

Unit - III

Being Ingenious & Fixing Problems

Syllabus: Understanding creative thinking process, understanding problem solving, Testing creative problem solving.

Process of product design - Process of Engineering product design, Design thinking approach, Stages of product design, Examples of best product design and functions, Assignment - Engineering product design.

Role of Creative Thinking in DT:-

- Creativity is the ability to think outside the box, see things from a different perspective, and come up with new and innovative ideas.
- In DT, creativity is essential to identifying and defining the problem to be solved.
- Creativity allows designers to approach problems in new and different ways, leading to innovative solⁿs that are not limited by traditional thinking.
- One of the key benefits of creativity in DT is that it allows designers to explore different possibilities and options.
- When creativity is encouraged, designers are free to experiment and take risks, which can lead to unexpected and exciting solⁿs.
- This approach can lead to the creation of designs that are not only functional, but also aesthetically pleasing, unique and memorable.

Understanding Creative Thinking Process :-

→ Innovative ideas come when you develop new combinations of old elements.

In other words, creative thinking is not about generating something from a blank slate but rather about taking what is already present and combining these bits and pieces in a way that has not been done previously.

Steps →

- ① Gather new material.
- ② Thoroughly work over the materials in your mind.
- ③ Step away from the problem
- ④ Let your idea return to you.

- ① At first you learn, during this stage you focus on
 - (i) learning specific material directly related to your task.
 - (ii) learning general material by becoming fascinated with a wide range of concepts.
- ② During this stage, you examine what you have learned by looking at the facts from different angles and experimenting with fitting various ideas together.
- ③ Put ^{the} problem completely out of your mind and go do something else that excites you and energises you.
- ④ At some point, but only after you have stopped thinking about it, your idea will come back to you with a flash of insight and renewed energy.

Shape and develop your idea based on feedback.

For any idea to succeed you must release it out into the world, submit it to criticism and adapt it as needed.

Creative Thinking Examples

Creative thinking includes the process of innovative problem-solving from analyzing the facts to brainstorming to working with others.

→ Creative thinking examples include analytical skills, innovation and Collaboration. Cent...

* A Creative person brainstorm their ideas, then they'll experiment with them.

→ They look at ideas from different perspectives and examine how their solutions fit into the scope of what they're working on.

→ Creative thinkers aren't afraid to take risks and try new ideas.

→ In fact, this ability to develop test and implement original solutions makes them a valuable asset to just about any workplace.

Creative Thinking can be helpful in:-

- ① Problem identification
- ② Understanding problem
- ③ Find Innovative Solutions
- ④ Service & Product development
- ⑤ Analyzing Company's sales & Growth
- ⑥ Marketing Strategy formation

Four Stages of Creative Process

- ① Preparation:- Gathering information & materials, identifying sources of inspiration and acquiring knowledge about project or problem.
 - ② Incubation:- Taking diverse ideas ~~and influences~~ and finding new ways to bring them together.
 - ③ Illumination:- Insights arise from the deeper layers of the mind. (Aha Moment)
 - ④ Verification:- Hone and refine the work and then communicate its value to others.
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Creative Thinking Examples:-

- ① Analytical Skills:- Data analysis, research, forecasting, reporting, interpreting, communication.
- ② Innovation:- Risk taking, brainstorming, imaging, critical thinking, ambition, resilience.
- ③ Collaboration:- written and verbal comm., active listening, empathy, feedback, inclusivity.

① Analytical Skills are problem solving skills that help you sort through facts, data and information to develop rational solⁿs.

→ These skills aid you in the first part of the creative thinking process as you brainstorm and start to generate ideas.

② Innovation:- is the ability to come up with something new,
→ means a method you haven't tried before or experimenting with an unfamiliar process.

③ Collaboration:- CT doesn't have to happen alone, you might have your most creative ideas when bouncing your work off others.

→ It ensures you consider multiple perspectives and ways of thinking when you develop and refine ideas.

Problem Solving :-

is the process of defining a problem, identifying its root cause, prioritizing and selecting potential solutions and implementing the chosen solution.

→ Some problem solving paradigms like - Six Sigma framework, Lean Management.

→ How to Solve problems: 5 Steps

- ① Precisely Identify Problems
- ② Collection information and plan
- ③ Brainstorm solutions
- ④ Decide and Implement
- ⑤ Evaluate

Creative Problem Solving:

→ Research is necessary when solving a problem. But there are situations where a problem's specific cause is difficult to pinpoint. This can occur when there's not enough time to narrow down the problem's source or there are differing opinions about its root cause.

In such cases, we can use creative problem-solving, which allows us to explore potential solutions regardless of whether a problem has been defined.

Creative problem solving is less structured than other innovation processes and encourages exploring open-ended solutions.

It also focuses on developing new perspectives and fostering creativity in the workplace.

Its benefits include:

- ① Finding creative sol's to complex problems.

- ② Adapting to change.
- ③ Fueling innovation and Growth.
- ④

Creative problem solving is based on foll. principles:-

- ① Balance Divergent & Convergent Thinking.
- ② Reframe problems as questions.
- ③ Defer Judgement of Ideas
- ④ Focus on "Yes", And "Instead of "No, But".

Creative Problem Solving is the habit or tendency of approaching problem solving with innovative or original ideas and solutions, toward feeling imaginative, ingenious, original and able to solve difficult problems; towards engaging in activities such as puzzles, games of strategy and toward striving to understand the underlying function of objects.

Testing Cognitive Problem Solving:-

- Psychology Today
 - www.insightassessment.com
 -
- Some Tests available (online)

Product Design:- Defⁿ

* Product design is the process of identifying an opportunity, defining the problems, developing a solⁿ for that problem and validating the solⁿ with real users.

* Product design is a cross-functional discipline that spans research, strategy, design and business + with lots of collaboration along the way. The goal of product design is to ideate, design and iterate on products that meet a specific user needs, make sense from a business perspective, and compete successfully in their given market.

Product Design Process

(I) Empathize → Define → Ideate → Prototype

* Not linear * Not Standard

(II) → Define a product vision and Strategy
→ Conduct user and market research
→ Ideate
→ Prototype
→ Test and iterate
→ Develop and Launch
→ Post Launch: gather user feedback & make improvements

Design Thinking Approach in product Design:-

- It is an iterative process allowing a cross-functional design team to question its assumptions and focus on the user experience above all else.
- Many Org. uses DT for product design & development like- Apple, Google, Netflix, IBM and many more.

Why use a Product design Process?

- A tried and tested product design process is an important framework that structures your research, design and development priorities and steers you through the full product design lifecycle
- Prevents from skipping crucial steps
- Having a centralized process.
- Clear expectations for product designers
- Keep different stakeholders align.

Ref ⇒ engineering product design. com

Product Design Process is a sequence of steps or activities a business employs to formulate, design and manufacture a product.

→ A PDP is a set of planned activities that convert an idea into a product and make it commercially available to the end user.

Types of PDP :- may vary according to the products

① Tangible :- Smart watches, mobile phones and earphones
→ Where PDP involves detailed design and manufacture.

② Intangible :- Such as services, mobile phone applications, and computer s/w
→ will have implementation, testing, verification and deployment.

* # PDP also changes depending on how the engineering product innovation is driven, whether Demand-pull innovation (Market-Pull) or Invention-Pull (Technology-Push).

Phases of Product Design Process :-

→ According to Pahl and Beitz, the design process needs to be broken down into phases and small steps, each with its procedures, to have a successful new product design. With this in mind, they split the process into four phases :-

- ① Product Definition - Product Planning
- ② Conceptual Design
- ③ Embodiment Design
- ④ Detail Design

① Product Defⁿ - Product Planning :-

→ Also known as Task Clarification.
Product Design & Development Task
→ Given by client or marketing dept.

→ Even if the Requirement is captured in a document, the design team must clarify the requirement and start a product design Specification (PDS).

→ PDS consists (emphasis) on all technical, economic and quality factors.

② Conceptual Design: is an early stage of the design process in an engineering setting and results in the specification of a principle solⁿ or so-called "Concept".

→ Steps in Conceptual Design Phase

- ① Define the problem and refine the PDS.
- ② Investigate the existing solⁿs.
- ③ Generate ideas and concepts.
- ④ Evaluate concepts
- ⑤ Finalise concepts

③ Embodiment Design: This is the stage of the design process where the design of a technical product is developed from the basic idea or concept per technical and economic standards up to the point where further detailed design can result in immediate production.

④ Three key Stages of Embodiment design,

- ① Product Architecture
- ② Design Configurations
- ③ Parametric Design

④ Detail Design :- During this stage of the design process, all of the individual parts arrangements, shapes, dimensions, and surface characteristics are finalised.

#③ ① Product Architecture :- is the organization (or chunking) of a product's functional elements.

→ It plays a significant role in how to design, make, sell, use and repair a new product offering.

② Design Configurations :- is a type of design activity in which a set of predefined components can be combined in certain ways to design a system.

③ Parametric Design :- is a technique in which engineers use algorithms to create complex, customized products or structure.