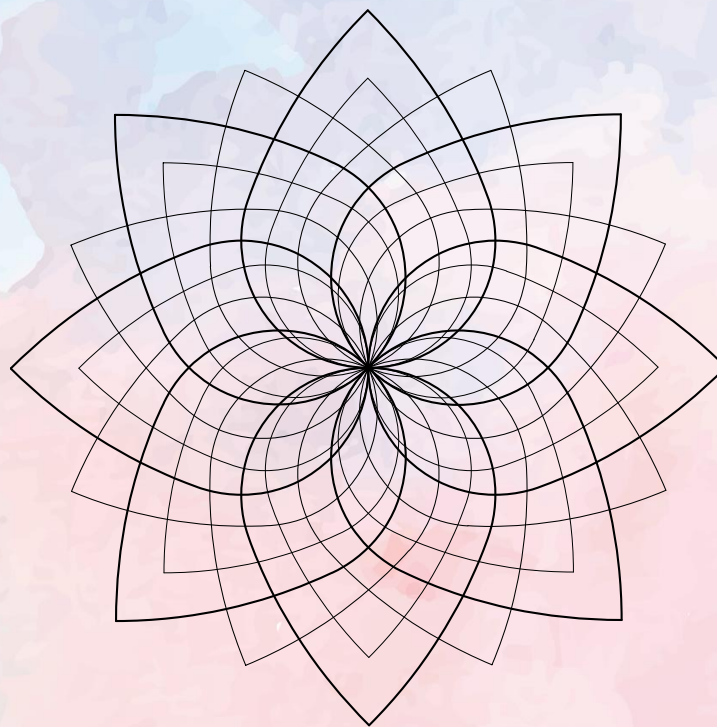


Design Thinking and Innovation
for Grade 6
Teacher's Manual
2022



CBSE, New Delhi

Teacher's Manual

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Preface

The Design Thinking & Innovations subject and its courses aim at providing students with the tools and exposure to be able to address problems using the design thinking process. Design Thinking & Innovations is designed in such a way that students learn to acquire both knowledge of design and practice of skills required to develop an attitude towards design. Being of the exemplary kinds, it focuses more on hands-on knowledge, learnt by doing and acting upon challenges discovered within the community and surroundings.

It aims at promoting socially responsible practices through enlightening the students with ways to solve problems within the Sustainable Development Goals as mentioned by the United Nations. The course also helps students derive

culturally rooted understanding of design from information documented under the Indian Knowledge Systems. It also promotes a healthy learning environment for students in which their ideas and creativity will not be dismissed.

The subject is aimed at creating long term impact in such a way-

- The Design thinking Process will impact all aspects of Schools including innovative thinking of teachers
- This will help a large number of schools who already have Atal Tinkering Lab and need to integrate this process for productive outcomes.
- This will help to ensure focussed utilisation of various government schemes and policies towards design and innovation

Acknowledgements

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- **Sh. Dharmendra Pradhan**, Minister of Human Resource Development, Government of India
- **Sh. Dhotre Sanjay Shamrao**, Minister of State for Human Resource Development, Government of India

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Basic Premises and Framework

The teacher manual on Design Thinking and Innovation is a continuation of CBSE's efforts to help create networks of good practices and achieve progressive realization of transforming schools from a place where a curriculum is taught to a place where children **think, learn, and innovate**. It shares the conceptual framework to Train-the-Trainer and provides scaffolding to school leaders and teachers to apply the ideas and **principles of Design Thinking for problem solving, decision making and innovation** into their own practice.

The basic premise is to provide actionable knowledge about the non-linear process of Design Thinking that is used to understand, challenge assumptions, redefine problems and create innovative solutions to prototype and test. The five non-sequential steps—**Observation (empathize), Analysis (define), Ideate, Prototype and Reflection (test)**—**can be used to tackle problems and issues in everyday life and to reach an innovative solution**.

This curriculum aims to build the following futuristic skills in students:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication
- Collaboration

This manual takes these principles to the school level, classroom level and individual level for the professional development of educators, their collaborative practices, and their understanding and to enable them to use design thinking and innovation tools in classroom teaching.

To sum up, **the purpose is to prepare children for the real world**. It is mostly a volatile, uncertain, complex and ambiguous (VUCA) world and we need to equip our students with the skills of problem solving, decision making, responsibility and collaboration to help them find innovative, out of the box solutions. This program also instills in them the skills of **observation and empathy** without which problems cannot be identified or resolved. Design thinking helps to solve problems that people face in their day to day interactions using out of the box thinking. What is out of the box thinking? Well, try to make the picture given below without lifting your pencil.

Design Thinking and Innovation is meant to improve lives by constant innovation. For example, the first mobile phone, was a large device. Later it kept getting smaller to fit into people's pockets and to be held in one hand to operate. Similarly the project in Anand in 1946 to strengthen the community of dairy farmers was an outcome of Design Thinking. Broadly it can be divided into different phases: **Empathize**- to observe and understand the problem, in this case- the dairy farmers not being able to reach out to a bigger market and not getting enough revenue, to **define** i.e that the milk producer was being exploited by the local milk dealers and agents, to **ideate**- here the plan to bring together the farmers into one cooperative in order to enable them to market and transport their goods in an economically viable manner-was out of the box thinking at that time. A **prototype** of the same was created (Amul Dairy) improved and **tested/ reflected** successfully which is now a well-established brand name

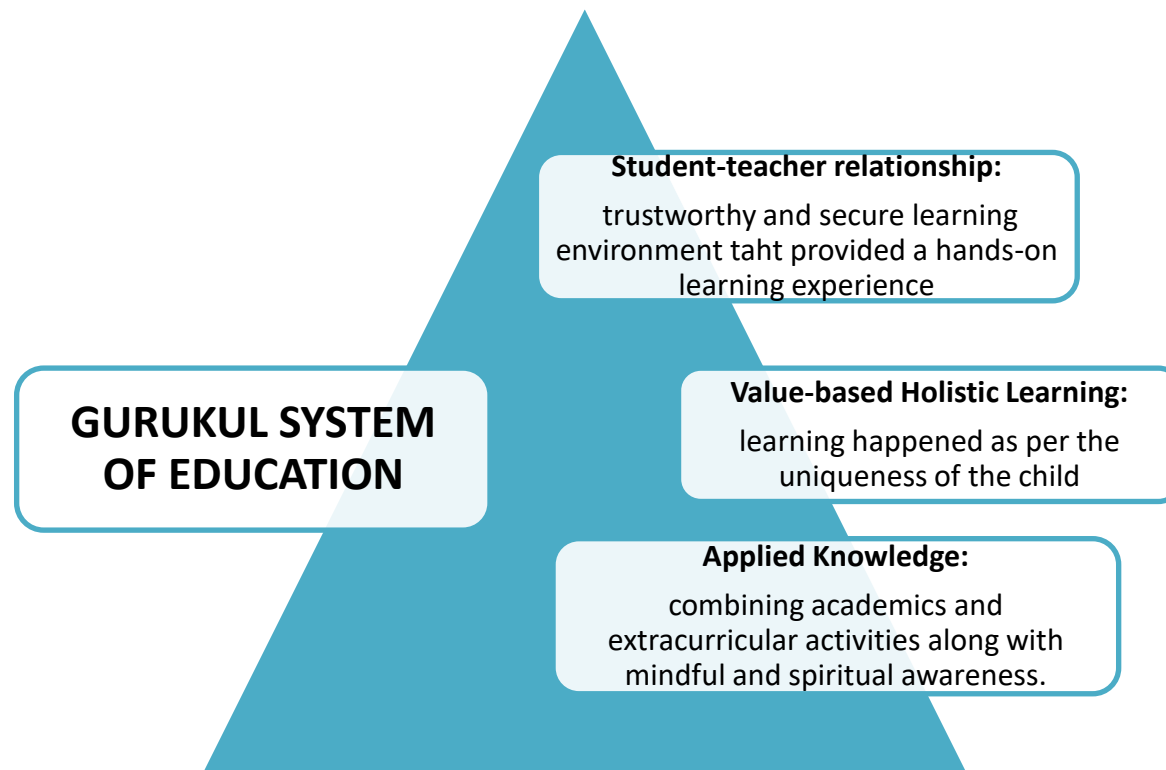
Historical Overview

The only constant about education is change and evolvement with the times and requirements. Traditionally it meant an organized arrangement in a society where teachers and students are related to each other for achieving definite goals of a curriculum through teaching, training, storytelling, discussion, and research.

In ancient India, schools were in the form of Gurukuls, which were traditional residential schools of learning, typically the teacher's house or a monastery. The etymological root of the word 'School' is derived from Greek word *Scholē*, originally meaning leisure, but later 'a group to whom lectures were given'. Under the British

rule in India, missionaries established boarding schools throughout the country. Autonomous public technical universities were established by the Government of India in 1956.

In every Hindu village which has retained anything of its form, I am assured that the rudiments of knowledge are sought to be imparted; that there is not a child, except those of the outcasts (who form no part of the community), who is not able to read, to write, to cipher; in the last branch of learning they are confessedly most proficient.
— [John Malcolm Forbes Ludlow](#), *British India*, Vol 1, 1858, p62-3 [\[23\]](#)



A Comparative Study Of Western And Indian Philosophies Of Learning

Key Indian philosophies

Key thinker	Rishi Sushruta	Sage Patanjali	Sage Vayasa
Philosophy	Sushruta Samhita	Yoga	Vedanta
Key idea	Medicine and surgery	Meditation and contemplation	Essence of Vedas
Main contribution	He wrote one of the world's earliest compendiums on medicine and surgery and is regarded as the 'father of medicine and plastic surgery.'	Yogic techniques control body, mind & sense organs to achieve self-realization	The pursuit of knowledge involving the four main vedas-rig, yajur, sama, atharva-along with upanishads and sutras

Key western philosophies

Key thinker



SENECA, THE YOUNGER

Philosophy

Greco-Roman philosophy

Key idea

Stoicism

Main contribution

Stoicism is a philosophy of personal ethics and attitudes, which can help an individual in achieving a state of calmness — ataraxia — by carefully understanding and mastering the cause-effect equation.



SOCRATES

Greek philosophy

Theory of questioning

Created the Socratic idea of teaching— learning new things by cooperative argumentative dialogue between individuals, based on asking and answering questions to stimulate critical thinking



FRIEDRICH NIETZSCHE

Germanic philosophy

Theory of perspectives

Emphasised the intellectual flexibility to recognize that there is no single truth but many different ways of considering a matter. The only reality is the will to power, and truth is simply the name given to the point of view of the people who have the power to enforce their point of view.

Theories of Learning

The scientific study of learning started in earnest at the dawn of the 20th century and developed hypotheses to bring together personal and environmental experiences. Any learning theory mainly describes how students receive, process,

and retains knowledge, while dealing with cognitive, affective and environmental influences. The most influential theories of learning can be summarized as:

	Behaviorist Theory (Skinner)	Cognitive Theory (Piaget)	Conditioning Theory (Pavlov)	Humanist Theory (Maslow)	Discovery/sensory theory (Maria Montessori)
Link	https://www.verywellmind.com/behavioral-psychology-4157183	https://www.simplypsychology.org/cognitive.html	https://youtu.be/qSqWiTG-o2Y	https://courses.lumenlearning.com/boundless-psychology/chapter/humanistic-perspectives-on-personality/	https://www.mariamontessori.org/
Knowledge	Behavioral responses to environmental stimuli	Acquisition of knowledge based on cognitive structures	Stimulus associated with an unrelated stimulus to produce a behavioral response	Cognitive and affective needs of learners	Cognitive development
Learning Perspective	Positive reinforcement helps reinforce learning	Assimilation of new information to existing cognitive structure called Constructivism .	Based on the principle of association and substitution	Learning is a way to fulfill an individual's potential	A constructivist or "discovery" model, in which students learn concepts from working with materials rather than by direct instruction
Teaching Perspective	Correctional rewards helps teacher in behavioral management	Providing an environment that promotes discovery and assimilation	A good method can bring desirable impacts upon the Learners	Recognizing the unique needs of each student leading to self-actualization	Giving the liberty to choose and act freely within a Montessori environment would lead to spontaneous action for optimal development.
Theory	Behavioural changes through a series of measurable rewards or punishments	4 Stages of development indicate the learner's ability to understand abstract complex concepts	Association between a naturally existing stimulus and a previously neutral one	Hierarchy of Needs with self-actualization as the ultimate goal of each individual	Development of natural interests and activities rather than using formal teaching methods. Encourages independent learning.

Objectives and Teaching Methodologies

The key objectives of the Teachers' Manual on Design & Innovations are to:

- **inspire** educators to become inclusive practitioners in tandem with the overall aim of outcome-based education
- **provide** teachers with **competency-based** education resources
- **assess** developed competencies of learners rather than only knowledge
- **motivate** students to step into the world of innovation as a natural and systematic process of tackling problems and designing solutions
- **develop** the 21st Century skills of collaboration, critical thinking, and creativity

- **adopt** and adapt to new technologies to streamline key processes of learning
- **prepare** growth mindset of educators and learners for problem identification and providing solutions

Teaching Methodology

Teaching methods used by teachers enable student learning in relation with the characteristic of the learner and the type of learning it is supposed to bring about. Teaching techniques are the means that reflect the success of the learning process and the competencies of the teacher. A comprehensive and integrated set of methodologies is a must.

MULTIPLE INTELLIGENCIES

- Developed by Howard Gardner 9 MIs

BLOOM'S TAXONOMY

- Framework developed by Benjamin Bloom

KOLB'S CYCLE

- Developed by David Kolb
- 4 stage cycle of experiential learning

Multiple Intelligences



According to Howard Gardner's theory of Multiple Intelligences, identifying each student's intelligence allows teachers to reach out to and accommodate different children more successfully. Gardner defined the first seven intelligences in Frames of Mind in 1983. He added the last two in Intelligence Reframed in 1999.

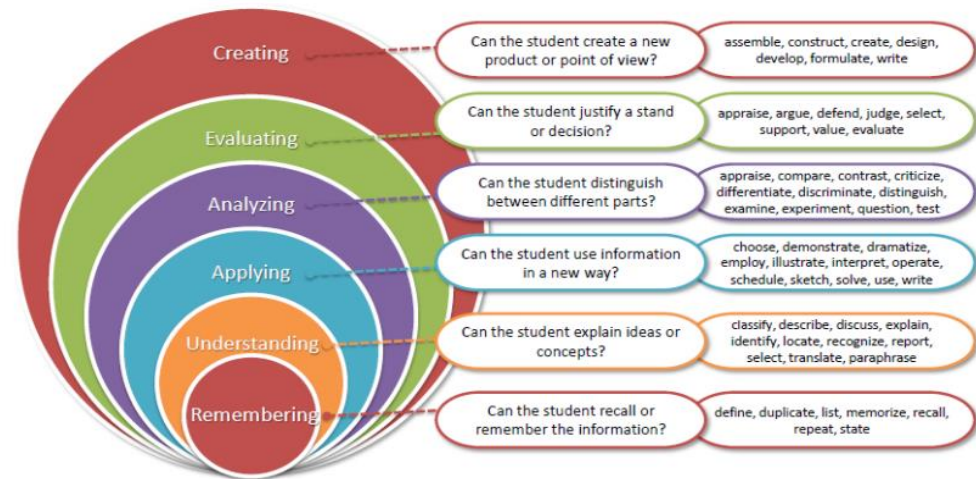
Visual/Spatial
Verbal/Linguistic
Mathematical/Logical
Bodily/Kinesthetic
Musical/Rhythmic
Intrapersonal
Interpersonal
Naturalist
Existentialist

Learning visually and organizing things spatially
 Learning through language arts, written, and spoken word
 Learning through reasoning, numbers, logic, and problem solving
 Learning through interaction with environment and through games, movement, and hands-on tasks
 Learning through songs, instruments, and musical expression
 Learning through own feelings, attitudes, and ideas
 Learning through collaboration with interaction with others
 Learning through outdoors, animals, field trips and classification
 Learning by understanding in the context of where humankind stands in the big picture of existence

Bloom's Taxonomy

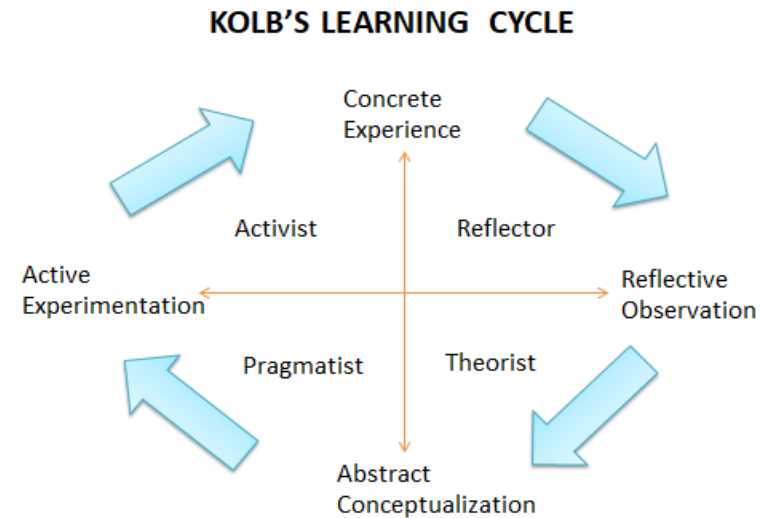


In 1956, Benjamin Bloom developed a classification of levels of intellectual behavior useful in learning. Bloom's taxonomy provides a common language for teachers for learning and assessment methods. It is most used to assess learning on a variety of cognitive levels. The taxonomy has been revised now to reflect relevance to the 21st Century skills



Kolb's Cycle

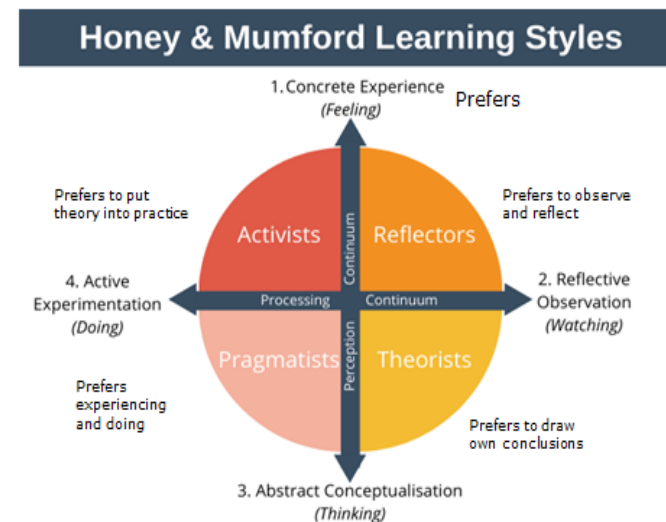
In 1984 David Kolb proposed that learning occurs through discovery and active participation. Kolb believed that learners progress through four stages to complete a cycle to transform their experiences into knowledge. The second part to Kolb's Theory focused on learning styles, or the cognitive processes that occurred in order to acquire knowledge. Kolb's entire theory is based on this idea of converting experience into knowledge.



Honey and Mumford Learning Styles

The Honey and Mumford learning styles were published by Peter Honey and Alan Mumford in 1986. Honey and Mumford's learning styles model identifies four different styles that people use to learn something new:

- Activist
- Theorist
- Pragmatist
- Reflector



VAK Learning Style

VAK learning styles form a model of learning designed by Walter Burke Barbe and later developed by Neil Fleming.

The VAK learning model divides people into three categories of learner:

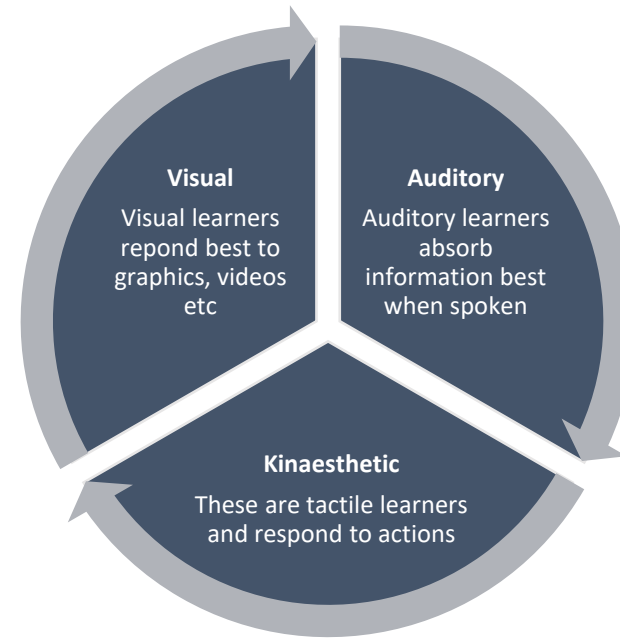
1. Visual learners – absorb information by sight
2. Auditory learners – absorb information by sound
3. Kinesthetic learners – absorb information by moving.

People predominantly learn using one style – whether visual, auditory or kinesthetic. Though every learner often incorporates elements of the other two styles, they are likely to achieve maximum benefit from learning by focusing on their primary style.

Values and life skills

Sustainable Developmental Goals

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet. The Sustainable Development Goals (SDGs) are 17 ambitious objectives for **a greener, healthier and more peaceful planet**, to be achieved by 2030. Education for Sustainable Development is a crucial tool, which empowers students to shape a better world. **Educators are in a unique position of influence millions of students** to overcome the greatest challenges of the 21st century and lead productive lives by implementing the SDGs. Schools and educators must rethink their role today, and redefine their purpose as agents of change. Teachers thus must look for opportunities not only to introduce but also to follow the SDGs in their lesson plans.



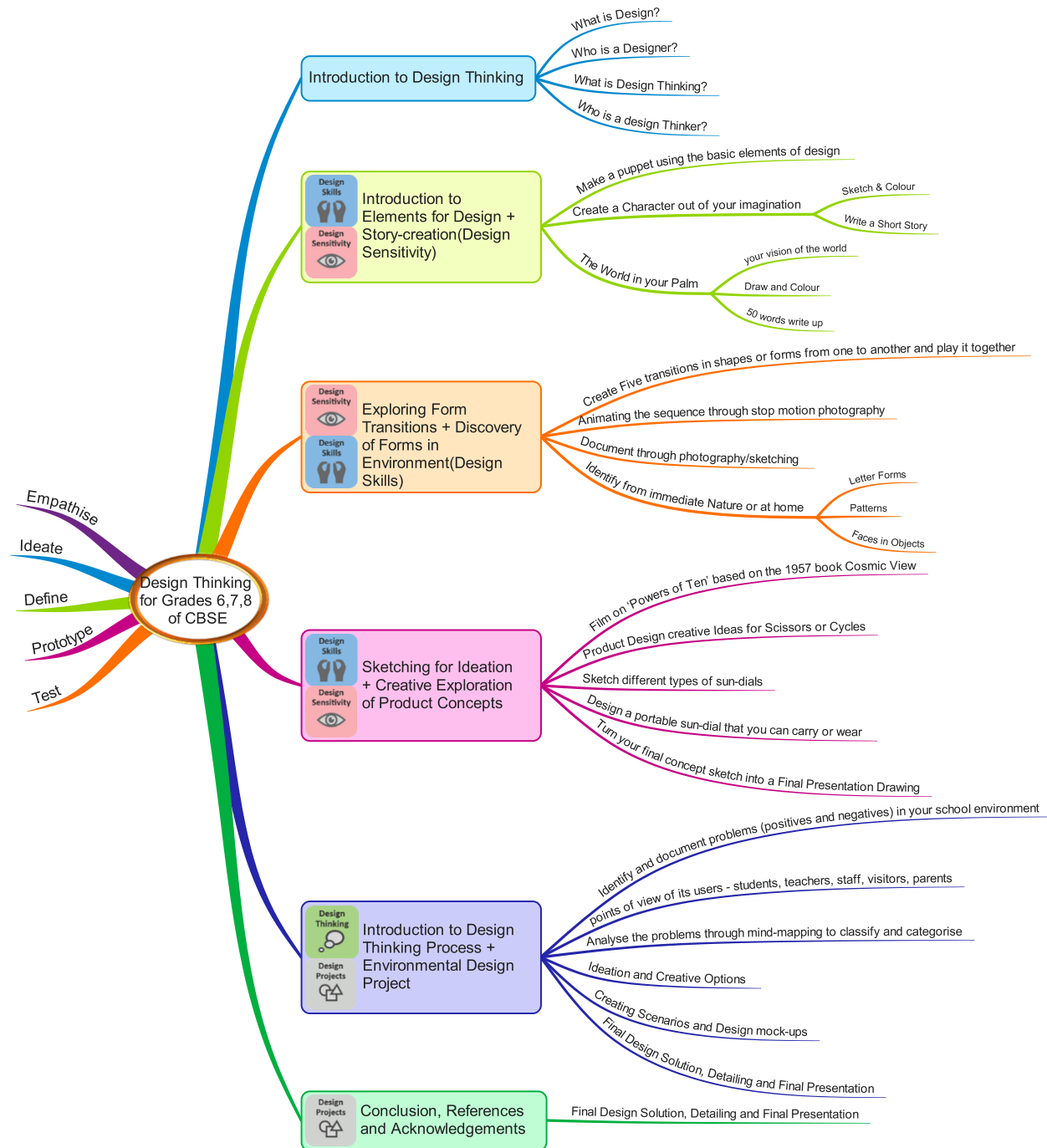
Objectives of Design Thinking & Innovations

The Design Thinking & Innovations curriculum for std 6th students is an eighteen hours coursework divided into four sessions. Each session consists of three hours of classwork and one hour of homework. All the sessions are complete with one exposure presentation and two task that support the exposure. During the 18 hours of coursework the students will learn concepts like what is design, form transitions, sketching and product forms and the design thinking process. The teacher is expected to follow the prescribed format of instruction and tasks to ensure maximum learning outcomes.

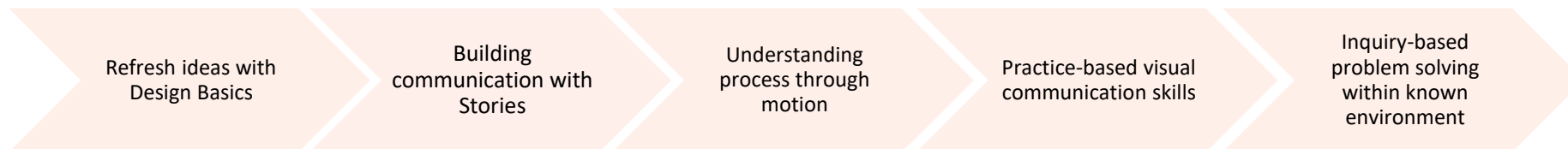
The objectives of DT&I curriculum is to be able to instill the following in the students enrolled in the 6th Std :

- Students should be able to explore their sensory abilities, cognitive abilities, and social abilities
- It should create awareness in the students through observation, discovery, analysis, experience, collaboration, and reflection

- It should nurture their curiosity and enhance their explorative abilities
- It should foster creativity and innovation in students
- They should be able to understand how to apply design thinking process and methods to solve various problems
- The focus is more on hands-on knowledge learned by doing, exploring, and acting upon challenges discovered within their surroundings
- In addition, DT&I will promote socially responsible practice by enlightening the students with ways to solve problems within the Sustainable Development Goals as mentioned by the United Nations.
- The course will also help students derive culturally-rooted understanding of design from information documented under the Indian Knowledge Systems



Pedagogical Strategy



Virtual Teaching Methods

Discussions, Activities, Experiments, Personal Projects

In-Person Teaching Methods

Group Discussions, Group Activities, Projects, Site Visits, Socratic dialogue

General Learning Objectives

- Create Awareness and a sense of Discovery
- Nurture Curiosity and Creative Explorations
- Experience of problem solving and Reflection upon what they did
- Introduction to Elements of Design and Story creation
- Forms in Environment and Form Transitions
- Fundamentals of Sketching and Product Concepts Explorations
- Fundamentals of Design Thinking Process

Additional Competencies

- Enhance Observation Skills
- Improve Sensitivity to Design
- Improve Communication and Presentation skills

Glossary:

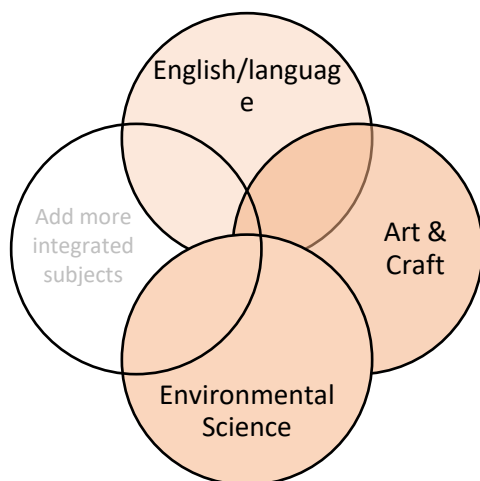
User	A person or a living being that operates or uses something
Form	A visible configuration or shape of something – eg. The form of a leaf is like a droplet
Plot	The plot is the sequence of events where each affects the next one through the principle of cause-and-effect in a story or a narrative
Character	A person in the story, drama or novel
Dialogue	A written composition in which two or more characters are having a conversation. This is represented by the use of double inverted commas (") before and after the lines.
Events	Things that happen are events in a story Lorem Ipsum
Close-up Photograph	Close up photography refers to a tightly cropped shot that shows a subject (or object) up close and with significantly more detail than the human eye usually perceives
Light	Photographic lighting is the illumination of scenes to be photographed.
Lens	A camera lens is an optical lens or assembly of lenses used in conjunction with a camera body and mechanism to make images of objects either on photographic film or on other media capable of storing an image chemically or electronically.
Aperture	Aperture refers to the opening of a lens's diaphragm through which light passes
Form	An arrangement or shape

Chapter 1: What is design? 3 Hours School + 1 Hour Home

Synopsis

This being the first chapter, is divided into two important aspects of design namely – **the elements that create a design** and **story creation that communicates it**. As this is also the first time, the students are learning about Design, additional information about ‘what is design?’, ‘who is a designer?’, ‘what is design thinking?’ and ‘who is a design thinker’ can be provided to students.

Integrated Subjects/cross curricular subjects:

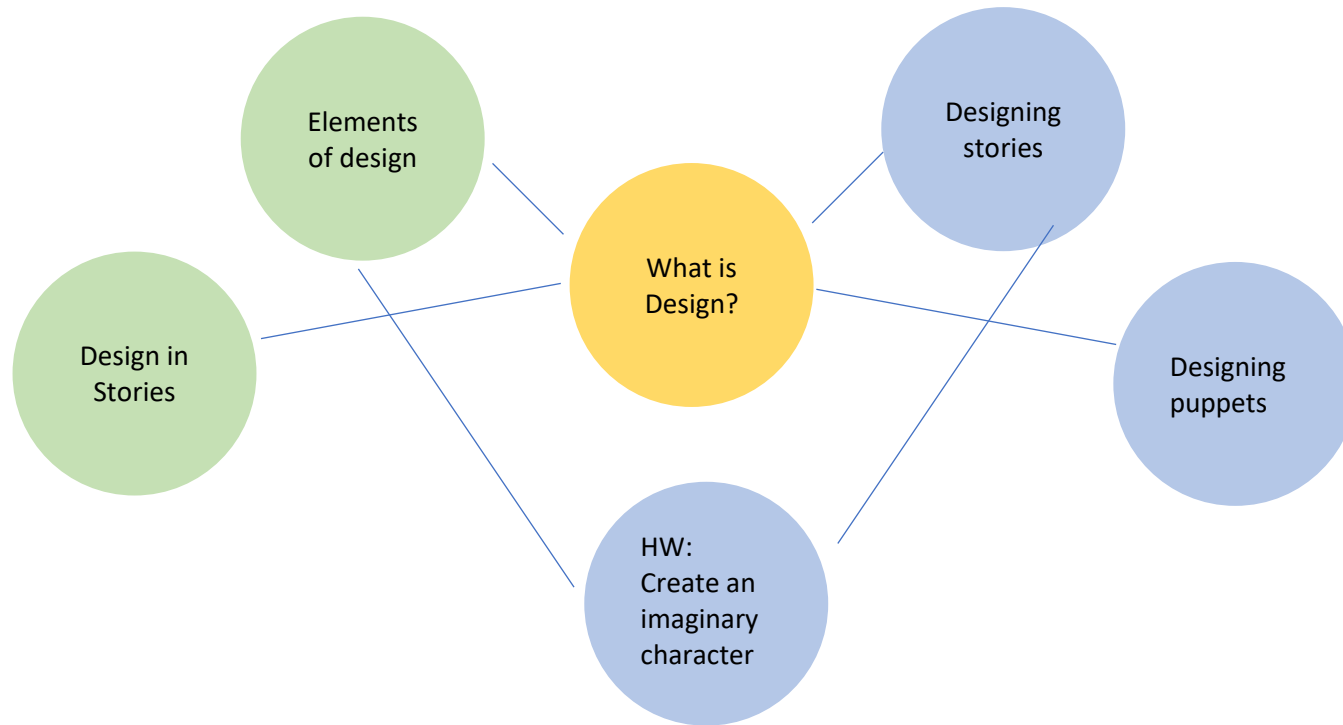


Intelligence

- Linguistic-verbal intelligence
- Spatial intelligence
- Naturalistic intelligence
- Interpersonal intelligence
- Intrapersonal intelligence

Chapter 1: What is design?

Chapter Mind Map



Chapter 1: What is design?

Sample Outline

3 Hours School +1 Hour Home

[Listen to the teacher's Podcast here](#)

Day 1		Students will be able to	Knowledge	
Exposure 1.1	Elements of Design	<ul style="list-style-type: none"> Gain information about the fundamental aspects of visual design Understand ways in which the aspects can be used 	<p>In this exposure walk the students through each of the slides, while brushing through the concepts and examples as mentioned on the slide. This exposure is for students to understand how design affects and impacts everything around them. It starts with the basic idea of design and then you must talk about the fundamental aspects of creating a design. The 6 Elements of Design are:</p> <ul style="list-style-type: none"> The first and most basic element of design is the line. This may be curved or straight, smooth or rough, broken or continuous, thick or thin. The second element of design is shape - when a two-dimensional line encloses an area. It can be geometric or organic (flower, leaf, animal etc.) Colour is a powerful element of design. It can stand alone or highlight other elements in a design. Typography is the most important part of communication and language The texture is the surface of the design. It can create a more dynamic experience while also adding depth to design. Space is the area above, below or around the design. It adds appeal to the design. Space can be positive and negative. 	
		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		<p>understand what is design and it's elements</p> <p>define how each element of design is important and relatable</p> <p>apply vocabulary related to design</p> <p>Create a puppet to understand how the elements of design affect the experience of people</p>	<ul style="list-style-type: none"> Go through the definitions Mention how each element of design, may it be a dot, line, shape, form, texture and color largely affects any design we are working with Try to give relatable examples from nearby environment, eg. Shapes and lines in the window or the online video screen 	To be filled by the teacher.
		Observation	Discussion	Action

Concept Initiation 10 mins	Show slide 3 of exposure 1 which has pictures of various things including furniture, advertisements, logos etc .	Pose a question to whole class: What is design? Teacher to ask students to discuss in their groups whether the pictures they see on the screen can be considered as design.	Brainstorming activity where students can either discuss in groups or write on sticky tags their idea of design which can then be read out by one child
Concept Elucidation 15 mins	Students ponder over the objects show in the slides like an <i>idli-stand</i> or a piece of furniture	Ask students to define design after showing the exposure 1	
Concept Closure 10 mins	Show a picture of the surgical tools used by sage Sushruta credited with having written the most comprehensive medical treatise of his times and is known today as the father of Indian surgery. Being the one to initiate ‘plastic surgery’, his power of observation, dexterity and precision made him the pioneer in the field of specialized surgery. He was inspired from nature while designing his surgery tools.	In a nutshell, design is about understanding needs and being sensitive to issues, identifying problems that need to be solved, creating innovative appropriate solutions, considering aspects of sustainability such that it makes a positive difference to life on our universe	A great design to save water in the modern world. The fish tank on top shows the water level decreasing as you drink or use the water. However the water is pure and not connected to the fish bowl. It is a very visual concept to help people be sensitive to the need to use water catioously. Students to think of a design of tap which will remind people not to waste water. (SDG 6)
Students will be able to		Knowledge	
Exposure 1.2	Story Creation	<ul style="list-style-type: none"> Deduce the process of creating a story into a systematic process so that it helps them both in communication as well as construction of ideas Start by explaining the idea of the story through either an example or a situation. A story is a medium to tell accounts of an event either fictional or real or Science related. By dividing parts of a story into three, it simplifies the creation process. It allows the students to plan before telling an idea or communicating a problem to another person. The idea of creating a story through the story map will help students create a holistic story. The words, dialogues, settings are a few of elements that a story can be built with. The important part to focus in the map is the character, as it will help them with the next task they are doing. 	
General Learning Outcomes		Points to remember	Specific Learning Outcomes
understand what the importance of a story is and it’s narrative define parts, elements, types and methods of story building create ways to tell and build an idea through a story		<ul style="list-style-type: none"> A story can be told in just two words, through a pictorial depiction as well as a novel. Try not to give examples related to only the famously known stories so that it broadens the perspective of students Variations of stories, not to bind them by limitations but to open up their imaginations and relatability to various stories they may have heard about 	Enter Learning Outcomes
Observation		Discussion	Action

	Concept Initiation (10 mins)	Show a picture and ask students to imagine the story.	Talk about the different genres of stories. Get students to list the stories that they have liked in the past and identify their genres.	Show them Exposure 1.2.
	Concept Elucidation (15 mins)	Show slides 6, 7 and 8 of Exposure 1.2 to further understand the concept of parts of a story (beginning, middle and end)	Ask children to talk about a favorite story and recount the beginning of the story. Others in the group can then think of an interesting middle and some others can add an appropriate ending.	Students to participate in the activity: Spin a Yarn- One student to begin the story with a sentence and thereafter, each student to say a line to continue to add to it and build a story. The last one in the circle to conclude the story.
	Concept Closure (10 mins)	Show a popular story in a pictorial form	Teacher to talk about types of story structure with the examples. (Some examples given in the Exposure 1.2)	Ask students to put a story in the correct order (Can be a popular story like from the Panchatantra or a Fairy Tale)
		Students will be able to	Knowledge	
Task 1 55 mins + 30 mins homework	Puppet Making	<ul style="list-style-type: none"> Use the understanding of elements of design as well as a story to create a puppet of a character that is completely imaginary or inspired by reality to highlight the story formulated. to create puppets with specific physical traits to match the personality of the character 	A puppet is a movable model of a character that can be controlled by sticks, hands, strings or any other mechanical medium. Instructions to students: <ul style="list-style-type: none"> Using shape cut-outs, the students are to create a puppet Ask them to imagine the emotion of the puppet to make sure the face is reflecting that emotion using elements of design like colour, shape or line(eg. happy, sad, angry) Ask them to create a voice, language and tone for the puppet to talk Students to discuss how their puppet works and animates with each other and the teacher 	
		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		understand elements of design and their functions define use of elements into a purpose create puppet character using story and elements evaluate the efforts and participation students put into the task	<ul style="list-style-type: none"> This is a group activity, so make sure each student has a specific role to play Try and let the students build their own models before suggesting any changes or ideas The homework should only include refining the original creation rather than getting help from others 	Enter Learning Outcomes
		Students will be able to	Knowledge	

Task 2 25 min Class 30 min Home	‘What if I could’	<ul style="list-style-type: none"> Imagine a personality or a situation as an alternate possibility than current and build a story about it Explore empathy, self- awareness and creativity to bring an optimistic point of view to challenges 	A story that is created through imagining a particular situation or their own limitations differently. Explain the task in three parts – 1. Select a limitation or situation 2. Look at it alternatively with imagination and 3. Write the event in the form of a story Ask students to present the work in class and use peer feedback for improvements.	
		Learning Outcomes	Points to remember	Elaborate - Learning Outcomes
		understand how perspective changes a story define what imagination can affect create visual composition using photographic documentation evaluate the efforts and participation students put into the task	<ul style="list-style-type: none"> As this is an imagination exercise, you can start with a warmup exercise to energize the creativity juices in students. For eg: Ask them to partner with another student. Student A (blindfolded) to draw a figure on a blank sheet of paper. Student B to add his/her perspective to complete the picture. Encourage students to be imaginative and to improve their stories. - 	Enter Learning Outcomes

Assessment Rubric

Achievement Levels	1-2 BEGINNING	3-4 DEVELOPING	5-6 PROMISING	7-8 PROFICIENT	9-10 EXCELLENT
Using elements of design	Demonstrates learning of at least one element of design	Demonstrates through puppet learning of 2 or more elements	Applies most of the elements of design in designing the puppet	Applies all the elements in designing the puppet	Demonstrates and applies the use of elements of design in the puppet
Creating Puppet character	Has an idea about creating the puppet but hasn't initiated developing the puppet	Has an idea and has begun creating the puppet	Creates a puppet using shapes and forms but has no idea about the character of the puppet and is not connected to a story.	Represents the character of the puppet using all elements of design in the act	Presents the story along with the puppet showing use of design elements
Realising alternative narrative in story	Has thought of an alternative, but no idea to change	Has thought of an alternative narrative, but isn't able to communicate	Creates a plot to change the selected narrative but isn't able to communicate the same.	Creates and communicates an alternative narrative of the story with some difficulties	Creates and communicates an alternative narrative of the story without difficulties
Presentation of a story	Has thought of characters but the elements of a story are not apparent.	Presentation has a story with characters and setting but the flow and plot is weak.	Presentation has a story with three parts (beginning, middle and end) but communication lacked clarity and organisation.	Presentation of story is well thought and sequential. It is communicated with effort and system	Story is well-presented with high creativity, organisation, eloquence and within the time given

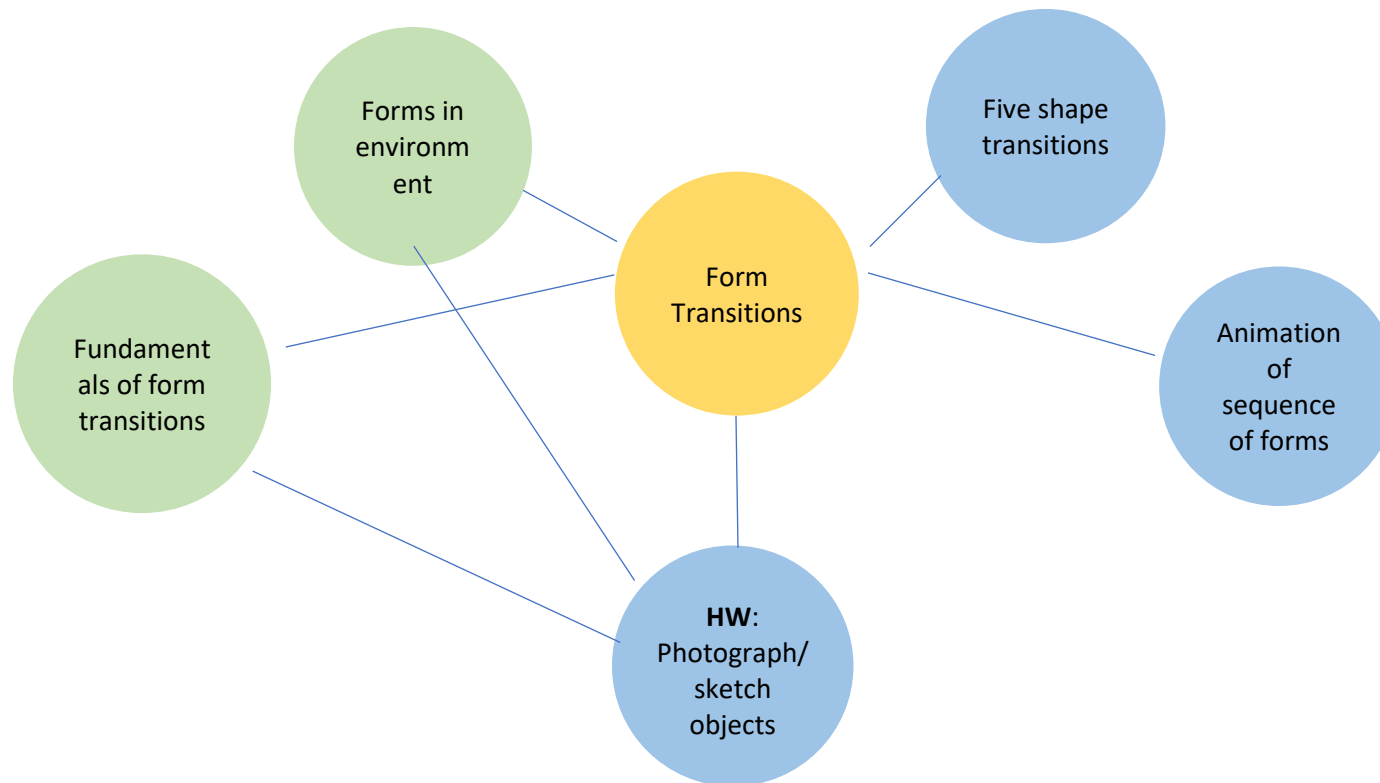
Assessment Outcomes

Evaluation of participation and efforts by students in photography, to make sure students understand further potential of development
 Develop knowledge seeking, retention and design application capability

Chapter 2: Form Transitions

3 hours Classwork + 1 Hours Homework

Mind Map



Chapter 2: Form Transitions

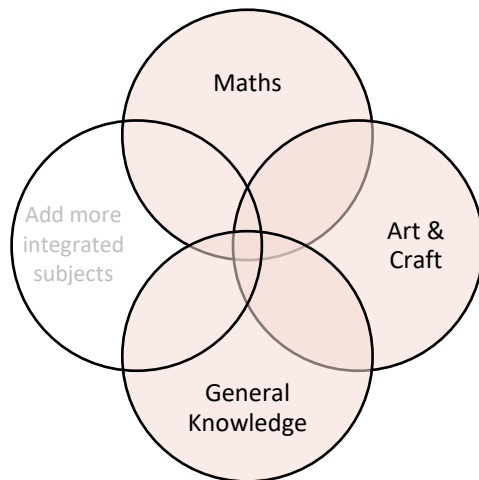
3 hours Classwork + 2 Hours Homework

Synopsis

Form transition is the basic principle of animation design. This chapter is meant as a brief exposure to this creative field and make the students sensitive to changes in form.

It introduces students to Form Transition for creating moving images as well as documentation of Forms in the Environment. It should create an interest in this field, nurture their sense of curiosity, motivate them to explore and discover this area. This Chapter will get students to think how shapes can change while retaining their volume.

Integrated Subjects/Cross curricular subjects used in this unit:



Intelligences

- Logical Mathematical intelligence
- Spatial intelligence
- Naturalistic intelligence
- Interpersonal intelligence
- Intrapersonal intelligence

Chapter 2: What is Form Transitions?

3 hours class work+ 1 hour homework

Sample Outline

[Listen to the teacher's Podcast here](#)

Day 2		Students will be able to	Knowledge	
Exposure 2.1	Fundamentals of Form Transitions:	<ul style="list-style-type: none">Gain information about the fundamentals of form transitions and find ways in which the aspects can be useduse vocabulary related to form transition. For example: transition, alter, change, optical illusion etc.use their skills of observation and expression.	This exposure is for students to observe and understand form transitions. In this exposure walk the students through each of the slides, while brushing through the concepts and examples as mentioned on the slide.	
			The basic character of a product is centered around the identity of that product, that is, its ability to suggest its purpose and function, and the mode of function through its visual appearance. It can be seen that the basic structure of the form must be respected and maintained as the active core of the final form. It is imperative that the transition from one basic element to another must respect these elements without contrasting against them or superseding their importance. For example: In nature, the transition can be observed in the life cycle of a frog or a butterfly. Or an Orange Oak butterfly can be seen in this picture as a leaf (camouflage). Another example can be a millipede that can turn into a coin like a circle for defense. In everyday life, the making of bread/roti from dough is a form transition. Or, a sculptor turning stone into a sculpture.	
			The transition between the sub-volumes that comprise a product provides the unifying relationship that combines these separate volumes into a unity of meaning as well as unity of appearance. The transition of one form into the other must ensure that the visual flow must be harmonious and smooth.	
			Learning Outcomes	Points to remember
	understand what is form a transition create designs from forms like letters, shapes and objects define their power of observation	<ul style="list-style-type: none">Go through the definitionsMention how form transition can be from creation of a wooden vase through carving or sculpting of stone into something beautiful and useful.		
	Observation	Discussion	Action	

	Concept Initiation 10 mins	Show the pictures below and ask children about what they can see.	Question the whole class: What can you see? Ask children to look around them and see if they can see a different form in things around them. For example, the handle on the class door. Does it remind you of something else? (Elicit responses to come to the conclusion that it could be a face)	Children to think and answer and explain their answer.
	Concept Elucidation 15 mins	Students to be shown the exposure 2.1 which will enable them to understand through pictures and examples how design thinking can be used to transition any form of letter, shape or thing. Examples of letters like 'e' transitioned to form an elephant,	Ask questions such as: Think of your baby pictures and your pictures. Is there a change of form? Can you think of any creature which has a strong metamorphosis where the baby changes completely to emerge as a totally different creature? (children can give the example of the life cycle of a butterfly.)	Children to draw a transition of a Tadpole to frog.
	Concept Closure 10 mins	Video of how clay can be transitioned to pots.	Form transition is when a shape, letter or objects can be changed to another. Teacher can walk them through the exposure.	Children to make a simple object/animal/bird using clay or hands (shadow puppetry)
Exposure 2.2	Forms in Environment and man-made	Students will be able to	Knowledge	
		<ul style="list-style-type: none"> Enhance their power of observation 	This chapter introduces students to Form Transition for creating moving images as well as documentation of Forms in the Environment. It should create an interest for the students in this field, nurture their sense of curiosity, motivate them to explore and discover newer areas. The students will become sensitive to changes in form and get to know that this knowledge can be applied in product, communication and animation design.	
		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		Children will be able to observe objects and imagine them as a different shape or form.	<ul style="list-style-type: none"> Encourage imagination by giving examples proactively. This lesson can be taught outdoors for better examples from nature. Examples such as moths or butterflies that look leaves or petals can be given. 	To be filled by the teacher
	Concept Initiation 10 mins	Observation	Discussion	Action
		Ask children to observe the class door. Look carefully to see if they can visualize a face in the door. In the picture given below one can see the two knobs which look like two eyes and the lines seem to signify the nose and mouth.	Ask questions like: When you look up at the clouds do you see any shape? Can you see the shape of a face in clouds? Think of other things like your car or a lock?	Children to draw a face in the object they visualize.
	Concept Elucidation 15 mins	Show Exposure 2.2	Teacher to walk them through the slides.	Ask children to list other things in the environment that can look like another object.

	Concept Closure 10 mins	<p>Watch a time lapse video on ice-sculpting https://www.youtube.com/watch?v=88NC2B7fHus</p> <p>example of stone sculpting (video on Ajanta caves) https://www.youtube.com/watch?v=kgu6vcNLECO</p>	<p>Ask children to see how a form can be transformed into another. Ask them to try and transform a shape in 4 or 5 steps.</p>	<p>Ask children to use a shape to change into a different form.</p>
		Students will be able to	Knowledge	
Task 1 55 mins Class 30 min Home	Transitioning five shapes	<p>Create five transitions from shapes or forms from one to another and play it together.</p> <p>Make a transition between two sets of shapes or forms.</p>	<p>What is form Transition when it comes to materials and shapes in hand? In simple words, change from one form to another while maintaining value is form transition. So when the students use various methods like cutting, folding, scraping, crushing, molding, shaping or sculpting to modify the existing letter into a shape or a form into another form, it will look like transition</p>	
		Learning Outcomes	Points to remember	Specific - Learning Outcomes
		Students will be able to become sensitive to changes in shape and its transformation	<ul style="list-style-type: none"> - The students will use paper cutouts or soft clay and look at transformation of form either in 2 D or 3 D from one letter to another or from one form to another. - The task involves sensitivity to minor changes in shape and form and creation of new forms by transition. 	Enter Learning Outcomes
		Students will be able to	Knowledge	
Task 2 25 mins class + 30 mins homework	'What can I see?'	<p>Document through photography/sketching letter forms or patterns or faces in objects from immediate nature or home.</p> <p>create a visual composition using photographic documentation</p> <p>Explore letter forms in nature</p>	<p>How can one see something through imagination and form understanding? Seeing familiar objects or patterns in otherwise random or unrelated objects or patterns is called <i>pareidolia</i>. It's a form of <i>apophenia</i>, which is a more general term for the human tendency to seek patterns in random information. Human mind can chose to interpret such randomness. This tendency allows us to explore patterns that we are looking for. The documentation of such patterns will help students see objects from multiple perspective and broaden their scope of learning about forms.</p>	
		Learning Outcomes	Points to remember	Specific - Learning Outcomes

understand define what imagination can affect create forms out of objects and see shapes in them evaluate life skills such as empathy and self- awareness	<ul style="list-style-type: none"> - Document any one of these through photography: - A. Alphabets of letterings from immediate nature or - B. Patterns found in the Environment either in objects/plants or animals or - C. faces in Objects. <p>Shoot at least 3 alternatives for each of them and select what you feel is the best one out of them. Make sure the lighting is enough and the subject is composed properly. Output 2: Selected photos to be arranged in a sequence</p>	Enter Learning Outcomes
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Important Terminologies

Transition	the process or a period of changing from one state or condition to another.
Form	A visible configuration or shape of something – eg. The form of a leaf is like a droplet
Close-up Photograph	Close up photography refers to a tightly cropped shot that shows a subject (or object) up close and with significantly more detail than the human eye usually perceives
Light	Photographic lighting is the illumination of scenes to be photographed.
Lens	A camera lens is an optical lens or assembly of lenses used in conjunction with a camera body and mechanism to make images of objects either on photographic film or on other media capable of storing an image chemically or electronically.
Aperture	Aperture refers to the opening of a lens's diaphragm through which light passes
Harmonious	free from disagreement or inconsistency

Assessment Rubric:

Achievement Levels	1-2 BEGINNING	3-4 DEVELOPING	5-6 PROMISING	7-8 PROFICIENT	9-10 EXCELLENT
Creating letters using paper/clay	The student: Needs to complete creating an alphabet	The student: Documents one alphabet using paper/clay	The student: Documents 1-2 alphabets using paper/clay	The student: Documents 3-4 alphabets using paper/clay	The student: Documents 5 alphabets using paper/clay
Order of transition	Needs to present paper cutout or soft clay form either in 2D or 3D from	Presents a paper cutout or soft clay form either in 2D or 3D from	Presents 1-2 paper cutouts or soft clay forms either in 2D or 3D from	Presents 3-4 paper cutouts or soft clay forms either in 2D or 3D from	Presents 5 paper cutouts or soft clay forms either in 2D or 3D from
Discovering in-between shapes and forms	Needs to complete creating a transition form	Creates a transition form	Creates 1-2 transition forms with the middle shape/form in-between the two letter forms	Creates 3-4 clear transition forms with the middle shape/form in-between the two letter forms	Creates transition clearly showcasing the in-between letters represent the transition
Sensitivity towards new forms by transitions	Displays poor sensitivity to minor changes in shape and form and creation of new forms by transitions	Displays very limited sensitivity to minor changes in shape and form and creation of new forms by transitions	Displays average sensitivity to minor changes in shape and form and creation of new forms by transitions	Displays sensitivity to minor changes in shape and form and creation of new forms by transitions	Displays heightened sensitivity to changes in shape and form and creation of new forms by transitions

Assessment Outcomes

Evaluation of participation and efforts by students in photography, to make sure students understand further potential of development
Develop knowledge seeking and retention capability

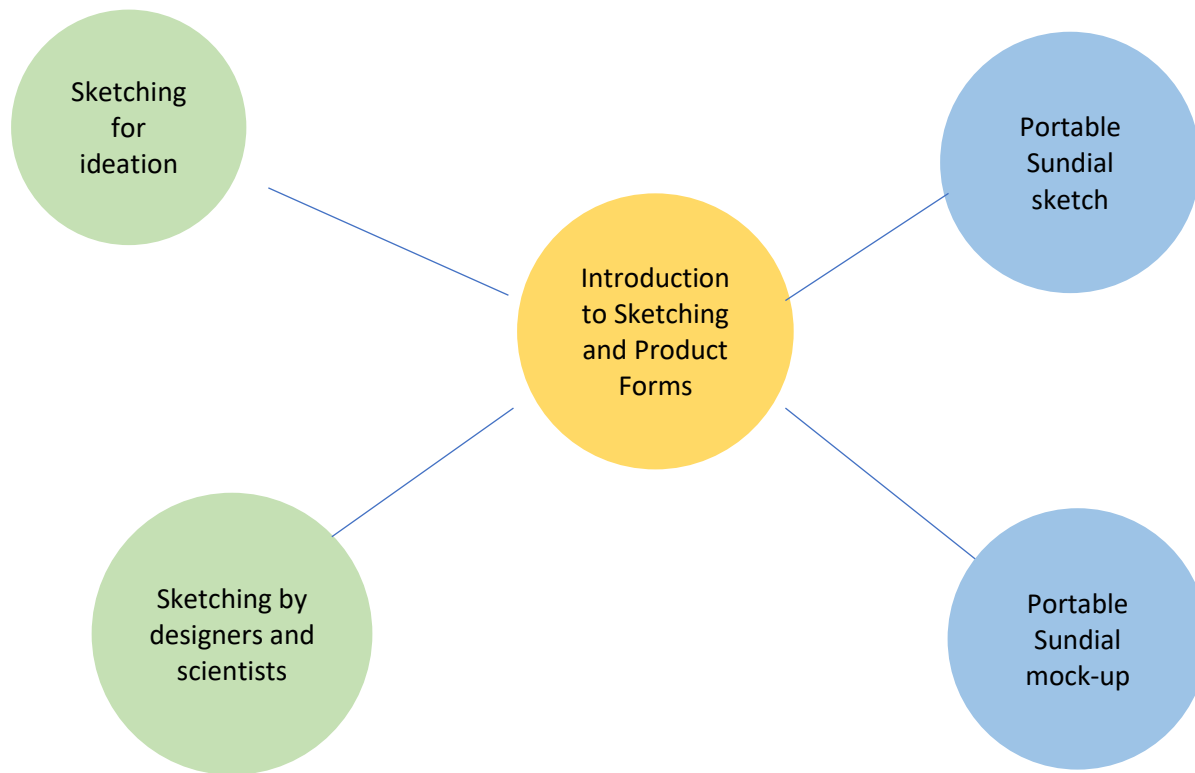
Resources and References:

1. https://www.researchgate.net/figure/Transition-from-one-form-to-another-carried-out-in-three-intermediate-steps_fig1_264160032
2. <https://www.dsource.in/course/elements-3-dimensional-design/form-transition>

Chapter 3: Introduction to sketching and product forms

3 hours Classwork + 2 Hours Homework

Chapter mind Map



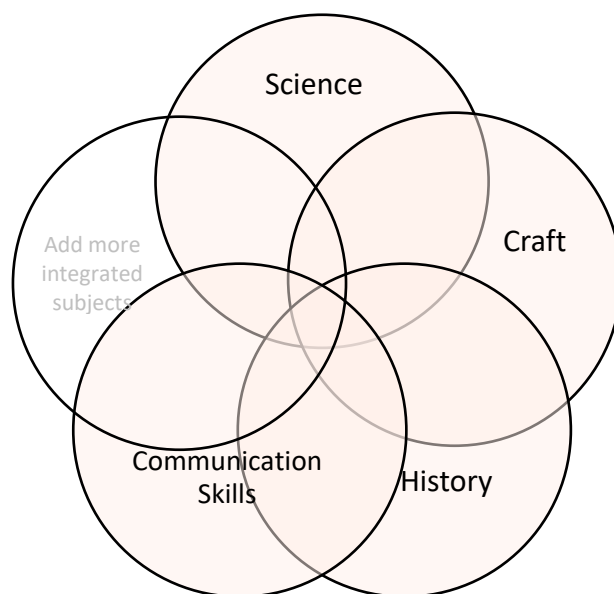
Chapter 3: Introduction to sketching and product forms

3 hours Classwork + 2 Hours Homework

Synopsis

The initial part of the Chapter is to expose school students to basics of sketching for ideation. The emphasis of sketching is mainly for representation of different ideas or concepts as visual representations. The easiest and simple way is to take a pencil and sketch ideas or concepts on a sheet of paper. The sketching becomes an extension of thinking with the output as visual representations. - The second part of the Chapter is to try out several variations of ideas or concepts. In the process of design, it is important to think of several alternative solutions to a given problem. This way one has the option of choosing the best alternative. Examples of the use of sketching by famous artists, scientists and architects as an extension of ideation can be given to the students to help them to understand the importance of sketching.

Integrated Subjects/Cross-curricular subjects



Multiple Intelligences:

- Linguistic-verbal intelligence
- Spatial intelligence
- Naturalistic intelligence
- Interpersonal intelligence
- Intrapersonal intelligence

Chapter 3: Introduction to sketching and product forms

3 hours Classwork + 2 Hours Homework

Sample Outline

Listen to the teacher's Podcast here

Day 3		Students will be able to	Knowledge	
Exposure 3.1	Sketching	<ul style="list-style-type: none">Gain information about the fundamentals of sketching	Sketching is an extension of ideation. Examples of the first sketches can be given. For example- cave paintings and frescos. Sketches by Leonardo Da Vinci and other painters and innovators can help children to understand how a simple sketch can transform an idea on paper and give the idea its first form. Examples of the same are given in the Exposure 3.1	
		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		Enhance their power of observation Understand the basics of sketching Introduce the idea of sketching for ideation Use vocabulary related to sketching Use their skills of observation and expression.	<ul style="list-style-type: none">Go through the definitionsHow cave drawings and sketching helped to maintain recordsSketching as an expression of thoughtFrom Frescos to murals from different parts of the world	Enter Learning Outcomes
		Observation	Discussion	Action
	Concept Initiation (10 mins)	Show a picture of a pencil sketch of Chad: Prehistoric Cave Art	Sketching is mainly for representation of different ideas or concepts as visual representations. The easiest and simplest way is to take a pencil and sketch ideas or concepts on a sheet of paper. The sketching becomes an extension of thinking with the output as visual representation. Talk about how the sketch must have helped the person to represent his ideas.	Sketch the picture of a possible variation of a desk on the board.
Concept Elucidation (15 mins)	Students to be shown the Exposure 3.1.	Students to understand that sketching is the first step for all design- whether it is a famous painter, scientist, engineer, designer architect or any professional. Students to understand that sketching is an extension of thinking and ideation. Examples to be given from the cave paintings of Ajanta and Ellora as well as the famous sketches made by designers and scientists before the main product.	Students to make a sketch of a futuristic pencil.	

	Concept Closure (10 mins)	Video of concept sketching https://www.shutterstock.com/video/clip-6144329-whole-process-sketching-drawing-dress-time-lapse Students to see how a designer first sketches a dress that he/she has visualized before making it.	Students to discuss what they found most interesting in the exposure 3. Students to be shown slide 12 and to be asked to make their own rough sketches on the topics mentioned on slide 12.	Students to review their sketches and improve them.
		Students will be able to	Knowledge	
Exposure 3.2	Creative exploration to product forms	<ul style="list-style-type: none"> Enhance their power of observation Think imaginatively about how a product can have different uses. 	In this part of the chapter students are to try out several variations of ideas or concepts. In the process of design, it is important to think of several alternative solutions to a given problem. This way one has the option of choosing the best alternative.	
		Learning Outcomes	Points to remember	Specific- Learning Outcomes
		<p>Children will be able to understand the need for exploring creative variations in Product Forms.</p> <p>The students will become sensitive to creating creative variations and understand its significance for creative alternate concepts for Design.</p>	<ul style="list-style-type: none"> Students should be free to imagine, without fear of being judged or proved wrong and their sense of curiosity to be nurtured. Students to be motivated to explore and discover this area. Sketching being the fastest medium of communication to explain every detail of design. Give examples of how you draw/sketch to explain a concept on board. 	Enter Learning Outcomes
	Concept Initiation (10 mins)	Observation	Discussion	Action
		Show students a picture of party shoes or every day sandals and sport shoes and	Ask questions like: Why are these shoes different? What purpose do they meet? What kind of shoe would you require if you were to walk through puddles of water?	Students to draw a shoe that would help them to walk through puddles. Students to mention the color, texture and material of the shoe.
		Concept Elucidation (15 mins)	Go through the exposure, explaining and asking questions. Students to see and learn how bicycles can be designed differently to meet different purposes.	Ask students to think of the different variations and how they helped to serve the purpose. Students to draw/sketch the kind they would like. Why did you choose to make this?
	Concept Closure (10 mins)	Watch a video on a cycle race. https://www.youtube.com/watch?v=L9p6lehoA6g Andalucía Bike Race 2019 Stage 3 - Highlights	Ask children to list what factors would the designers have to keep in mind when designing bikes for such a race. Would there be modifications in the body of the bike, the tires, the handle bar and seat?	Brainstorm on product variations.
		Students will be able to	Knowledge	

Task 1 Hour 55 minutes Class time 30 min Home	Sun dials	Make a sketch of their own version of a Sundial Use sketching to create their own Sundials.	A sundial is an instrument showing the time by the shadow of a pointer cast by the sun on to a plate marked with the hours of the day. Show them a picture of the 750 year old Sun dial in Konark, India. https://www.youtube.com/watch?v=K9RF9ILBIMs A video to explain how this sun dial works at the Sun temple of Konark.	
		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		<ul style="list-style-type: none"> Understand how the position of the sun can be used to tell the time of the day. Co relate their knowledge of shadows to tell the time of the day 	Read about ancient Sun dials and look at the pictures of modern ones. https://kids.britannica.com/kids/article/sundial/403911 (Resource for information on the different parts of a sundial as well as the working of a sundial)	Enter Learning Outcomes
		Students will be able to	Knowledge	
Task 2 25 min Class 30 min Home	Portable Sun-dials.	<ul style="list-style-type: none"> Design a portable sun-dial to work in groups and collaborate to create a sketch of a Sun dial. 	https://www.google.com/search?q=portable%20sundials&tbm=isch&tbs=il:cl&rlz=1C1UEAD_enIN968IN968&hl=en&sa=X&ved=0CAAQ1vwEahcKEwigkZiM6eDyAhUAAAAAHQAAAAAQAg&biw=1017&bih=603#imgsrc=NUku2s6usQIkM Site for images of potable sun dials for the teacher to share with the students)	
		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		Define various parts of requirements to build a designed product Create a sketch after a discussion and thought. Understand ideating for innovation	- The teacher to move around and check if all the participants in a group as contributing.	Enter Learning Outcomes
		Students will be able to	Knowledge	
Task 3 30 min Home	Present-ation of the final Portable Sun-dials	<ul style="list-style-type: none"> Students will be able to present an idea in front of an audience. 	The children should have completed their project. Encourage them to explore all ideas and complete the task. The children should have a dial and a simple object to help the movement like a cardboard plate underneath the dial. When kept in the sun, a pencil/stick inserted in the centre of the dial will cast a shadow on the right number to tell the hour of the day.	
		Learning Outcomes	Points to remember	Elaborate - Learning Outcomes
		- Students will be able to work at a project with rigor and focus with the aim to attain perfection - Students will improve presentation skills. - Students will be able to use vocabulary related to time	- Students to make a drawing of the idea on A4 size drawing paper using 0.5 ink pen and colour it using colour pencils.	Enter Learning Outcomes

Important Terminologies

Dial plate	The flat surface of a sundial.
Hour lines	Numbered lines on the dial plate
Shadow-	An area of darkness formed by an opaque object obstructing light is called a shadow. Objects can be transparent, translucent, or opaque, depending on how much light can pass through them. A shadow is formed when an opaque object blocks the light falling on it.

Assessment Rubric

Achievement Levels	1-2 BEGINNING	3-4 DEVELOPING	5-6 PROMISING	7-8 PROFICIENT	9-10 EXCELLENT
Making connections between shadows and use of sun dials	The student: Has no or very little understanding of the concept of shadow formation through light and shade and use of sun dials	The student: Possesses a vague understanding of the concept of shadow formation and use of sun dials	The student: Possesses a limited understanding of the concept of shadow formation and use of sun dials	The student: Possesses understanding of the concept of shadow formation and use of sun dials	The student: Possesses detailed understanding of the concept of shadow formation and use of sun dials
Designing and sketching Sun dials	Has to begin the sketch of Sun dial Has only discussed the concept.	Creates a sketch that is limited in design and operation, and the basics of sketching are not clear.	Creates a complete sketch that reflects limited basics of sketching for ideation, but lacks attention to details.	Creates a sketch that reveals a fair understanding of the design process and the basics of sketching for ideation.	Creates a sketch clearly showcasing the understanding of the design process and is able to use the basics of sketching for ideation

Creating Shape Alternatives	Is beginning to present a complete design with shape alternatives	Presents an alternative sketch that reflects very basic creative variations in Product Forms. No alternative objects/surface used	Presents 2 sketches that explore in a limited manner the creative variations in Product Forms. A few alternative object/surface used	Presents 3 sketches that fairly explore creative variations in Product Forms. Some alternative objects/surface used.	Presents 4-5 sketches that explore creative variations in Product Forms. Different alternatives like Linear, planar, 3D objects and planar and curved, surfaces used.
Sensitivity towards creating creative alternate concepts for Design	Displays no or poor sensitivity to creating variations and to understand its significance for creative alternate concepts for Design.	Displays very limited sensitivity to creating variations and to understand its significance for creative alternate concepts for Design.	Displays average sensitivity to creating variations and to understand its significance for creative alternate concepts for Design.	Displays sensitivity to creating variations and to understand its significance for creative alternate concepts for Design.	Displays heightened sensitivity to creating variations and to understand its significance for creative alternate concepts for Design.

Resources and references: <https://www.britannica.com/art/prehistoric-art>

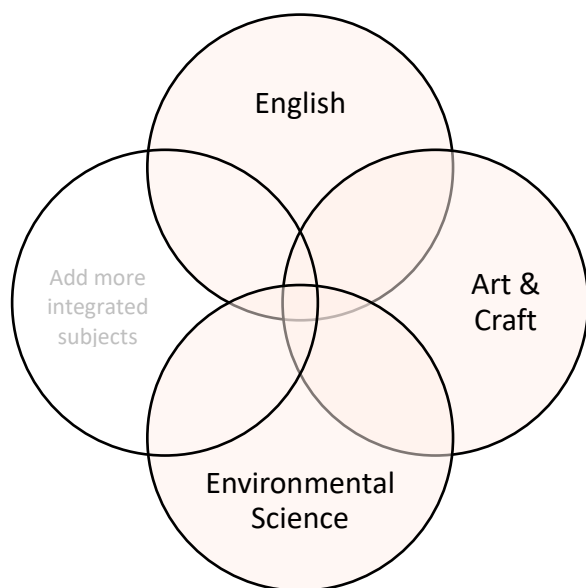
Chapter 4: Design Thinking Process and Environment Project

3 hours Classwork + 2 Hours Homework

Synopsis

Introduction to Design Thinking Process and Environmental Design Project - Design Thinking may be seen as a method to solve problems using a process **by prioritizing the consumer's needs above all else**. It relies on observing, analysis, how people interact with their environments, and employs an iterative, hands-on approach to creating **innovative** solutions.

Integrated Subjects/Cross-curricular subjects used in this unit:



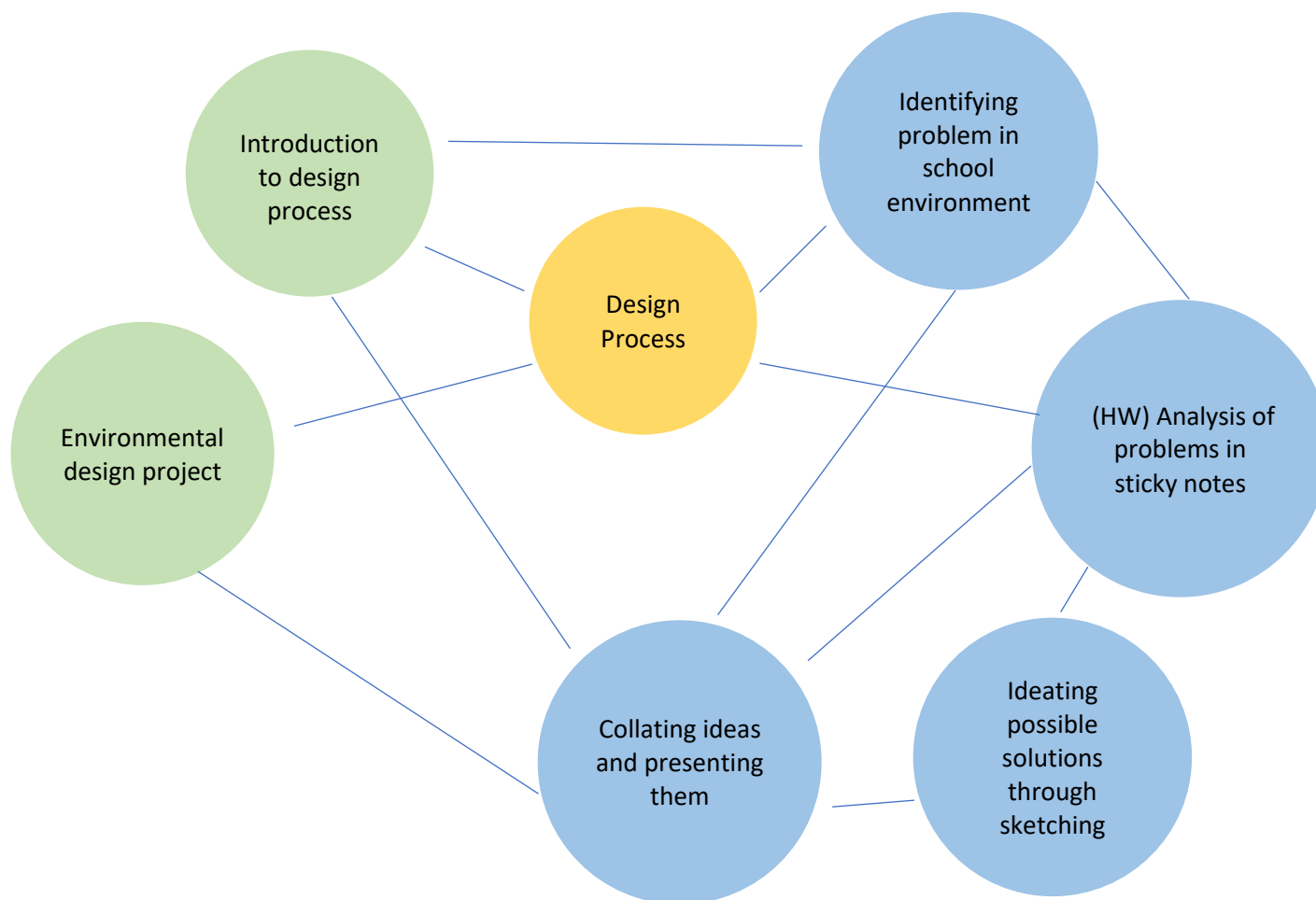
Multiple Intelligences:

- Logical Mathematical intelligence
- Spatial intelligence
- Naturalistic intelligence
- Interpersonal intelligence
- Intrapersonal intelligence
- Linguistic-verbal intelligence

Chapter 4: Introduction to Design Thinking and Environmental Design Project

3 hours Classwork + 2 Hours Homework

Chapter Mind Map



Chapter 4: Introduction to Design Thinking and Environmental Design Project

3 hours Classwork + 2 Hours Homework

Sample Outline

[Listen to the teacher's Podcast here](#)

Day 4		Students will be able to	Knowledge	
Exposure 4.1	Introduction to Design Thinking Process	<ul style="list-style-type: none"> Gain information about the fundamental aspects of the Design Thinking Process Understand ways in which the aspects can be used to identify problems and find innovative solutions. Students will be able to use vocabulary related to design-thinking. For example: empathize, ideate, prototype etc. 	<p>Design Thinking <i>is</i> a method to help to give solutions to solve a problem. It is based on tackling difficult problems that are not very well known or defined. The solutions can be reached by thinking of the needs of involved, by re-defining the problem, by creating ideas, and by testing. Design Thinking methods can be applied in order to solve complex problems that occur around us — in our companies, in our countries, and even on the scale of our planet.</p> <p>The five stages of Design Thinking, are as follows: Observation (empathize), Analyze (define the problem), Ideate, Prototype, and Reflect (test).</p>	
		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		<ul style="list-style-type: none"> understand what design thinking is define the five steps of design thinking Use design thinking to understand the basics of this design process and apply it to solve a problem concerning the school environment Students will be able to use their skills of observation, imagination, innovation, and expression. 	<ul style="list-style-type: none"> Go through the definitions Mention how each step of design thinking is important for the process. Try to give relatable examples from nearby environment, eg. The innovation of a carrier on the handlebars of a bicycle to enable the rider to carry his/her belongings. 	Enter Learning Outcomes
	Concept Initiation 10 mins	Observation Show a school bag to the children. Any other object can be used too like a chair or pen etc.	Discussion Pose a question to whole class: How does the bag improve your lives? Why do you think the bag has 2 straps? Do the straps make the bag more comfortable? How is a back pack better than a shoulder bag?	Action Students will share how the bag has gradually improved to have pockets and be more comfortable.
	Concept Elucidation 15 mins	Exposure 4.1 Students to be shown the slides to understand the concept of Design Thinking.	This is a process that first understands users, identifies, and analyses a problem or need, and research relevant information, after which ideas are explored and analysed, until an appropriate innovative solution to the problem or need is arrived at. - It involves these five phases - Empathize, Define, Ideate, Prototype and Testing. - Design Thinking could be viewed as the	Students to list 2 products that have greatly improved their lives.

		process that translates an idea into an appropriate useful solution. This could be applied to any field, be it economics, products, services, health, environment and other such areas..	
Concept Closure 10 minutes	Students to be shown a picture of an ice cream cone.	In a nutshell, design is about understanding needs and being sensitive to issues, identifying problems that need to be solved, creating innovative appropriate solutions, considering aspects of sustainability such that it makes a positive difference to life on our universe Reference to the picture of the ice-cream cone as it allows the ice-cream to be served without the need for a cup or spoon.	Show video of the African drum Link Article on Design Thinking in rural India and how it changed lives during the Pandemic. https://www.thebetterindia.com/261588/migrant-workers-earn-livelihood-garden-vegetables-food-lockdown/
	Students will be able to	Knowledge	
Exposure 4.2	Sticky Notes for Analysis	<ul style="list-style-type: none"> Use sticky notes for decision making and mind mapping 	Sticky notes are a valuable tool to help students to brainstorm ideas and analyze them.
	General Learning Outcomes	Points to remember	Specific - Learning Outcomes
	understand the importance of identifying a problem and evaluating the pros and cons define the positives and the negatives from different perspectives create ways to improve a situation.	-	Enter Learning Outcomes
	Observation	Discussion	Action
Concept Initiation 10 minutes	Exposure 4.2 and 4.3 to be made: Show children colorful sticky tapes.	.Ask students to write down on a sticky note what could be an improvement in their class	Ask children to paste the sticky notes on a board.
Concept Elucidation 15 minutes	Students to be divided into groups and asked to categorize the sticky notes in the order of preference and priority.	What are the most important improvements? Are there any similar suggestions? Group the similar notes together. Sequence the notes in the order of priority	Ask one child to read out the suggestions.

	Concept Closure 10 minutes	Show students how mind maps and sticky notes can help to take decisions.	Ask students to read out their main solution to the improvement.	Students to write the steps used to solve a problem using sticky notes.
		Students will be able to	Knowledge	
Exposure 4.3	Design Case Study using Design process	<ul style="list-style-type: none"> Gain information about the fundamental aspects of the Design Thinking Process Understand ways in which the aspects can be used to identify problems and find innovative solutions. 		
		General Learning Outcomes	Points to remember	- Specific- learning Outcomes
		<ul style="list-style-type: none"> Use the five steps of design thinking and apply it to solve a problem Students will be able to use vocabulary related to design-thinking. For example: empathize, ideate, prototype etc. Students will be able to use their skills of observation, imagination, innovation and expression. 	<ul style="list-style-type: none"> Go through the definitions Mention how each step of design thinking is important for the process. Stress on the importance of looking at the problem from the point of view of all stake holders. 	Enter Learning Outcomes
		Observation	Discussion	Action
	Concept Initiation 10 mins	Show them pictures of a horse cart and a Ford car. Show them a picture of Thomas Edison.	Pose questions to whole class: What could have triggered the transition from horse carts to cars? How do you think the idea first began? What observations do you think the first manufacturers of cars must have made? How many times did Edison try to make the bulb light up before he succeeded?	Research on Ford. Research on Thomas Edison.
	Concept Elucidation 15 minutes	References: Design Thinking Process - explained with an example: https://www.youtube.com/watch?v=uRtAzzitBmA Design Thinking Framework - a short video: https://www.youtube.com/watch?v=LhQWrHQwYTk	These animated videos will help to understand the whole process of design thinking.	Students to be asked questions related to the video: For example: How many different ways were shown in the video to pick the apples from the tree? Why was the last product the most suitable?

Concept Closure 10 minutes		Show some problem statements	Ask questions to get students to think about the problem from different perspectives.	Ask students to write the steps taken in each of the video in order to reach the conclusion.
		Students will be able to	Knowledge	
Task 1 25 mins Class 30 min Home	Identifying problems in school environment	Use their observation skills to identify a problem in their environment Work in groups and collaborate	<p>The first stage of the Design Thinking process is to gain an empathic understanding of the problem you are trying to solve. This involves consulting experts to find out more about the area of concern through observing, engaging, and empathizing with people to understand their experiences and motivations, as well as immersing oneself in the physical environment to gain a deeper understanding of the issues involved. Empathy is crucial to Design Thinking, and empathy allows design thinkers to set aside their own assumptions about the world to gain insight into users and their needs.</p> <p>Students will learn and study about the immediate environment. They can explore various topics and read and enhance their knowledge about the same before trying to identify the problem.</p> <p>For example: the parking lot for parents and teachers, the traffic management during arrival and dispersal, waste management, plantation of shade providing trees, wastage of water/paper in school, time management during lesson transitions etc.</p>	
		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		understand elements of design thinking and their functions identify a problem in their immediate environment ideate and create a solution. evaluate their work based on the testing of their final product. Apply their knowledge of design thinking into real life problems identified by them in their environment	<ul style="list-style-type: none"> This is a group activity, so make sure each student has a specific role to play Try and let the students build their own models before suggesting any changes or ideas The homework should only include refining the original creation rather than getting help from others 	Enter Learning Outcomes
		Students will be able to	Knowledge	
Task 2 25 min Class 30 min Home	Ideation and creative options	<ul style="list-style-type: none"> Ideate and create options Brainstorm in a group and short list possible solutions 	<p>Ideation is the process of generating ideas. Once students understand the users and their needs in the Empathise stage, and they have analysed and combined their observations in the Define stage, and ended up with a human-centered problem statement, they can start to "think outside the box" to identify new solutions to the problem statement, and to look for alternative ways of viewing the problem. Ideation techniques such as Brainstorm, Think of the worst idea etc help to generate new ideas and to stimulate free thinking. It is important to get as many ideas or problem solutions as possible at the beginning of the Ideation phase.</p>	

		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		understand to ideate and think of possible solutions Evaluate the best solutions after brainstorming	<ul style="list-style-type: none">- Remind student to look at the perspectives of all the stakeholders- Provide access to information about the immediate environment	Enter Learning Outcomes
		Students will be able to	Knowledge	
Task 3: 25 mins class time 30 mins Homework	Creating Scenarios, Design mock-ups and detailing	<ul style="list-style-type: none">• Implement a selected option• Brainstorm in a group and short list possible solutions	For design mock ups or prototype, a number of inexpensive, scaled down versions of solution can be created. Prototypes may be shared and tested within the team itself, in other departments, or on a small group of people outside the team. This is a trial phase, and the aim is to identify the best possible solution for each of the problems identified during the first three stages. The solutions are applied within the prototypes, and, one by one, they are investigated and either accepted, improved and re-examined, or rejected on the basis of the users’ experiences. By the end of this stage, one would have a better idea of the limitations in the situation and the problems present, and have a clearer view of how real users would behave, think, and feel when using the new solution.	
		General Learning Outcomes	Points to remember	Specific - Learning Outcomes
		Evaluate the best solutions after brainstorming Understand about the importance of detailing to enforce an idea.	<ul style="list-style-type: none">• Remind student to look at the perspectives of all the stakeholders• Provide access to information about the immediate environment	Enter Learning Outcomes
		Students will be able to	Knowledge	
Task 4: Final Design Solution Presentation 35 minutes: Class work 30 mins Home		<ul style="list-style-type: none">• Implement a selected option• Brainstorm in a group and short list possible solutions	This is the final stage of the design thinking process. The solution thought about now needs to be tested. However, even at this stage the solution can be relooked and thought about again in order to avoid a problem solution. Since a presentation needs to be done, scaffolding must be provided for organizing the slides, sequencing and reminders to include all the stages in the presentation.	

General Learning Outcomes	Points to remember	Specific - Learning Outcomes
<ul style="list-style-type: none"> - Students will be able to ideate and think of possible solutions - Evaluate the best solutions after brainstorming - Learn about the importance of detailing to enforce an idea. 	<ul style="list-style-type: none"> - Remind student to look at the perspectives of all the stakeholders - Provide access to information about the immediate environment 	

Important Terminologies

Prototype	a first or preliminary version of a device, or vehicle from which other forms are developed.
Brainstorm	a spontaneous group discussion to produce ideas and ways of solving problems.
Ideate	To form an idea or imagine
categorize	place in a particular class or group
mind mapping	A mind map involves writing down a central theme and thinking of new and related ideas which radiate out from the centre.

Assessment Rubric

Achievement Levels	1-2 BEGINNING	3-4 DEVELOPING	5-6 PROMISING	7-8 PROFICIENT	9-10 EXCELLENT
Problem/Issue Identification	Unable to comprehend at all or needs help to identify the key elements of a problem and/or the objectives with a great deal of assistance	Identifies the key elements of a problem and vaguely outlines the objectives with assistance	Identifies the key elements of 2 problems and outlines the objectives with assistance	Identifies the key elements of 3 problems and clearly outlines the objectives in an effective manner with little assistance	Identifies the key elements of 4-5 problems and clearly outlines the objectives in an effective manner with no assistance.
Ideation and Observation	Unable to ideate or observe or needs a great deal of assistance to interact with the school environment and note down observations	Needs some assistance to interact with the school environment and note down observations	Develops strategies to interact and use logical reasoning to observe and note down observations with assistance	Develops strategies to interact with the school environment and use logical reasoning to reach accurate results with little assistance	Develops strategies to interact with the school environment that are insightful and use logical reasoning to reach accurate results with no assistance
Analysis and Documentation	Is unable to or needs a great deal of assistance to document a representation that reflects the problem and solution	Documents one representation with assistance that accurately reflects the problem and aids in solving the problem	Documents more than one representation with assistance that accurately reflect the problems and aid in a limited manner in solving the problems	Documents more than two representations that reflect the problems and aid in solving the problems with little assistance.	Documents more than four representations that accurately reflect the problems and aids in solving the problem with no assistance
Presentation	Is unable to expedite at all or needs a lot of assistance to ideate, collate and present 2-3 slides that reflect the basics of design process with limited solutions	Needs some assistance to ideate, collate and present 4-5 slides that reflect the basics of design process with appropriate solutions	Displays average skills to ideate, collate and present 6-8 slides that reflect the basics of design process with appropriate solutions	Displays above average skills to ideate, collate and present 9-11 slides that reflect the basics of design process with appropriate and innovative solutions	Displays a high level of creative skills to ideate, collate and present 12 slides that reflect the basics of design process with very innovative solutions

Resources and references:

1. <https://www.interaction-design.org/literature/article/stage-2-in-the-design-thinking-process-define-the-problem-and-interpret-the-results>
2. <https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process>

1.0

Introduction to Design Thinking and Innovation in Schools:

1.1

What is Design?

To understand what is design, let's look at quotes by designers:



"Design is solution to a problem"
- John Maeda, Designer and Teacher

"Essentials of design are- purity, precision, details "
- Prof. Sudhakar Nadkarni, Designer and Teacher



"Design is thinking made visual"
- Saul Bass, Graphic Designer

"Design is plan for arranging elements in such a way
as best to accomplish a particular purpose "
- Charles Eames, Designer and Film Maker



"Design is not just what it looks like and feels like.
Design is how it works."
- Steve Jobs, Designer and Businessman

In a nutshell, design is about understanding needs and being sensitive to issues, identifying problems that need to be solved, creating innovative appropriate solutions, considering aspects of sustainability such that it makes a positive difference to life on our universe.

1.2

Who is a Designer?

A designer is a highly creative person who enjoys solving problems. A designer also needs to be a sensitive human being empathetic to issues and problems.

As a designer, you will learn to identify problems, think of a creative solution to solve it and show and demonstrate how this can be done such that it adds value to peoples' lives. (Ref: 2)

Design is part of the creative industry and has many options for you to pursue, such as: Communication/Graphic Design, Product Design, Animation Design, Automobile Design, Architecture Design, Environmental Design, Digital Design, Textile/Fashion Design, and such.

So, if you are looking for something which will give the creative streak in you an outlet and also provide you with innovative problem-solving skills, design may be the option for you.

One can understand Design Thinking as a method to solve problems using a process.

1.3

What is Design Thinking?

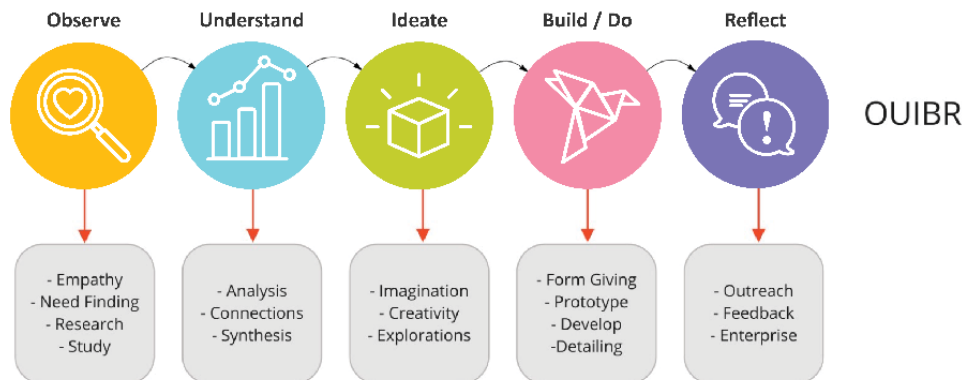
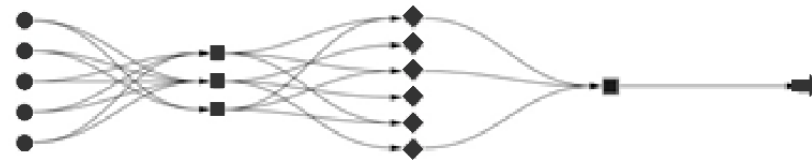
A process that first understands user's needs, identifies and analyses a problem, and research relevant information, after which ideas are explored and analyzed, until an appropriate innovative solution to the problem or need is arrived at. Hence Design Thinking could be viewed as the process that translates an idea into a blueprint for something useful, whether it's a vehicle, a building, a graphic, a service or a system. (Ref: 2)

1.4

What is the design Thinking Process?

It involves these following five phases in the process of solving a problem:

1. Observe/Empathize/Research,
- the first phase helps you to identify needs and locate issues to be solved through observation and empathy
2. Understand/Analyse/Define,
- this phase of the process helps you to understand, define and analyse the problem area
3. Ideate/Alternate/Create,
- this phase helps you to come out with several alternate creative innovative solutions to the problem
4. Build/Prototype/Detail and
- this phase helps you to actualize the solution by building mock-ups, creating scenarios and then prototyping and detailing
5. Evaluate/Reflect/Implement
- the last phase is to get feedback through evaluation so that the suggestions can be implemented in the final solution.



1.5

Who is a Design Thinker?

A Designer Thinker is a person who applies the Design Thinking process to solve problems and finding an creative innovative solution in any field or domain. For example, you could apply Design Thinking to solve problems in arts, social sciences, law, medicine, engineering, business, etc. It could even be applied to solve problems at home or in your neighbourhoods or your place of work. If everyone could adopt this method to solve problems then we would be moving towards a creative society which finds solutions to many of its problems.

1.6

What is Design Innovation?

Innovation involves implementation of something new and replacing or reframing of the existing mindset. It is about translating a concept, idea, thought or invention into artefacts and services that creates value to life. It is the process of transforming ideas into commercial reality. Innovation plays a major role in society. It helps us cater to the needs of people that arise from constant physical and emotional changes. It helps identify the crucial applications of technology and scientific inventions.

As compared to Innovation, Invention happens once in a while. However, each Invention may produce millions of Innovative Products – like the invention of Wheel has produced and continues to produce Innovative Products for the benefit of mankind. Innovation is in how an invention can be used to solve problems. Hence, Design pursues Creativity of Innovation.

1.6

Why should a student opt for this curriculum?

Design Thinking and Innovation will assume an ever more important role to play in the future of our world. This will help address, identify and solve problems creatively whatever the field or specialization. It should be useful to find solutions to issues both within one's own neighborhoods and to issues at a national or global level. It will also be a useful tool for us to move towards a creative economy in the coming years. So if you would like to be part of this creative innovative practice, do opt for this subject.

What areas or specializations of design can one pursue?

Design today is everywhere. It's driving businesses, cultures, media and technology and making sure environments (virtual or real) are easier to navigate. Design is integral to the creative industries and is part of the economy driven through creativity and innovation. We could categorize the following as broad fields of design which imbibe various specializations within themselves. These are some of the options for you to pursue as part of your future studies or as a carrier option:

- Communication design (Animation, Publication Design, Web Design, Graphics Design, Printing, Film and Video)
- Spatial design (Architecture and Interior Design, Environmental Design, Exhibition Design, Set Design, Signage Design)
- Industrial Design (Transportation, Furniture, Ceramics, Products and Packaging)
- Textiles Design (Fashion, Accessories, Jewellery)
- Craft Design (Material Based, Technology based)
- Digital design (User experience design, User Interface design, New Media Design, Game Design, AR/VR/MR, Information Visualisation)
- Service Design (Social Services, Health and Wellness Services, Agriculture Services, Public Services)
- Design management (Design Policy, Design Strategy, Design Planning, Transformation Design)

2.0 Aims and Objectives of Design Thinking and Innovation Curriculum:

2.1

What is the overall vision and aims of Design Thinking and innovation Curriculum?

The overall vision of DT&I curriculum is to be able to instill the following in the students:

- Students should be able to explore their sensory abilities, cognitive abilities, and social abilities
 - It should create awareness in the students through observation, discovery, analysis, experience, collaboration, and reflection
 - It should nurture their curiosity and enhance their explorative abilities
 - It should foster creativity and innovation in students
 - The students should be able to identify problems and be able to find solutions
 - They should be able to apply design thinking process and methods to solve various problems
 - They should be able to learn the fundamentals/essentials of creative design discipline
 - The focus is more on hands-on knowledge learnt by doing, exploring and acting upon challenges discovered within their surroundings
-
- In addition, DT&I will promote socially responsible practice through enlightening the students with ways to solve problems within the Sustainable Development Goals as mentioned by the United Nations.
 - The course will also help students derive culturally-rooted understanding of design from information documented under the Indian Knowledge Systems.

2.2

What are the learning objectives and competencies of Design Thinking and innovation Curriculum?

The students should be able to do the following after taking the DT&I modules:

- The students will enhance their observation skills and build empathy for issues and problems concerning users and our environment
- The students will improve their communication skills to be able to make presentations and defend their ideas and thinking with confidence
- This curriculum will bring in sensitivity to various aspects of design
- The students will be able to identify potential problems and be able to understand and analyse them
- The students will learn to explore creative innovative alternatives as possible solutions
- The students will learn how to create solution scenario, make mock-ups and build prototypes

2.3

How does the focus of the curriculum change from grade 6 to grade 12?

The focus of the curriculum for the different grades are as follows:

- Grade 6/7/8:

- Focus on exposure and discovery

During Grade 6/7/8 the students get an initial short exposure to Design Skills, Design Sensitivity and Design Thinking Process with the main aim of creating an interest in this field.

- Grade 9:

- Focus on concerns, skills and sensitivity

During Grade 9, it involves learning of Design Skills, Building Empathy with Analysis and application of Design Thinking Process to simple Problem Solving.

- Grade 10:

- Focus on creativity and problem solving

Grade 10 involves further learning of Design Skills, discovery through Creative Explorations, Prototyping and application of Design Thinking Process to Contextual Problems.

- Grade 11:

- Focus on design options and solving problems together

Grade 11 will introduce students to different fields/branches of Design and Design Thinking Process involving projects solving Wicked Problems. They learn to work collaboratively and discover how to start a Design Enterprise.

- Grade 12:

- Focus on application and execution

in Grade 12, the students will be able to apply Design Problem Solving to different Environments followed by a Semester long Design Thinking Process Capstone Project where they will get a chance to implement all that they have learnt during the Design Thinking and innovation curriculum.

2.4

Which student can opt for Design Thinking and Innovation curriculum?

Design Thinking and innovation is open to all students who would like to learn about this field.

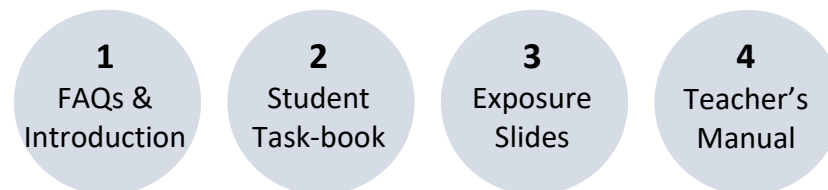
It is being introduced as part of the skill subject as per the mandates of the National Education Policy 2020.

The curriculum can also be adapted to the needs of the children with disability.

3.1

How is the content for Design Thinking and Innovation made available?

The content for the Design Thinking and Innovation curriculum is made available through these four documents which will be available online.



1. FAQs and Introduction

This document will provide an introduction to Design Thinking and innovation as well as answer all the frequently asked questions regarding this new subject in the school curriculum

2. Workbook

This will comprise of an introduction to the subject, its vision, learning objectives and competencies, the tasks to be done, grading criteria, assessment matrix, Feedback forms and references

3 Exposure Slides/Video

Each of the modules will be supported by exposure slides or video that can be accessed by both the teacher and the students.

4. Teacher's Manual

This will have more details on teaching methods, aims and objectives, task sequence flow, task details, assessment matrix for grading and evaluation forms for feedback.

3.2

How will Design Thinking and Innovation be implemented in Schools?

DT&I will be implemented from Grade 6 till Grade 12. In Grades 6, 7, 8 the students will get an initial exposure to DT&I for a duration of 18-20 hours such that it can create an interest in this field, nurture their sense of curiosity, motivate them to explore, experiment and take it up as a subject to pursue from Grade 9 onwards. From Grade 9 till Grade 12, DT&I will be introduced as a regular subject comprising of various related modules with duration of 160 hours for each grade. The recommended duration of contact hours is 2:1 between school hours and home hours. All CBSE schools are eligible to introduce DT&I as part of their curriculum.

3.3

How is Design Thinking and Innovation taught and assessed in schools?

DT&I learning involves playful joyful immersive experiences. The students learn through experiential, exploratory, do-it-and-learn methods. They learn by solving contextual problems. They will explore and experiment creative options. The students will work together, collaborate and cooperate while finding solutions. The classrooms will become studios where they can explore different materials and processes. The teacher will be like a mentor who supports the students in the learning and doing process.

It is recommended that 3 periods of 40 minutes each be combined together into 2 hour duration for the DT&I classes such that it gives sufficient time to solve the given task.

The learning happens through exposure to the subject, solving problems/tasks defined in the workbook, discussions and presentations.

The assessment is through continuously assessing the performance of work/tasks carried out by the students throughout the academic year. The criteria for assessment are defined in the workbook for each of the tasks.

3.4

What infrastructure do schools need for conducting Design Thinking and innovation classes?

The curriculum has been structured such that DT&I can be taught in schools in normal classrooms. Provision should be made for students to work together in groups of 2 to 4. Arrangements should be made to put up the student's work on the walls of the classrooms to facilitate discussions as well as for the presentation of the work.

Computer facility and access to the internet will be helpful but is not a must. For schools without access to the internet, the Workbooks, Teacher's Manual, and the Exposure Content can be made available physically through printouts.

The Design Thinking and Innovation curriculum is easy to understand and deliver for teachers. And, it can be taught in remote locations with limited resources and knowledge.

3.5

Who will be the Design Thinking and Innovation specialist at your school?

It is best to train your existing teacher to implement the Design Thinking and Innovation curriculum in your school. The Teacher's Manual is made available in order to facilitate and support this activity.

CBSE will be providing training to teachers of the schools.

The DT&I course will be made easy to understand and deliver even with limited resources. This will facilitate teachers located in remote areas.

3.6

What will the impact of implementing Design Thinking and Innovation curriculum in Schools?

This subject will impact in the following ways:

- The Design thinking Process will impact all aspects of Schools including innovative thinking of teachers
- This will help a large number of schools who already have Atal Tinkering Lab and need to integrate this process for productive outcomes.
- This will help to ensure focused utilization of various government schemes and policies towards design and innovation

4.0

References

Reference 1: <https://dsource.in/resource/quotes>

Reference 2: <http://designindia.net/institutions/design-information/design-questions>