

Special Project

Design & Technology: A Curriculum for School Children

- Guide: Prof. K.Munshi

My Approach and Process :

1: Understanding the Syllabus:

- Helps to **target weak areas**. *(i.e. areas of the syllabus which deal in Design & Technology but fail to convey completely to the students).*
- Helps to **detect potential areas of design & Technology** which would be of **future** help to the student's understanding.
- Also reveals the **understanding pattern and potential** of the students of that age.

2: Objective:

- Enlist the areas of target, and draft the **learning objective** of students for the same.

3: Brainstorming:

- Enlist briefly as many ideas of exercises as possible that fulfill each objective.
- Combine/ enrich the ideas if possible.

My Approach and Process :

4: Idea Evaluation:

- Desirable exercises by the kids
- Desirable exercises in teacher's view.
- Evaluation of the learning potential.
- Its suitable age segment.
- Material availability and awareness.
- Intensity of complexity
- any skills required?

5: Exercise Development:

In accordance to the above evaluation and feedback, a detailed exercise shall be developed.

The exercises shall follow a particular **format**.

6: Feedback from Students & Teachers :

- shall concentrate on :
- the interest generated by the students,
- any relative ideas if any,
- any areas of improvement required?
- any unmanageable constraints?
- any underestimated areas of exercise?
- its feasibility.

My Approach and Process :

7: Personal Observations:

- student's enthusiasm,
- new insights,
- improvements realized,

8: Refinement of the exercise:

Format of the Exercises:

Introduction

- A brief overview of the exercise.

Objective

- The learning objective for students within the exercise.

Learning Goal

- My goal of the exercise.

Required Knowledge Base:

- Basics require to learn pre exercise.

Challenges:

- A clear view of the challenges that the students shall face.

Materials Required:

- The materials must be readily available, non-toxic, and harmless.

....Format of the Exercises.....:

Instructions:

- Explains the exercise process in detail with the sequential order to follow.

Assessment:

- A detailed explanation of the process of assessment.

Extensions:

- Any additional points to the exercise to bring in more complexity and interest.

Related Exercises:

- Any related exercises that are brought inn by new insights.

Students Handout:

❑ **Data Collection:**

➤ **Syllabus Analysis:**

- 25 no. of students were interviewed from different grades .
- helps us to **gauge the student capabilities** of a particular grade of students.
- **Loop holes** within many topics of the syllabus of science and mathematics were observed.
- ✓ *Loop holes are those parts of the syllabus which are not clearly understood by the students.*
- This may be due to –lack of practical exposure,
 - lack of interest within students,
 - unaware of its practical implications.
 - teaching methodology.

❑ **Data Collection:**

➤ **The Syllabus Loopholes:**

▪ **Visualization of Concepts & Phenomenon:**

- students failed to understand many concepts and phenomenon due **to lack of visual illustrations.**
- Could be in **form of slides, animated illustrations,**
- an **animated illustration of sound transfer, and heat transfer** were shown to 25 students.
- **15 students failed to identify** between that of sound and that of heat.

▪ **Electrical Charges and Circuits:**

- students find it difficult to visualize the concepts of current, voltage, etc. as it is not seen, but only within the conductor.

▪ **Nature of Sound and its Principles:**

- Sound is only heard and not seen. Hence illustrations are required.

▪ **Nature of Light and its Principles:**

- Students find it difficult to distinguish the properties between sound and light.
- Hence, again, illustrations are required.

❑ **Data Collection:**

▪ **Graphs and its Effective Utilization:**

- it was seen that graph was a subject very much overlooked and avoided by students.
- this may be true because students are not taught the uses of graphs and its implications.

▪ **Principle of Magnets:**

- although without any external forces, exhibits attractive and repulsive forces
- The concept of magnets was also an ambiguity to students.

▪ **Stress and Strains:**

- It was seen that students lacked to understand a clear difference between stresses and strains.

▪ **Moment and Inertia:**

- The definition of these by hearted by all students. But all lacked a clear understanding of the concept of inertia.

▪ **Structural strengths in Geometry:**

- this subject seemed very boring to many students as it did not reveal its practical implications in real life - like space frames, construction basis, stability issues etc.

❑ **Data Collection:**

▪ **Transitions of States of Matter :**

-Students would understand the properties of different states of matter. But fail to understand the concept of **latent heat and change of state of matter**.

▪ **Friction and its effective utilization:**

- similar to topics like graphs, inertia and moment, friction also is less understood by students as it lacks to imbibe the **utilization and implications** of friction in the real world.

▪ **Concept of Vectors:**

▪ **Trigonometry**

- students would by heart the chapters of trigonometry, without actually understanding what is trigonometry. The formulas of trigonometry are derived from the quadrant divisions of a graph plane.

▪ **Map reading, and drawing (*sense of proportion*).**

-students must be exposed to proportions and map drawings from their early ages itself. It
-would also give them a sense of scale.
-Many students fail to understand the concept of scaled drawing unto graduation.

▪ **Aesthetics**

- there was no trace of aesthetics within any of the subjects of the curriculum.
- the student's education life goes on without any exploration on aesthetic senses.
- His aesthetic senses are tested only if he later enrolls into a creative design field.
- Hence - a need that students must explore into their aesthetic senses too.

❏ **Brainstorming:**

✓ *A brainstorming of idea objectives were done with the above mentioned topics.*

▪ **Sound:** *The objective of the exercise was to understand sound principles- its transfer behavior.*

-Ideas:

- a) **Make a personal desk speaker using simple paper.**
- b) **A mechanical telephonic connection using simple boxes and string.**
- c) Make a megaphone using magnetic properties.
- d) Design and construct a musical instrument.
- e) Construct drums with any material.
- f) Design and construct a bell – understand different sound qualities and its perception.

➤ *The first two ideas were taken and an exercise was made out of it.*

- The objective of the first exercises was to acquaint the students with sound and its behavioral qualities.
- The objective of the second exercise was to perceive the transfer pattern of sound in a solid medium.

❏ **Brainstorming:**

▪ **Structural Strengths in Geometry:**

Objective- *bring in geometry into practical implications, thereby understanding structural framework, and stress and strains, compression and tensile forces etc.*

- a) Construct a Bridge using only paper.
- b) Construct a bridge with provided material.**
- c) Construct a tower with limited materials.
- d) Explore new frameworks to build bridges.
- e) Design a support from only paper/straw to bear a given load.
- f) Using simple paper, make the longest free standing cylinder.
- g) Make a sphere with equilateral triangles / pentagons (*the Geodesic Dome*).
- h) Make an object out of paper/ straw.

The second idea was shortlisted and an exercise was drafted for it.

❑ **The Exercise :**

❖ **Construct a Bridge:**

Introduction:

- Getting students to understand the concept of stress and strain through a basic material like plastic.
- the effects of different assemblies of a particular module on stress and strains.
- It shall enhance the understanding of rigid frame structures to a higher degree.
- student faces challenges like – limitation in material, its joinery, the desired span of the bridge, the load it has to carry, and the time constraint.
- The exercise also brings in management parameters where the students first needs to clearly plan the amount of material required for the desired span of the bridge.
- Suitable for grade – 6th and 7th.

The Exercise :

Aim:

To construct a bridge within the given material and constraints.

Objective:

- To get the students to understand the effects on stress and strains of the body in relation to the acquired framework and assembly.
- The exercise also ascertains a required amount of planning and management.

Learning Goal:

- Understanding stresses and strains on a rigid body with respect to its assembly and framework.

Required Knowledge Base:

- Basic knowledge of structural frames.
- Joinery details
- Basic geometry and mathematics.

Challenges Met:

- A proper planning of the construction is required.
- Constructing a bridge of the desired span, within the time and material constraint. This bridge must also sustain a particular amount of load.

❑ The Exercise :

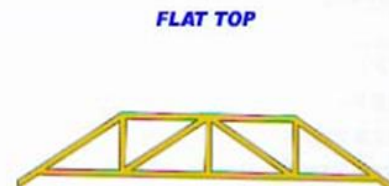
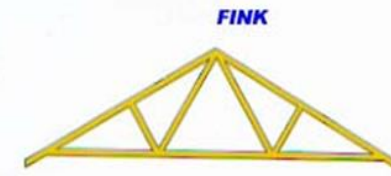
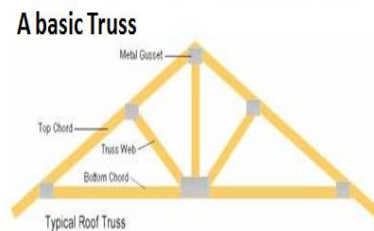
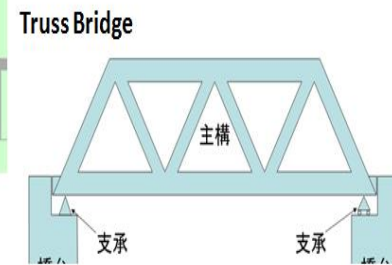
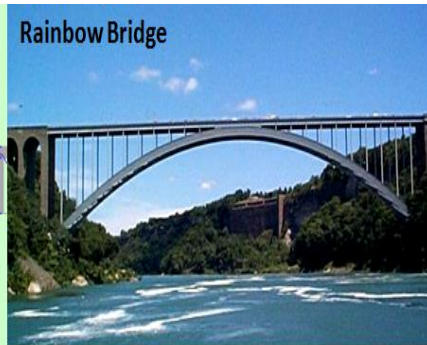
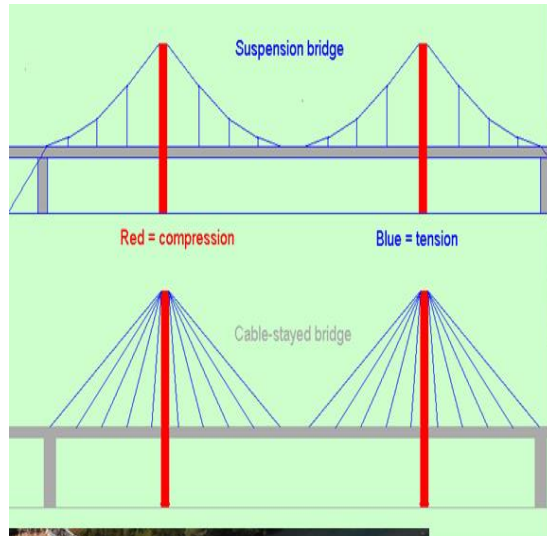
Materials required:

- Plastic Straws,
- Cello tapes and adhesives,
- Plain A4 size papers,
- Threads.

Instructions:

- The students must be briefed with the basic geometries of stability; and provide a visual brief of various framed structures around the world.
- The students are made into groups of three or two.
- Each group is provided with a particular amount of material.
- A **barter system** is established between the groups where the student identifies the amount of material required, and then **plans his/her model**.
- Prior to the exercise, the student can **experiment on a basic module**. (*through sketches, and model*).
- The challenge is to construct a bridge which is stable, can sustain a particular load, and has an appreciable span. *Let the span vary - **the higher the span the better**.*
- The students are given a limited time (*say **1 ½ hr.***).
- The students are then supposed to briefly explain the features of their bridge, - sketches shall be appreciated.

Reference Images:



Assessment:

- The assessment shall comply on the maximum span, its stability, the load carrying capacity, its frame work, prior planning, joinery details, innovative methods of joinery, and extent of explorations.
- Separate value shall be given to the post briefing of the bridge structures that students provided.

Extensions:

- The span of the bridge shall be kept constant, and the amount of weight it shall sustain must be a variable.

❑ Student's Handout:

Construct a Bridge:

- As shown by the teacher, understand the basic geometries of stability, and glance through various examples of framed structures existing today. Take your time and understand its geometries and details.
- You are given a maximum time of **1 ½ hrs.** for the exercise. Some amount of material is issued to you. You will have to barter your material with other groups as per the below value table, to acquire your required materials.
- *Make sure you are issued materials that **hypothetically value Rs.10/-**.*
- Now, start your exercise - *Utilize the first 20 minutes to plan and manage your resources.*
- Construct your bridge using any or all materials available. Note that the larger the span the better. Also note that the bridge should be able to carry a given load of 350 gms.
- Your innovation in joinery detail, frame structure, and explorations will be appreciated.
- Also, the cheaper the bridge the better. Hence it does not become necessary to utilize all the available material.
- After completion of the bridge to your satisfaction, write a brief about your learning from this exercise. Also, explain the features of your bridge. Explain the good and bad points of your bridge.
- *Use sketches wherever required.*
- *Maximum time given – 1 ½ hr.*
- *Maximum material value – Rs.10/-.*

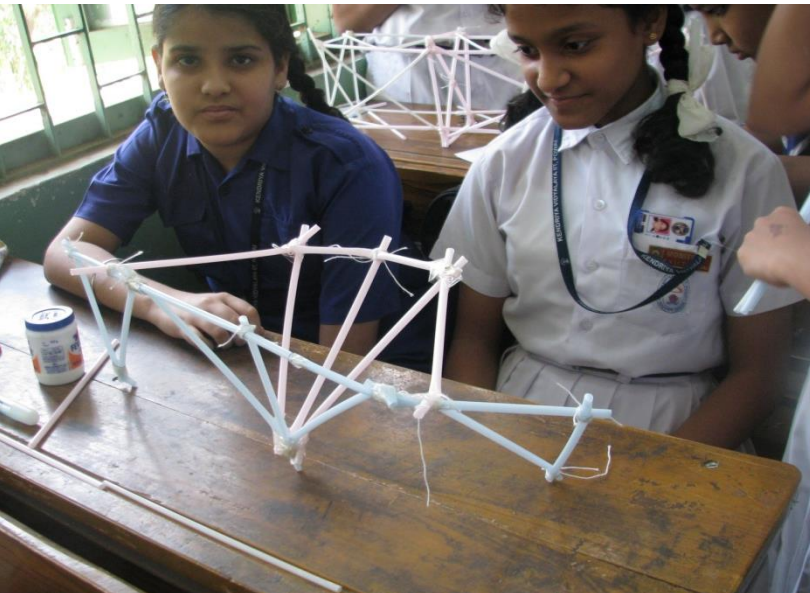
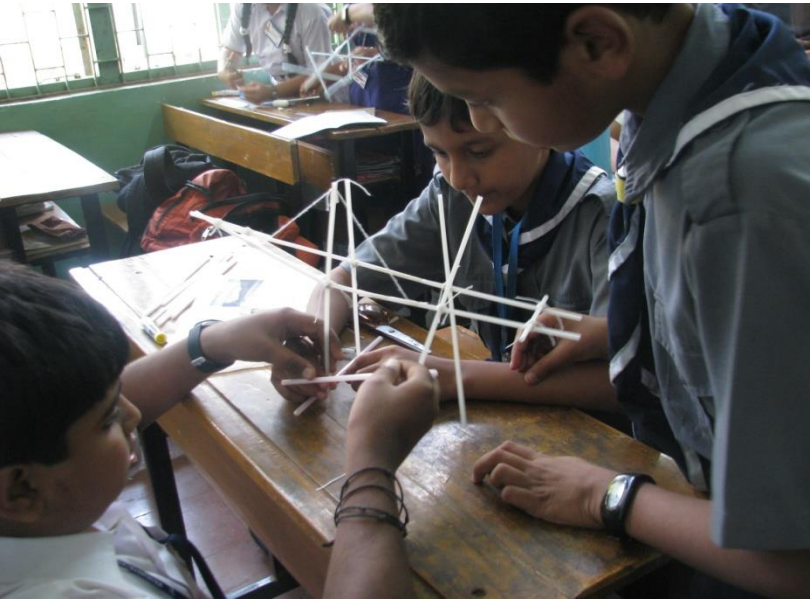
Material	Value (Rs.)
Plastic Straws	0.40
A4 Paper	0.10
Threads	0.10 (<i>per ft.</i>)
Adhesive	----
Cello Tapes	0.20 (<i>per feet</i>)

❑ User Study:



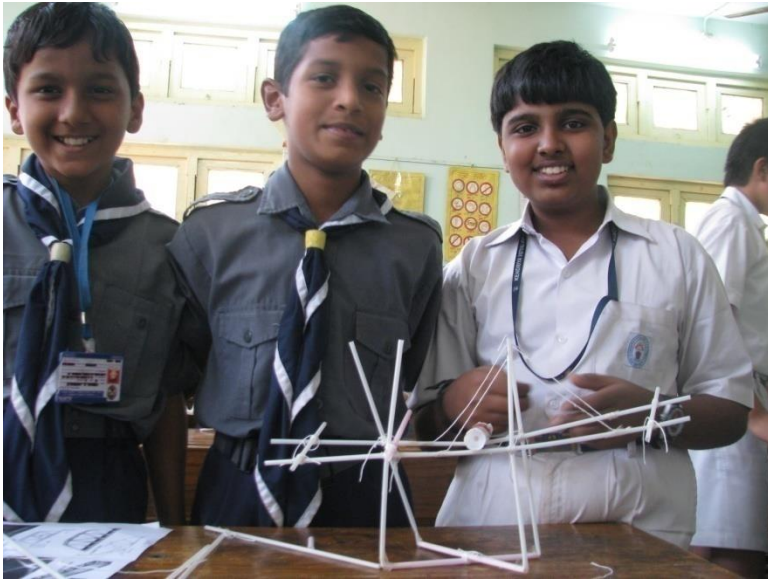
- The exercise 3- '**Construct a Bridge**' was implemented to school children (24 nos.) of the grade six under the supervision of the school teacher.
- A group of 3 students each was made, with 8 nos. of groups performing the exercise.
- The total time given was 1 ½ hr. for this exercise.
- The students were provided with a handout which conveyed the requirements of the exercise, and the sequential order of approach for that particular exercise.
- The students were also provided with a few snapshot examples of famous structures, and types of bridges, and trusses.
- Here, the exercise was curtailed only to specific material – plastic straws and thread.
- There was limitation of material to be used. A few group of students were provided with extra material as case specific.
- Later the student's and teacher's feedback was taken for the same.

❑ User Study:



- great **enthusiasm** was seen within the kids
- At the start the students decided and sketched (*although very less*), and started making the model. A few came up with great results.
- Students tend to **avoid sketching**. More interest was seen towards practically making something.
- During piloting the class it was observed that the **senses** of structural rigidity, structures, geometry, etc. was already nesting within their small minds.
- interesting situations came up where the student had to understand **why his/her model could not be rigid, stable or freely standing**. Hence it forced them to think in the required directions.
- A group made a suspension bridge. Some groups came up with weird structures rather than a bridge.

❑ Teacher's Feedback:



- The exercise is **complicated** for the 6th grade, as it involves a great deal of planning, and forethought due to the material constraints and barter system followed.
- Hence, the test of **managerial skills** was of a higher level of approx. 9th grade.
- The materials could preferably be only curtailed to threads and straw.
- A **disciplined division of work** within each group of three would be preferred.
- Students could be handed over the notes to study, a day or two- **prior** to the exercise.
- They would like similar exercises to teach students the **concepts of areas, and volume.**



☐ Student's Feedback:

- Similar to the teacher's say - notes for study-2 days prior to the exercise.
- Time constraint of 1 ½ hrs. was less.
- They would like to construct other structures too.
- They needed more time.

Thank
You.

