
Theme / topic			

CRITICAL THINKING through **Evaluation** drives changes in design, through some type of user testing, user feedback, etc.

IDEATE
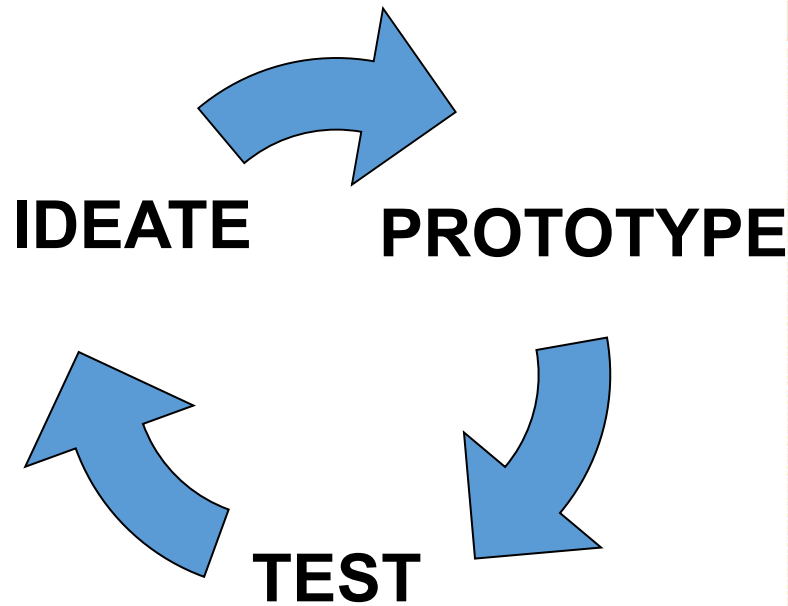
PROTOTYPE

TEST

EXPERIMENTATION

MAKE PROTOTYPES

BRING YOUR FAVOURITE IDEA TO LIFE

THINGS TO TEST OUT:
Create simpler separate prototypes / how it looks / how it works / shrink big things down / use / proportion / size
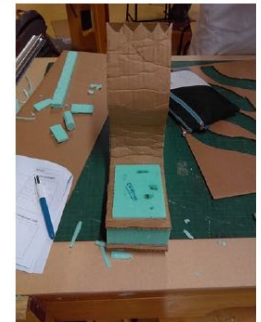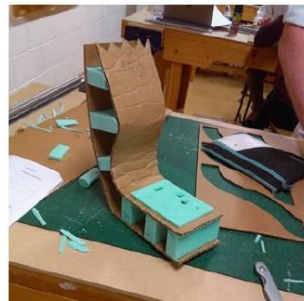
Complexities of design with wood

Wood influencing product / component design
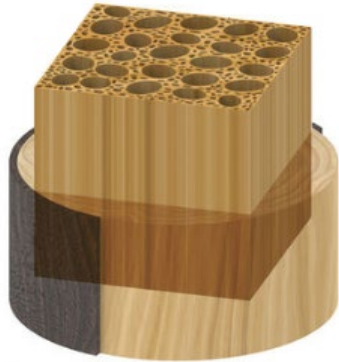
Wood compressive stress resistance

MORE RESISTANT   LESS RESISTANT
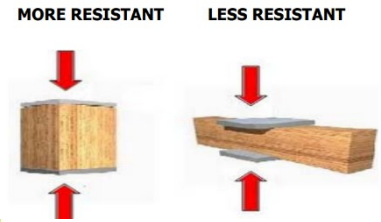
Wood is an organic material it is impossible to predict
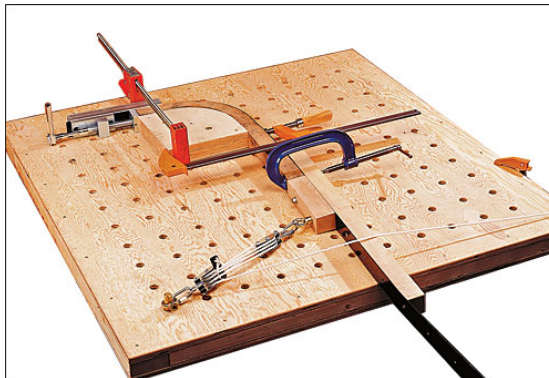
Wood is a hygroscopic material; it absorbs moisture very easily
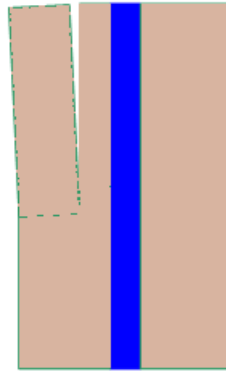
Structural failure   Adhesive failure   Cohesive failure
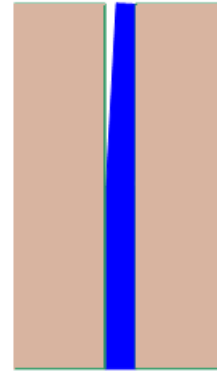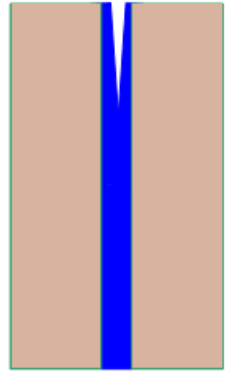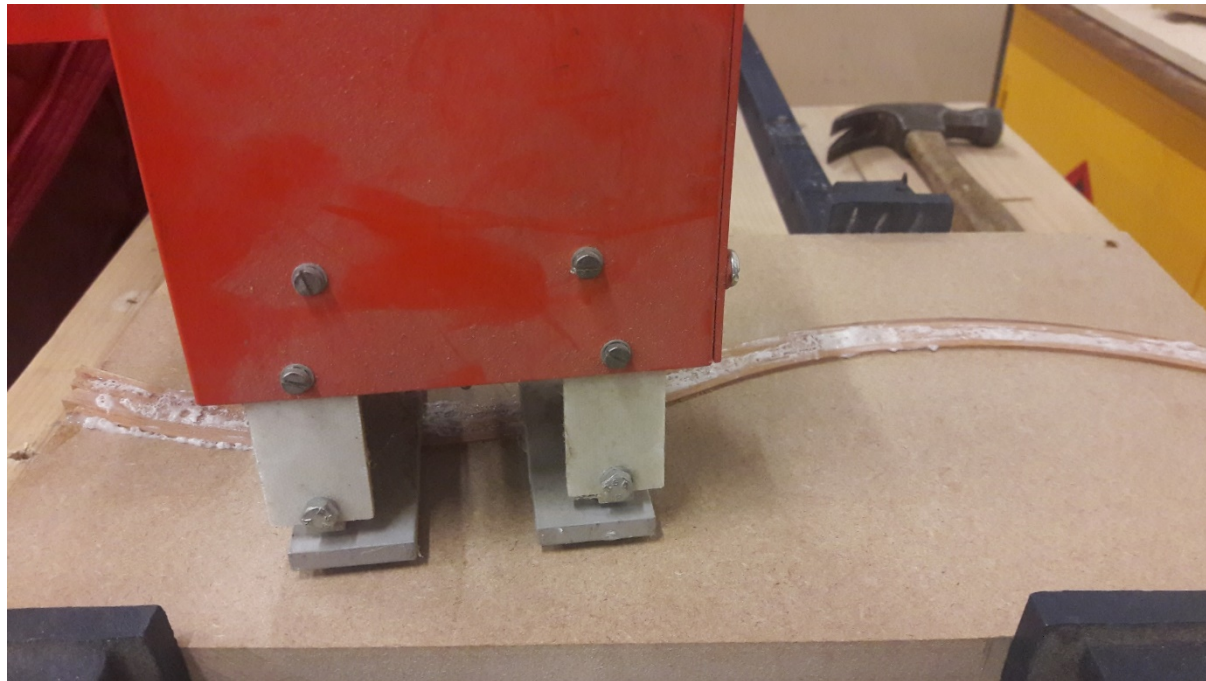
01 *Innovative*

Inspired by pine cones and transforming lamp shades, the artefact is definitely unique.

02 USEFUL

The lamp allows for both ambient lighting when closed and sufficient lighting when open, making it functional and practical.

03 *Aesthetic*

The lamp closely resembles a pinecone in shape, proportion, and colour. The transforming aspect only adds to this.

10 *Little design as possible*

Although the lamp may look complex, it only has 4 different parts. I think it is simple yet bespoke.

04 Helps Understand

The lamp could be used to show people how pine cones work and release their seeds. The opening/closing feature allows us to see how this happens.

09 CONCERN FOR ENVIRONMENT

The lamp will use LED strips instead of a regular lightbulb. (Average 85% more efficient)

05 *Unobtrusive*

The lamp is small and compact. It is suitable as a feature piece in either a hall, living room or bedroom of a house and will not be an eyesore.

FULFILLED   NEEDS WORK

08 *Consistent in all detail*

The design is symmetrical, of solid colour and repeats the shape and size of various pieces throughout the artefact.

07 Ageless

Again the nature element helps make this design ageless as pine cones have and will always exist.

06 Honest

There is honesty in this design as it takes its inspiration from nature as well as modern designers.
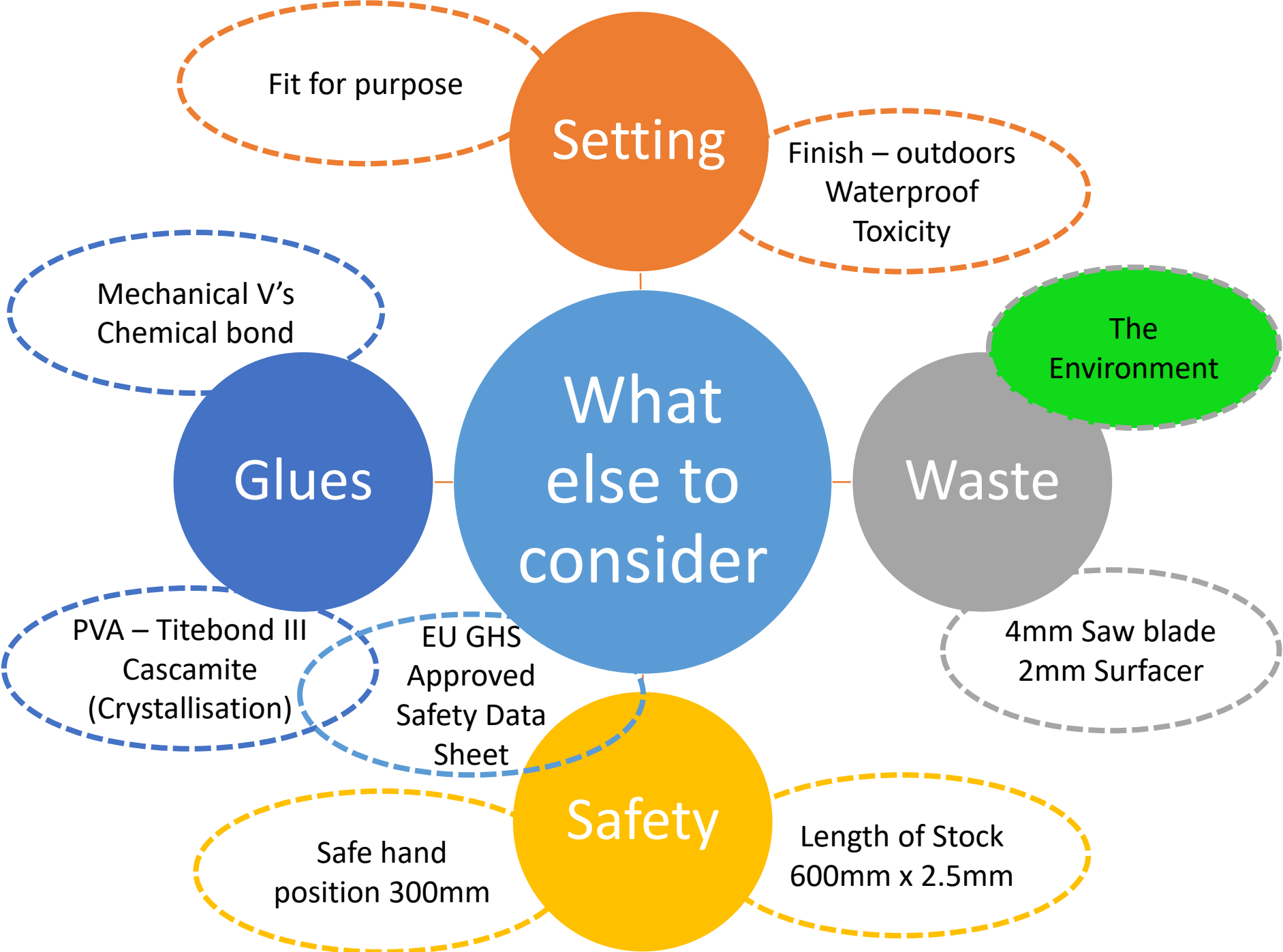
How can we bring
Environmental and sustainable considerations
into the classroom?

In Chapter 11, we learned how **carbon sequestration is the process of taking in and storing carbon dioxide (CO_2) from the atmosphere**.
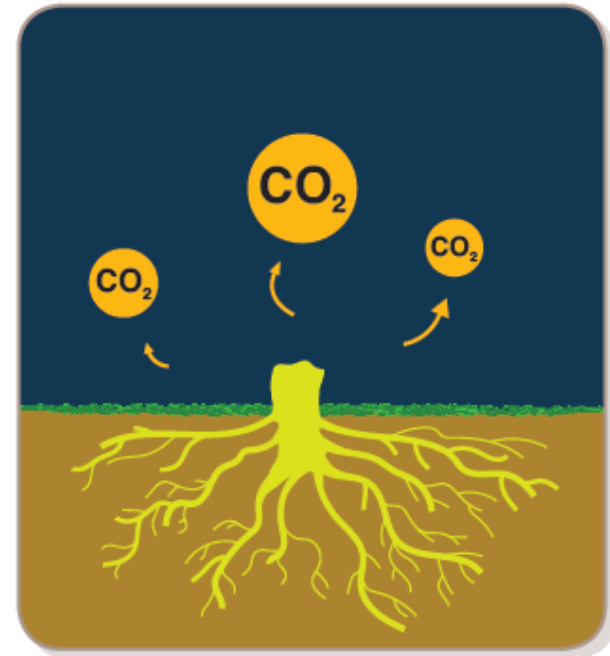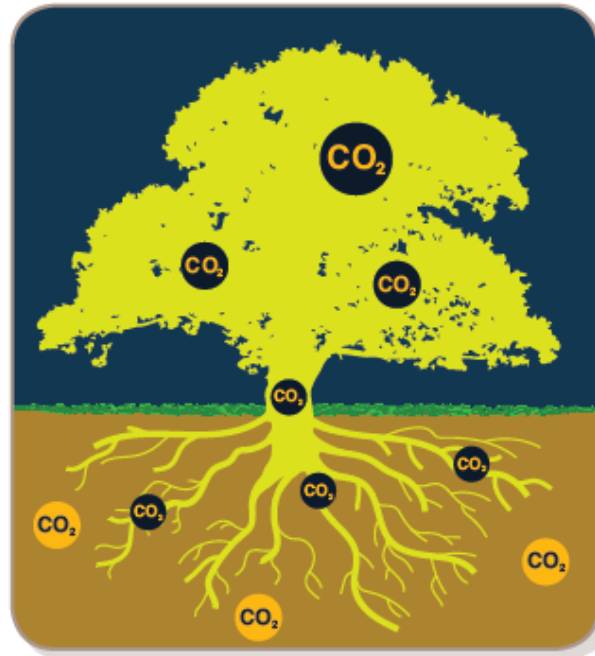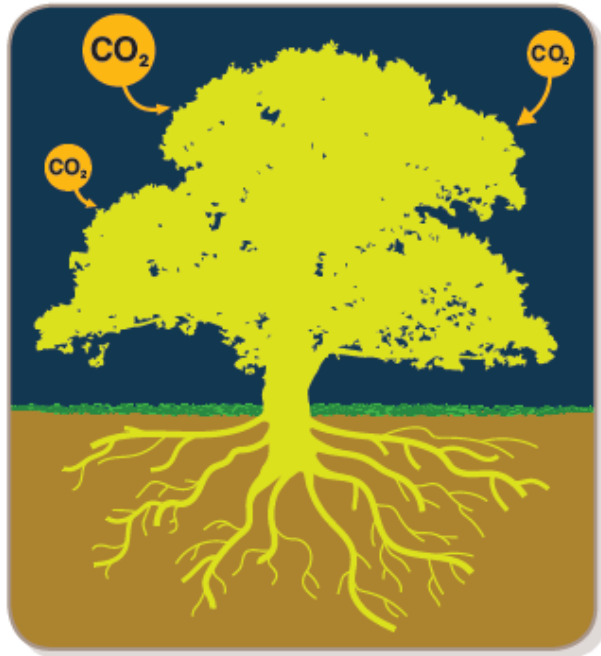
⚠ *Trees sequester (store) CO_2 from the atmosphere for photosynthesis. This carbon is stored in the leaves, roots, trunk and branches of the tree, and in the soil of the forest.*

⚠ *When a tree is felled or dies, the carbon stored in the leaves, roots and soil is released.*

Cradle to Cradle

- To seek a more sustainable approach to product design

— one that creates both economic and environmental value — through attentive design efforts that maximise benefit to the environment, rather than just minimise harm.

- Relies on a design cycle of innovative materials, processes, and systems wherein all waste that cannot be simply disposed into the biosphere is pooled and fed back to the technosphere

Are you using sustainable wood?

Just 8% of the world's forest is properly protected from destruction.

Don't support illegal logging or encourage deforestation

What is sustainable wood?

- It is <u>sourced legally</u>.

- Wood is <u>harvested using practices that protect the species that live in the forest, the local water quality, and the rights of indigenous people</u>, all at a very high level.

DESIGN IS OFTEN DONE TO MAXIMIZE ECONOMIC GAINS RATHER THAN TO CONSIDER THE SOCIAL AND ENVIRONMENTAL IMPACTS OF WHAT WE DO IN THE ECONOMY.

Aside from the economic value, what are the social and system-wide implications of what you are creating?

ECOLOGICAL IMPACT = Effect of human activities and natural events on living organisms and their non-living environment.

Material extraction, removal, and transportation

Energy and effects associated with disposal; end of life

Damage to environment during harvesting

Ecological Impact of Materials and Processes

Environmental impact during the life cycle

Environmental impacts during processing

Recyclable material

Looking ahead to 2021, 2024, 2027 and 2030

OECD 2030 Framework for Education
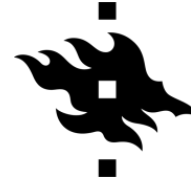
THANK YOU

QUESTIONS or COMMENTS?