joy2learn

Title: Understanding Trusses
Author: Michael Boulis, Brooklyn Technical High School, NYC
Subject Area/ Grade: Statics and Strength of Materials/ Grade 12

In this civil engineering project, students will learn about the different types of trusses, strength of materials, and the behavior and force of truss members; students will then design and build a bridge from soft balsa.

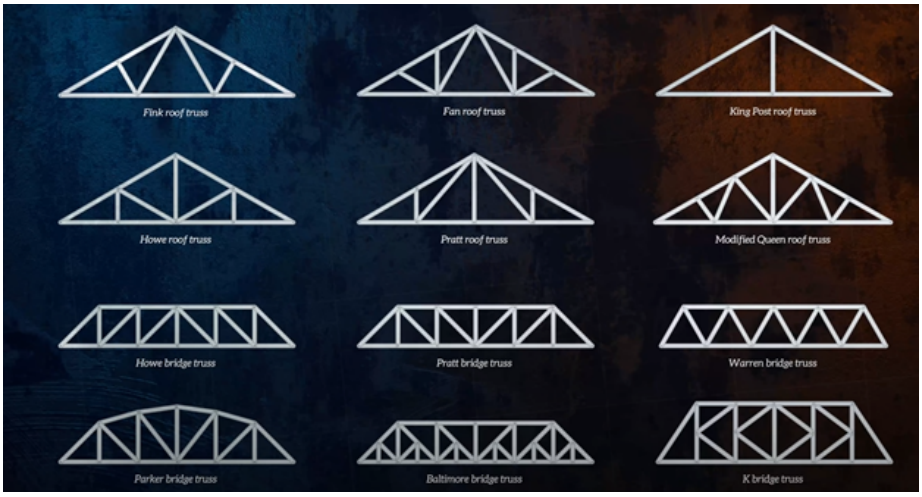
Goals

Students will be able to

1. Students will be able to know the different types of trusses by DRAW TRUSSES using “Pencils, Scale, paper OR using Autodesk software like AutoCAD or REVIT.
2. Students will be able to understand the behavior of a truss members under different loads
3. Students will be able to analyze the force in members. Which member will be in tension or compression.
4. The students will be able to use Trigonometry to calculate the value of the forces to be used in designing (another class) the members using
    a. The Method of JOINTS
    b. The method of SECTION.

Content Area and Standards

1. Understand that the simplest truss is a triangle.
2. Understand the PYTHAGORAS Theorem to be able to analyze inclined members.
   VIDEO LINK:
   https://www.youtube.com/watch?v=CAkMUdeB06o&feature=youtu.be
3. Analyze a simply supported TRUSS subjected to a given loading condition to determine reaction forces.
4. Understand the EQUATION OF EQUILIBRIUM
5. Find the values of forces in members to be used in DESIGN.
6. Students need to know some Trigonometry to be able to solve and analyze the problems .



Standard 2
BM AA:: Students will develop an understanding of the core concepts of technology Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.

MB BB: Optimization is an on-going process or methodology of designing or making a product and is dependent on criteria and constraints.

Standard 4:
Students will develop an understanding of the cultural, social, economic, and political effects of technology.

BMI: Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.

BMJ: Ethical considerations are important in the development, selection, and use of technologies.

Standard 9:
Students will develop an understanding of engineering design

BMI: Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.

BM J: Engineering design is influenced by personal characteristics, such as creativity,

resourcefulness, and the ability to visualize and think abstractly.

BM L: Decisions regarding the implementation of technologies involve the weighing of tradeoffs between predicted positive and negative effects on the environment.

Standard 11:
Students will develop abilities to apply the design process.

BM M: Identify the design problem to solve and decide whether or not to address it.

BM N: Identify criteria and constraints and determine how these will affect the design process

BM O: Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.

BM P: Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed

BM Q: Develop and produce a product or system using a design process.

Activity

1. STUDENTS WILL BE ASKED TO SKETCH OR TAKE A PICTURE OF ANY STRUCTURE (truss)
2. WATCH VIDEO TO UNDERSTAND THE CONTENTS
   VIDEO LINK https://www.youtube.com/watch?v=Hn_iozUo9m4
3. WATCH VIDEO TO UNDERSTAND OF THE SIDE EFFECT OF MISTAKES CARRIED OUT BY THE DESIGNER ON PUBLIC
   VIDEO LINK: https://www.youtube.com/watch?v=hBjntrebxj8

Balsa Wood Bridge

Objective: To design and build a bridge so it has as high a strength-weight ratio as possible and follows the following Specifications:
1. The bridge shall be constructed from only 3/32” x 3/32” soft balsa wood and any

type of glue or surface application.
2. The bridge shall be supported by two wood piers spanning 15” at the same elevation.
3. No part of the bridge may extend below the pier elevation
4. The load shall be applied by a wood plate centered on the span
5. The maximum width of the bridge at either end shall be 3-1/8”. The maximum height of the bridge shall be 4”

Joy2Learn Artists /Videos that Support Project

Session 1:
Practice the skills: https://youtu.be/gW0_KQT134w
Article: 4 Myths about Creativity:
https://www.edutopia.org/article/4-myths-about-creativity

Session 2:
Article: Divergent & Convergent thinking by Sara Smith
Link:https://www.fablevisionlearning.com/creativity-blog/2018/12/divergent-and-convergent-thinking

Article: Your Brain Can Only Take So Much Focus
by Srini Pillay Link:https://hbr.org/2017/05/your-brain-can-only-take-so-much-focus

Video: Richard Serra, Sculptor-Richard the Artist
Link: https://www.joy2learn.org/sculpture/my-thoughts/on-site/

Session 3:
Alan Gampel (PIANIST)
Video: Develop Technical Skills
Link:https://www.joy2learn.org/at-the-piano-featuring-alan-gampel/

Alan Gampel (PIANIST)
Video: Knowing the history of what you do and practice and do
Link:https://www.joy2learn.org/at-the-piano-featuring-alan-gampel/the-piano-an-introduction/the-piano-history/

Elizabeth Murry (Painter)
Video: Early Drawing
Link:https://www.joy2learn.org/painting-with-elizabeth-murray/growing-up/early-drawings/

Elizabeth Murry Painter

Video: Ambitions
Link:https://www.joy2learn.org/painting-with-elizabeth-murray/growing-up/my-ambitions/

Elizabeth Murry Painter
Video " NOTEBOOK"
Link:https://www.joy2learn.org/painting-with-elizabeth-murray/my-studio/an-artist-s-notebook/

Article by Youki Terada
The Science of Drawing and Memory
Link: https://www.edutopia.org/article/science-drawing-and-memory

Article by "New York Times" Matt Richtel
HOW TO BE CREATIVE
Link: https://www.nytimes.com/guides/year-of-living-better/how-to-be-creative

Session 4:
Video: Hector Elizondo
The importance of the words.
Link:https://www.joy2learn.org/theater/cyrano-de-bergerac/inside-hector-s-head/importance-of-words/

Video: Hector Elizondo
An Actor Tools.
Link:https://www.joy2learn.org/theater/cyrano-de-bergerac/inside-hector-s-head/an-actors-tools/

Video: Hector Elizondo.
An Actor Transformation
Link:https://www.joy2learn.org/theater/cyrano-de-bergerac/inside-hector-s-head/an-actor-s-transformation/

Video: Hector Elizondo.
Use of Language.
Link:https://www.joy2learn.org/theater/cyrano-de-bergerac/inside-hector-s-head/use-of-language/

Video: Hector Elizondo
Conclusion.
Link: https://www.joy2learn.org/theater/conclusion/

Article by Linda Flanagan,
How Improv Can Open Up the Mind to Learning in the Classroom and Beyond.
Link:https://www.kqed.org/mindshift/39108/how-improv-can-open-up-the-mind-to-learning-in-the-classroom-and-beyond

Article by HARVARD GRADUATE SCHOOL OF EDUCATION
Step Inside: Perceive, Know About, Care About.
Link: http://www.pz.harvard.edu/sites/default/files/Step%20Inside_2.pdf

Article by A.J.Juliani.
Why "20% Time" Is Good for Schools
Link: https://www.edutopia.org/blog/20-percent-time-a-j-juliani

Article by Dan Ryder.
What One Word Can Do: a Pathway to Critical Creativity in Any Classroom
Link:https://medium.com/@WickedDecent/what-one-word-can-do-a-pathway-to-critical-creativity-in-any-classroom-a38d8eb326fb

Article by Amy schwarzbach-Kang
Learning Math by Seeing It as a Story.
Link: https://www.edutopia.org/article/learning-math-seeing-it-story

Session 5
Video:Gregory Hines:
https://docs.google.com/document/d/1fMuppzn8KmYmv65Ed_ik8Qo_rJszURuB7KP_V0lQKeM/edit

- https://www.joy2learn.org/dancing/why/influences/
- https://www.joy2learn.org/dancing/why/changing-personal-styles/
- https://www.joy2learn.org/dancing/why/personal-expression/

Videos: Hector Elizondo

- https://www.joy2learn.org/theater/cyrano-de-bergerac/inside-hector-s-head/an-actors-tools/
  https://www.joy2learn.org/theater/cyrano-de-bergerac/inside-hector-s-head/importance-of-words/
- https://www.joy2learn.org/theater/cyrano-de-bergerac/inside-hector-s-head/an-actor-s-transformation/
- https://www.joy2learn.org/theater/cyrano-de-bergerac/inside-hector-s-head/use-of-language/

- Videos: Elizabeth Murry
  https://www.joy2learn.org/painting-with-elizabeth-murray/growing-up/the-profile

/https://www.joy2learn.org/painting-with-elizabeth-murray/growing-up/parents/
https://www.joy2learn.org/painting-with-elizabeth-murray/growing-up/a-fantastic-art-teacher/
https://www.joy2learn.org/painting-with-elizabeth-murray/my-studio/an-artist-s-notebook/

Videos: Frank Gehry

- https://www.joy2learn.org/architecture-with-frank-gehry/my-dreams/my-son-and-i/
- https://www.joy2learn.org/architecture-with-frank-gehry/my-dreams/my-dreams-come-true/
- https://www.joy2learn.org/architecture-with-frank-gehry/my-dreams/eisenhower/
- https://www.joy2learn.org/architecture-with-frank-gehry/my-dreams/a-developer-building/
- https://www.joy2learn.org/architecture-with-frank-gehry/my-dreams/interaction-as-a-creative-force/

Session 6
Video: Hilda Morgan
Cultural diversity The Sum of Our Parts (Madness and Miracles)
https://ed.ted.com/on/ab24SZOt
NOTE: After watching the video: Iam very much related to each word HIDA said in her video. At all times I ask myself WHO AM I?

Video: Pusarla Venkata Sindhu
Ideas worth spreading
https://www.ted.com/talks/pusarla_venkata_sindhu_limitless/recommendations/23926
How to get students inspired and NEVER GIVE UP!!!

Art Forms that May Be Included
Drawing & Sketching

Connections to Students Passion Areas and Interests

- Students have that passion of hands on.
- Students are interesting to learn about ENGINEERING & ARCHITECTURE SCALES (THEY ARE VERY EASY TO USE)

Materials Needed

- Pencil,
- Paper 8 ½” x 11”.
- Engineering Scale.
- Balsa wood (I will supply the wood)
- Cutter to cut the balsa wood.
- Calculator.

Collaborators

- The class will be divided into groups. Each group has two students Teacher/Students
- Students/Students

Assessment

Using a RUBRIC to assess the outcome of The BALSA WOOD Project

- In class we will do the testing using some heavy textbooks
- The students will be able to create a RUBRIC.
- They will be able to rank their work according to the number of books the TRUSS carries.
- 100 points for the TRUSS which will carry the most loads (Counting the number of the books. 95 points for TRUSS in second place,...and so on.
- The engineering drawing of the BALSA WOOD TRUSS
- The hand calculation of the member forces due to the weight of the books

Timeline

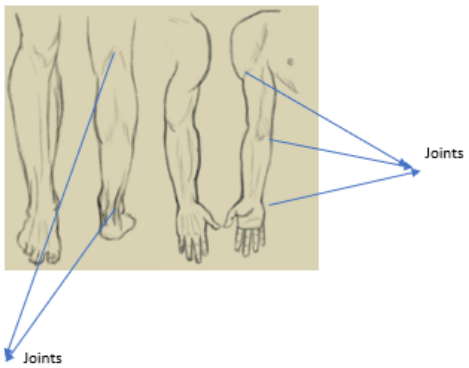
Two week of classwork. One period a day. 45 minutes per period.
(I am very much open to giving extra time if needed.)

Other Notes
How to Launch the sessions, and where we find it?:

1. Introduction from (ME) to class to what a truss is?
Members connect together through a join which will carry only tension force or compression force.

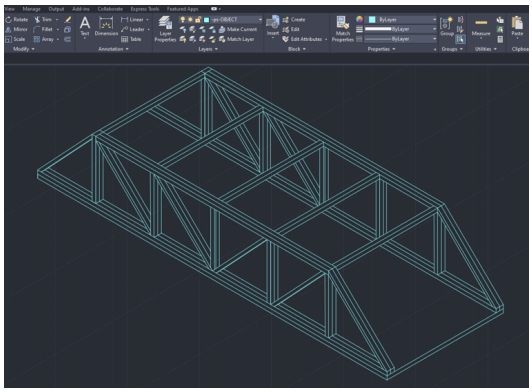
Example of our body.
Hands and legs are members connecting to joints which only can handle compression OR tension. One at the time. Hands and legs as a truss member can not handle tension and compression at the same time. IT IS EITHER OR!!! We can not bend our arms and

legs. We will have pain due to any bending. So, this is how the truss members will behave under loads.



2. Students will sketch and draw with colored pencils any structure they will see on their way to school using their ENGINEERING NOTES. Examples: (Bridges, or maybe a roof or ceiling of a Homedepot store, Some train stations have trusses.)

3. Next day: Students will be able to describe the sketches from their ENGINEERING NOTES.



4. Students will draw their sketch using AutoCAD (They had AutoCAD the year before they joined the class).

5. I used to take a trip with my class to"TACONY-PALMYRA BRIDGE" before having this lesson. If I am not able to do it I will show them that VIDEO
https://www.youtube.com/watch?v=LzgZmt2XiFQ
And that video
https://www.youtube.com/watch?v=Iw1faP6jjKM
And that video for a previous trip from my school (BROOKLYN TECH. HS)
Tacony Palmyra Bridge Visit - Brooklyn Tech (Civil & Architect)
As you can see the Bridge Engineer explained the function of how the bridge operate using some engineering terminology.

During the trip students will sketch in their ENGINEERING NOTES how they saw the bridge.

6. Students will search online about the history of TRUSSES.

7. Introducing the BALSA WOOD PROJECT

Balsa Wood Bridge
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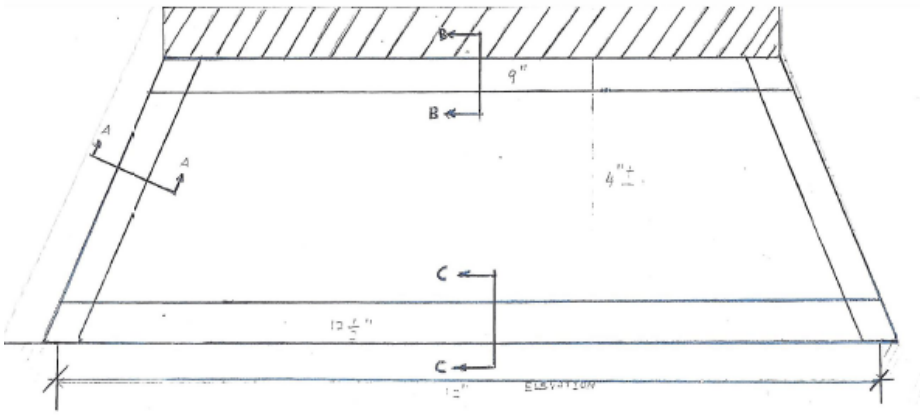
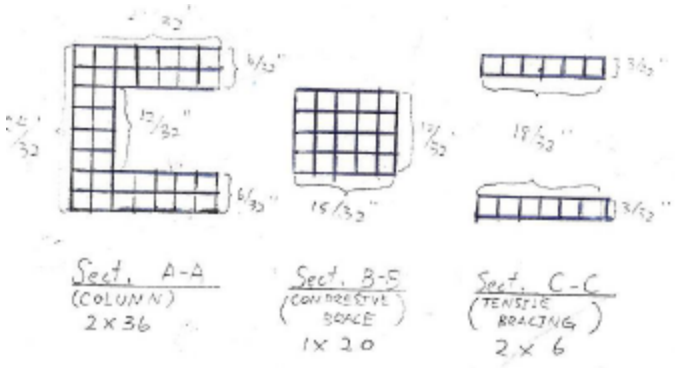
And supply them with materials. They will work on it in pairs in class.





This is How the BALSA WOOD TRUSS WILL LOOK LIKE. BUT STUDENTS WILL BE CREATIVE INTO THEIR DESIGN

8. Running the test on their BALSA WOOD Bridge using TEXT BOOKs. Each group will mark how many TEXT BOOK will their bridge carries and translate the number of text book into loads. (NOW, WE HAVE TRUSSES AND LOADS).

9. Supplementaries:
Students will watch this VIDEO (LECTURE) to have an idea on how structure works (I WAS NOT ABLE TO COPY & PASTE IN THE GOOGLE DOCUMENT. *I will email it to you.*

10. Now, it come to how to calculate the force members
I believe the students are ready for some arithmetics.

11. At the end students will be able to create their own truss bridge using a 3D printer (I have one in my class room).

- 20% TIME WHICH STUDENTS WILL HAVE TO CREATE THEIR OWN THOUGHTS BY GIVING THEM A PURPOSE FOR LEARNING AND CONDUCT FOR THEIR PASSIONS AND INTEREST.
- THERE WILL BE IN GROUPS TO APPLY COLLABORATION, AND COMMUNICATION.
- NO STRUCTURE NO CONSTRAIN. USING THEIR CRITICAL THINKING
- USING THEIR OWN IMAGINATIONS.
- DOING WHAT THEY KNOW AND APPLYING WHAT THEY DISCOVER TAKING INTO CONSIDERATIONS THEY ARE ALLOW TO MAKE MISTAKES WHICH WILL LEAD TO SOMETHING NEW.
- FROM THE START TO THE ENDS, MY STUDENTS WILL HAVE MY SUPPORTS AND MY ENCOURAGEMENTS.

CONCLUSION:

Creativity is something that enables us to be unique. As Gregory Hines mentioned, it is in all of us as humans given by the creator. Therefore, it develops by the surroundings, for example family, friends, and the environment...As we say “It takes a village to raise a child”. Creativity is about problem solving. Because of the challenges we face, creativity has to make sense of all what we deal with.