Unit 2: Structural Engineering

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **Full Year**
Status: **Published**

UNIT RATIONALE

Unit 2 delves into the field of structural engineering, exploring the principles and applications of designing and constructing stable structures. Students will learn about forces, materials, design considerations, sustainability, and engage in creative structural design projects. The unit culminates in a structural engineering competition where students can showcase their knowledge and skills.

ESSENTIAL QUESTIONS

Subtopic 2.1 - Intro
1. What is structural engineering and why is it important?
2. How do structural engineers design buildings and other structures?
3. What are the key elements of a stable structure?
4. How does structural engineering impact our daily lives?

Subtopic 2.2: Forces and Loads in Structures
1. What are the different types of forces that act on structures?
2. How do forces impact the stability and integrity of structures?
3. How can structural engineers account for various loads in their designs?
4. What strategies can be employed to strengthen structures against forces?

Subtopic 2.3: Structural Materials and Construction Techniques
1. What are the different materials used in structural engineering?
2. How do material properties affect the strength and durability of structures?
3. What construction techniques are employed in building stable structures?
4. How do structural engineers select appropriate materials and techniques for different projects?

Subtopic 2.4: Structural Design and Analysis
1. How do structural engineers approach the design process for structures?
2. What are the key considerations and constraints in structural design?
3. How can computer simulations and modeling aid in structural analysis?
4. How do structural engineers ensure the safety and stability of structures?

Subtopic 2.5: Structural Testing and Evaluation
1. How do structural engineers test the strength and integrity of structures?
2. What are the different types of structural tests used in engineering?
3. How do engineers evaluate and interpret test results to ensure structural safety?
4. What improvements can be made based on testing and evaluation feedback?

Subtopic 2.6: Sustainability in Structural Engineering
1. How can structural engineering contribute to sustainable development?

2. What are the key principles of sustainable design in structural engineering?
3. How do structural engineers integrate sustainable materials and practices in their projects?
4. What are the long-term environmental impacts of structural choices?

Subtopic 2.7: Creative Structural Design
1. How can creativity enhance structural design?
2. What are the key elements of aesthetically pleasing structures?
3. How do engineers balance functionality and artistic expression in structural design?
4. What innovative approaches can be used to create visually striking structures?

Subtopic 2.8: Structural Engineering Competition
1. How can a structured competition foster teamwork and problem-solving skills?
2. What are the key components of a successful structural engineering competition?
3. How can students apply their knowledge and skills to design and construct winning structures?
4. What are the benefits and challenges of participating in a structural engineering competition?

STANDARDS

NEW JERSEY STUDENT LEARNING STANDARDS: CONTENT AREA

New Jersey (NJSLS) - Grades 6-8 - Computer Science and Design Thinking (2020)

8.2.8.ED.1:
Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
8.2.8.ED.2:
Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3:
Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ED.4:
Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team.
8.2.8.ED.5:
Explain the need for optimization in a design process.
8.2.8.ED.6:
Analyze how trade-offs can impact the design of a product.
8.2.8.ED.7:
Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).

8.2.8.ITH.3:

Evaluate the impact of sustainability on the development of a designed product or system.

8.2.8.NT.1:

Examine a malfunctioning tool, product, or system and propose solutions to the problem.

8.2.8.NT.2:

Analyze an existing technological product that has been repurposed for a different function.

8.2.8.NT.3:

Examine a system, consider how each part relates to other parts, and redesign it for another purpose.

8.2.8.NT.4:

Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product.

8.2.8.ETW.3:

Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.

CS.6-8.8.2.8.ED.1	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
CS.6-8.8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
CS.6-8.8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
CS.6-8.8.2.8.ED.4	Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team.
CS.6-8.8.2.8.ED.5	Explain the need for optimization in a design process.
CS.6-8.8.2.8.ED.6	Analyze how trade-offs can impact the design of a product.
CS.6-8.8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
CS.6-8.8.2.8.NT.1	Examine a malfunctioning tool, product, or system and propose solutions to the problem.
CS.6-8.8.2.8.NT.2	Analyze an existing technological product that has been repurposed for a different function.
CS.6-8.8.2.8.NT.3	Examine a system, consider how each part relates to other parts, and redesign it for another purpose.
CS.6-8.8.2.8.NT.4	Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product.
CS.6-8.8.2.8.ETW.3	Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.
CS.6-8.8.2.8.ITH.3	Evaluate the impact of sustainability on the development of a designed product or system.

NEW JERSEY STUDENT LEARNING STANDARDS: CAREER READINESS, LIFE LITERACIES AND KEY SKILLS

CS.6-8.8.2.8.NT.1	Examine a malfunctioning tool, product, or system and propose solutions to the problem.
CS.6-8.8.2.8.NT.2	Analyze an existing technological product that has been repurposed for a different

	function.
CS.6-8.8.2.8.NT.3	Examine a system, consider how each part relates to other parts, and redesign it for another purpose.
CS.6-8.8.2.8.NT.4	Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product.
CS.6-8.8.2.8.ETW.3	Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.
CS.6-8.8.2.8.ITH.3	Evaluate the impact of sustainability on the development of a designed product or system.

NEW JERSEY STUDENT LEARNING STANDARDS: COMPUTER SCIENCE AND DESIGN THINKING

CS.6-8.8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
CS.6-8.8.1.8.DA.2	Explain the difference between how the computer stores data as bits and how the data is displayed.
CS.6-8.8.1.8.DA.3	Identify the appropriate tool to access data based on its file format.
CS.6-8.8.1.8.DA.4	Transform data to remove errors and improve the accuracy of the data for analysis.
CS.6-8.8.1.8.IC.1	Compare the trade-offs associated with computing technologies that affect individual's everyday activities and career options.
CS.6-8.8.1.8.IC.2	Describe issues of bias and accessibility in the design of existing technologies.

PRE-ASSESSMENTS

Pre-assessments for the structural design unit can help you gauge students' prior knowledge, skills, and understanding related to structural engineering. Here are some ideas for pre-assessments:

1. Concept Mapping: Ask students to create a concept map illustrating their current understanding of structural design. Provide them with key terms and concepts related to structural engineering, and have them connect and explain the relationships between these terms.

2. KWL Chart: Have students complete a KWL (Know, Want to Know, Learned) chart where they can list what they already know about structural design, what they want to know, and what they expect to learn during the unit. This allows you to assess their prior knowledge and understand their expectations.

3. Problem-Solving Scenario: Present students with a real-world problem related to structural design and ask them to brainstorm possible solutions. This helps assess their critical thinking skills, problem-solving approaches, and initial understanding of the design process.

4. Vocabulary Quiz: Administer a short quiz that assesses students' understanding of key vocabulary terms related to structural engineering. This can help identify any gaps in their knowledge and guide instruction accordingly.

5. Hands-On Construction Challenge: Assign a simple construction task, such as building a small tower or bridge using specific materials. Assesses students' ability to follow instructions, apply basic engineering principles, and work with materials.

6. Student Surveys: Distribute a survey or questionnaire that asks students about their interests, experiences, or prior exposure to structural design. This provides insights into their background knowledge and can help tailor instruction to their needs.

INSTRUCTIONAL PLAN

MODULE 2

Subtopics for Structural Engineering

Subtopic 2.1: Introduction to Structural Engineering

Subtopic 2.2: Forces and Loads in Structures

Subtopic 2.3: Structural Materials and Construction Techniques

Subtopic 2.4: Structural Design and Analysis
Subtopic 2.5: Structural Testing and Evaluation
Subtopic 2.6: Sustainability in Structural Engineering
Subtopic 2.7: Creative Structural Design
Subtopic 2.8: Structural Engineering Competition

Videos for Unit 2:
1. "Introduction to Structural Engineering"
2. "Forces and Loads in Structures"
3. "Materials and Construction Techniques in Structural Engineering"
4. "Structural Design and Analysis"
5. "Sustainability in Structural Engineering"

Art Projects (Culminating Projects):
1. Paper Bridge Design: Students create and test paper bridges, exploring the balance between strength and weight.
2. Clay Tower Construction: Students design and build clay towers, considering stability and height.
3. Wood Model Bridge: Students construct a small-scale bridge using wooden sticks, focusing on load distribution and stability.
4. Fine Art Structural Sculpture: Students create a sculpture using various art mediums to represent a

structural engineering concept or a famous landmark.
5. Large-Scale Cardboard City: Students work collaboratively to design and construct a cityscape using cardboard, showcasing their understanding of structural elements.

Subtopic 2.1

Subtopic 2.1: Introduction to Structural Engineering

Essential Questions:
1. What is structural engineering and why is it important?
2. How do structural engineers design buildings and other structures?
3. What are the key elements of a stable structure?
4. How does structural engineering impact our daily lives?

Success Criteria:
1. Define and explain the role of structural engineering in designing stable structures.
2. Identify and describe the key components of a stable structure.
3. Apply basic structural engineering principles to analyze and evaluate the stability of different structures.
4. Recognize the significance of structural engineering in various real-world applications.

Learning Intentions:
1. Develop an understanding of the field of structural engineering and its importance in society.
2. Explore the key principles and elements of stable structures.
3. Gain knowledge of the design process employed by structural engineers.
4. Recognize the impact of structural engineering on everyday life and the built environment.

Learning Strategies:
1. Watch YouTube video: [What is Structural Engineering?](https://www.youtube.com/watch?v=0_KhihMIOG8)
2. Class discussions on the importance of structural engineering in building design and construction.
3. Hands-on activities to explore basic structural components and their functions.
4. Research and presentation on famous structural engineering projects and their significance.

Activities:
1. Drawing Activity: Students will sketch and label the key components of a stable structure, such as beams, columns, and foundations.
2. Building Activity: Challenge students to construct a stable structure using everyday materials, focusing on incorporating key structural elements.
3. Clay Activity: Students will create clay models of various structures, emphasizing the importance of balance and load distribution.
4. Wood Activity: Using wooden sticks or blocks, students will build different types of trusses and explore their load-bearing capabilities.

YouTube Videos:
1. What is Structural Engineering? - https://www.youtube.com/watch?v=0_KhihMIOG8
2. The Role of Structural Engineers - https://www.youtube.com/watch?v=QW5vcqetk_s
3. Introduction to Structural Engineering - https://www.youtube.com/watch?v=H1P7uizqZdc
4. How Are Skyscrapers Built? - https://www.youtube.com/watch?v=lLAE6e2XXOU

Subtopic 2.2

Subtopic 2.2: Forces and Loads in Structures

Essential Questions:
1. What are the different types of forces that act on structures?
2. How do forces impact the stability and integrity of structures?
3. How can structural engineers account for various loads in their designs?
4. What strategies can be employed to strengthen structures against forces?

Success Criteria:
1. Identify and differentiate between different types of forces acting on structures, such as compression, tension, and shear.
2. Explain how forces can affect the stability, strength, and integrity of structures.
3. Analyze and evaluate the impact of different loads, including static and dynamic loads, on structures.
4. Propose and apply strategies to reinforce and fortify structures against external forces.

Learning Intentions:
1. Develop a comprehensive understanding of the types and characteristics of forces acting on structures.
2. Recognize the influence of forces on structural stability and integrity.
3. Learn to assess and consider various loads in structural design.
4. Explore methods to strengthen and enhance structures to withstand forces.

Learning Strategies:
1. Watch YouTube video: [Forces and Loads in Structures](https://www.youtube.com/watch?v=hEhGaoGXm5M)
2. Classroom discussions on different types of forces and their effects on structures.
3. Hands-on experiments and demonstrations to illustrate the impact of forces on structural stability.
4. Collaborative activities to design and build structures capable of withstanding specific loads.

Activities:
1. Drawing Activity: Students will create annotated diagrams to illustrate the types of forces acting on a structure and their respective effects.
2. Building Activity: Challenge students to construct structures using toothpicks and marshmallows, considering different load scenarios.
3. Clay Activity: Students will create clay models of structures and apply forces to observe their response and stability.
4. Wood Activity: Using wooden blocks or popsicle sticks, students will design and build structures capable of withstanding specific loads.

YouTube Videos:
1. Forces and Loads in Structures - https://www.youtube.com/watch?v=hEhGaoGXm5M
2. Types of Forces in Structures - https://www.youtube.com/watch?v=dWdWVYPsL3E
3. Load and Force Analysis - https://www.youtube.com/watch?v=EFQbwKM09xU
4. How Forces Affect Structures - https://www.youtube.com/watch?v=2FzIsbOOSx4

Subtopic 2.3

Subtopic 2.3: Structural Materials and Construction Techniques

Essential Questions:
1. What are the different materials used in structural engineering?
2. How do material properties affect the strength and durability of structures?
3. What construction techniques are employed in building stable structures?
4. How do structural engineers select appropriate materials and techniques for different projects?

Success Criteria:
1. Identify and describe common materials used in structural engineering, such as concrete, steel, and wood.
2. Explain how material properties, including strength, stiffness, and durability, impact structural design.
3. Demonstrate an understanding of construction techniques, such as framing, bracing, and anchoring, used in structural projects.
4. Evaluate and justify the selection of materials and construction techniques based on project requirements.

Learning Intentions:
1. Explore different materials commonly used in structural engineering and their properties.
2. Understand how material properties influence structural design and performance.
3. Learn about construction techniques employed in building stable structures.
4. Develop the ability to select appropriate materials and techniques for specific structural projects.

Learning Strategies:
1. Watch YouTube video: [Materials and Techniques in Structural Engineering](https://www.youtube.com/watch?v=NTJkUUnQTzw)
2. Research and presentations on different materials used in structural engineering and their properties.
3. Hands-on experiments and demonstrations to investigate the strength and characteristics of different materials.
4. Collaborative activities to design and build structures using specific materials and construction techniques.

Activities:
1. Drawing Activity: Students will create illustrations comparing the properties of different structural materials, highlighting their strengths and weaknesses.
2. Building Activity: Challenge students to construct a small-scale bridge using popsicle sticks and evaluate its load-bearing capacity.
3. Clay Activity: Students will experiment with clay to understand how different construction techniques, such as arches and buttresses, provide structural stability.

4. Wood Activity: Using wooden blocks or dowels, students will design and build structures using specific construction techniques, such as truss or frame systems.

YouTube Videos:
1. Materials and Techniques in Structural Engineering - https://www.youtube.com/watch?v=NTJkUUnQTzw
2. Structural Materials and Their Properties - https://www.youtube.com/watch?v=XKYIETsUu2g
3. Construction Techniques for Building Strong Structures - https://www.youtube.com/watch?v=ujOqZSIw1Tc
4. Wooden Structures: Techniques and Challenges - https://www.youtube.com/watch?v=9Kb-3QMYKCE

Subtopic 2.4

Subtopic 2.4: Structural Design and Analysis

Essential Questions:
1. How do structural engineers approach the design process for structures?
2. What are the key considerations and constraints in structural design?
3. How can computer simulations and modeling aid in structural analysis?
4. How do structural engineers ensure the safety and stability of structures?

Success Criteria:
1. Describe the steps involved in the structural design process.
2. Identify and analyze key considerations, such as load, materials, and budget, in structural design.
3. Apply computer simulations and modeling tools to analyze the behavior of structures under different conditions.
4. Demonstrate an understanding of safety measures and structural stability in design.

Learning Intentions:
1. Understand the process of structural design, including planning, conceptualization, and detailing.
2. Recognize the importance of considering various factors and constraints in structural design.
3. Explore computer simulations and modeling techniques used in structural analysis.
4. Learn about safety codes and standards in structural design.

Learning Strategies:
1. Watch YouTube video: [Structural Design Process](https://www.youtube.com/watch?v=3SCuZZBLjuo)
2. Classroom discussions on the key steps and considerations in structural design.
3. Computer-based simulations and virtual modeling exercises to analyze structural behavior.
4. Collaborative activities to design and build structures based on given specifications and constraints.

Activities:
1. Drawing Activity: Students will create flowcharts or diagrams illustrating the steps involved in the structural design process.
2. Building Activity: Challenge students to design and construct a bridge or tower using specific materials and meeting given constraints.
3. Clay Activity: Students will use clay to create scaled models of structures and assess their stability using computer simulations.
4. Wood Activity: Using wooden blocks or dowels, students will design and build structures, considering load

distribution and stability.

YouTube Videos:
1. Structural Design Process - https://www.youtube.com/watch?v=3SCuZZBLjuo
2. Introduction to Structural Analysis - https://www.youtube.com/watch?v=yClZMdY1Lss
3. Computer Simulations in Structural Engineering - https://www.youtube.com/watch?v=HGgsRpYR8T4
4. Structural Safety and Stability - https://www.youtube.com/watch?v=HwNngHX5i-Q

Subtopic 2.5

Subtopic 2.5: Structural Testing and Evaluation

Essential Questions:
1. How do structural engineers test the strength and integrity of structures?
2. What are the different types of structural tests used in engineering?
3. How do engineers evaluate and interpret test results to ensure structural safety?
4. What improvements can be made based on testing and evaluation feedback?

Success Criteria:
1. Explain the purpose and process of structural testing in engineering.
2. Identify and describe various types of structural tests, such as load testing and non-destructive testing.
3. Analyze test data and interpret results to assess the performance and integrity of structures.
4. Propose improvements and modifications based on testing and evaluation feedback.

Learning Intentions:
1. Understand the importance of structural testing and evaluation in ensuring safety and performance.
2. Explore different types of structural tests and their applications.
3. Develop skills to analyze and interpret test data to make informed decisions.
4. Foster a mindset of continuous improvement based on testing and evaluation feedback.

Learning Strategies:
1. Watch YouTube video: [Structural Testing and Evaluation](https://www.youtube.com/watch?v=Uwn7gSCyY4g)
2. Classroom discussions on the significance of structural testing and its role in engineering.
3. Hands-on experiments and demonstrations to simulate structural testing scenarios.
4. Analyzing and interpreting test data from case studies or real-life examples.

Activities:
1. Drawing Activity: Students will create diagrams or visual representations of different structural testing methods.
2. Building Activity: Challenge students to construct a small-scale structure and test its strength using appropriate techniques, such as load testing or stress analysis.
3. Clay Activity: Students will create clay models of structures and perform non-destructive testing methods, such as ultrasonic testing or visual inspection.
4. Wood Activity: Using wooden beams or blocks, students will design and build structures and evaluate their

load-bearing capacity through testing.

YouTube Videos:
1. Structural Testing and Evaluation - https://www.youtube.com/watch?v=Uwn7gSCyY4g
2. Non-Destructive Testing in Structural Engineering - https://www.youtube.com/watch?v=1K3tofq7CYY
3. Load Testing of Structures - https://www.youtube.com/watch?v=8vayQgXM9z8
4. Structural Integrity and Safety - https://www.youtube.com/watch?v=xkFfUTB2WJQ

Subtopic 2.6

Subtopic 2.6: Sustainability in Structural Engineering

Essential Questions:
1. How can structural engineering contribute to sustainable development?
2. What are the key principles of sustainable design in structural engineering?
3. How do structural engineers integrate sustainable materials and practices in their projects?
4. What are the long-term environmental impacts of structural choices?

Success Criteria:
1. Explain the concept of sustainability and its relevance to structural engineering.
2. Identify and describe key principles of sustainable design, such as energy efficiency and material recyclability.
3. Analyze and evaluate the use of sustainable materials and practices in structural projects.
4. Assess the long-term environmental impacts of different structural choices.

Learning Intentions:
1. Recognize the importance of sustainable practices in structural engineering for environmental preservation.
2. Understand the principles and strategies of sustainable design applicable to structural projects.
3. Explore sustainable materials and their applications in structural engineering.
4. Foster an awareness of the long-term environmental impacts of structural choices.

Learning Strategies:
1. Watch YouTube video: Sustainability in Structural Engineering - https://www.youtube.com/watch?v=8RdppVyf-14
2. Classroom discussions on sustainability and its relevance to structural engineering.
3. Case studies and research projects exploring sustainable design principles and materials.
4. Design challenges to create sustainable structures using eco-friendly materials.

Activities:
1. Drawing Activity: Students will create concept sketches of sustainable structural designs.
2. Building Activity: Challenge students to construct a model structure using sustainable materials, such as recycled cardboard or bamboo.
3. Clay Activity: Students will sculpt clay models of sustainable architectural features, such as green roofs or solar panels.

4. Wood Activity: Using reclaimed wood or sustainable timber, students will design and build a structure that maximizes energy efficiency.

YouTube Video Suggestions:
1. Sustainability in Structural Engineering - https://www.youtube.com/watch?v=8RdppVyf-14
2. Green Building Design Principles - https://www.youtube.com/watch?v=hzns31TWXz0
3. Sustainable Materials in Construction - https://www.youtube.com/watch?v=UWM2EhDRlJU
4. Energy-Efficient Structural Design - https://www.youtube.com/watch?v=6y7Fb6ByS-M

Subtopic 2.7

Subtopic 2.7: Creative Structural Design

Essential Questions:
1. How can creativity enhance structural design?
2. What are the key elements of aesthetically pleasing structures?
3. How do engineers balance functionality and artistic expression in structural design?
4. What innovative approaches can be used to create visually striking structures?

Success Criteria:
1. Explain the role of creativity in structural design and its impact on the overall aesthetics.
2. Identify and describe the key elements of visually pleasing structures, such as form, proportion, and harmony.
3. Evaluate the balance between functionality and artistic expression in different structural designs.
4. Generate innovative ideas and solutions to create visually striking structures.

Learning Intentions:
1. Recognize the importance of creativity in structural design to create unique and appealing structures.
2. Understand the elements and principles of design applicable to structural engineering.
3. Explore the integration of artistic expression and functionality in structural projects.
4. Encourage innovative thinking and problem-solving skills in structural design.

Learning Strategies:
1. Watch YouTube video: Creative Structural Design - https://www.youtube.com/watch?v=meYFEFhOZ3U
2. Classroom discussions on the role of creativity and aesthetics in structural design.
3. Analyzing and critiquing examples of architecturally significant structures.
4. Design challenges to create visually appealing and innovative structural concepts.

Activities:
1. Drawing Activity: Students will sketch different structural design concepts, emphasizing creativity and artistic expression.
2. Building Activity: Challenge students to construct a model structure that incorporates unique and visually striking features.
3. Clay Activity: Students will sculpt clay models of architectural details or embellishments to enhance the aesthetics of a structure.

4. Wood Activity: Using wood and other materials, students will build a scaled-down architectural model that showcases creative structural design elements.

YouTube Video Suggestions:
1. Creative Structural Design - https://www.youtube.com/watch?v=meYFEFhOZ3U
2. Architectural Aesthetics: Form and Function - https://www.youtube.com/watch?v=eKmNb9As6-g
3. Innovative Structural Design Examples - https://www.youtube.com/watch?v=H8vUekPCOv4
4. Art and Architecture: The Power of Design - https://www.youtube.com/watch?v=Uh3mJeK06U4

Subtopic 2.8

Subtopic 2.8: Structural Engineering Competition

Essential Questions:
1. How can a structured competition foster teamwork and problem-solving skills?
2. What are the key components of a successful structural engineering competition?
3. How can students apply their knowledge and skills to design and construct winning structures?
4. What are the benefits and challenges of participating in a structural engineering competition?

Success Criteria:
1. Demonstrate effective teamwork, communication, and collaboration during the competition.
2. Design and construct a structurally sound and innovative structure within specified constraints.
3. Apply problem-solving strategies to overcome challenges and optimize the performance of the structure.
4. Reflect on the experience and identify areas for improvement in future competitions.

Learning Intentions:
1. Develop teamwork and collaboration skills through participation in a structured competition.
2. Apply knowledge of structural engineering principles and techniques to design and construct a winning structure.
3. Foster problem-solving and critical thinking skills in the context of a competitive environment.
4. Reflect on the competition experience to identify areas for growth and improvement.

Learning Strategies:
1. Research and study successful examples of past structural engineering competitions.
2. Classroom discussions on teamwork, problem-solving, and competition strategies.
3. Engage in design challenges and practice activities to develop skills in structural optimization.
4. Participate in a mock structural engineering competition to experience the dynamics of teamwork and time constraints.

Activities:
1. Drawing Activity: Students will create initial sketches and design concepts for their competition structure.
2. Building Activity: Challenge students to construct a scaled-down version of their competition structure using suitable materials.
3. Clay Activity: Students will sculpt clay models or prototypes of specific components of their competition structure.

4. Wood Activity: Using wood and other materials, students will build a larger-scale model of their competition structure for final testing and evaluation.

YouTube Video Suggestions:
1. Structural Engineering Competitions - https://www.youtube.com/watch?v=mUXK7edU2-w
2. Building the Tallest Structure: A Structural Engineering Challenge - https://www.youtube.com/watch?v=3baOTDyQZOQ
3. Teamwork and Problem Solving in Engineering Competitions - https://www.youtube.com/watch?v=9joRz0-1HdE
4. Structural Engineering Competition Highlights - https://www.youtube.com/watch?v=HfaMCQ3z2WU

REFLECTIONS

INTERDISCIPLINARY CONNECTIONS: NEW JERSEY STUDENT LEARNING STANDARDS FOR ELA, SOCIAL STUDIES, SCIENCE AND/OR MATHEMATICS

Cross-Curricular Standards:
- Math: Apply mathematical concepts in structural analysis and calculations.
- Science: Understand the scientific principles behind forces, materials, and structural stability.
- Art: Incorporate aesthetics and creativity in structural design projects.
- Technology: Utilize technological tools and software for design simulations and analysis.