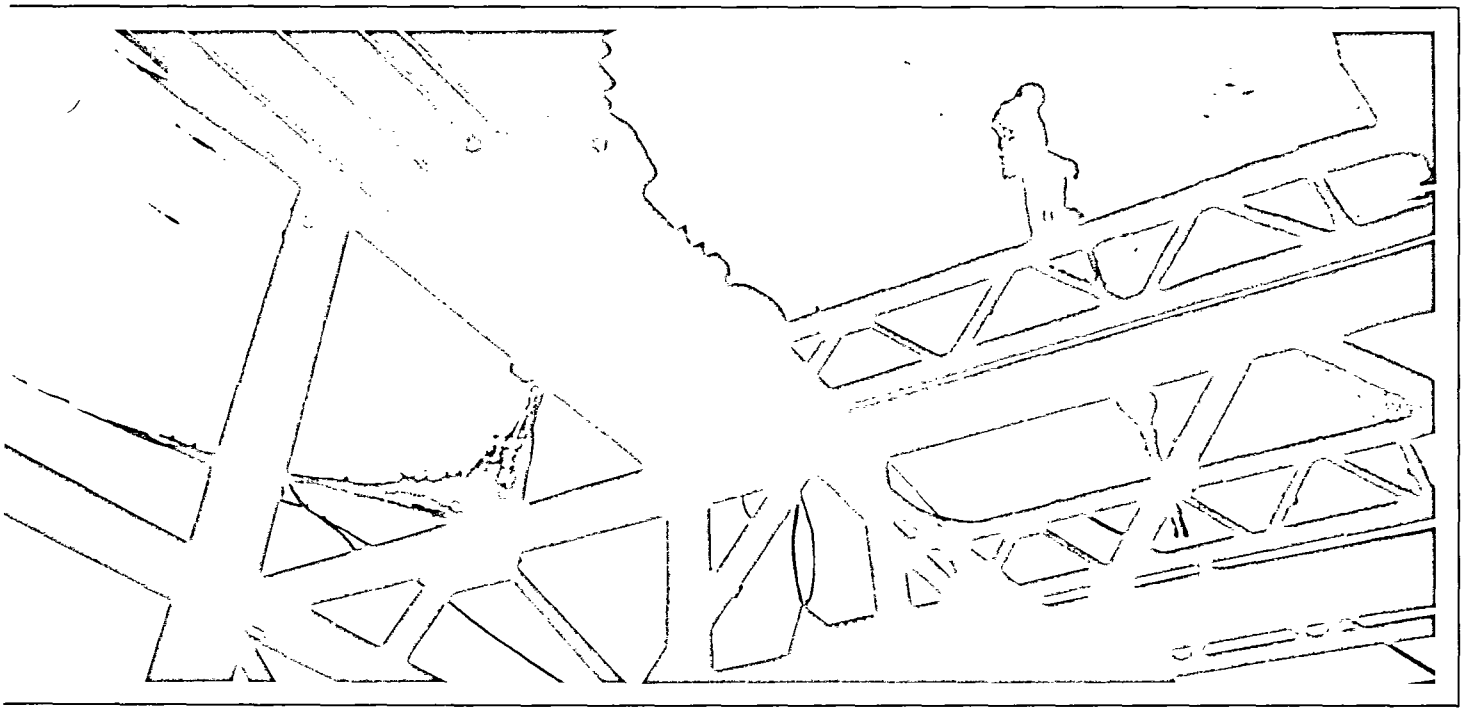
TECHNOLOGY EDUCATION
CONSTRUCTION ENGINEERING AND MANAGEMENT

GRADES 9-12
ELECTIVE



The University of the State of New York
The State Education Department
Bureau of Home Economics
and Technology Education Programs
Division of Occupational Education
Albany, New York 12234

THE UNIVERSITY OF THE STATE OF NEW YORK

Regents of The University

MARTIN C. BARELL, *Chancellor*, B.A., I.A., LL.B	Muttontown
R. CARLOS CARBALLADA, *Vice Chancellor*, B.S.	Rochester
WILLARD A. GENRICH, LL.B.	Buffalo
EMLYN I. GRIFFITH, A.B., J.D.	Rome
JORGE L. BATISTA, B.A., J.D.	Bronx
LAURA BRADLEY CHODOS, B.A., M.A.	Vischer Ferry
LOUISE P. MATTEONI, B.A., M.A., Ph.D.	Bayside
J. EDWARD MEYER, B.A., LL.B.	Chappaqua
FLOYD S. LINTON, A.B., M.A., M.P.A.	Miller Place
MIMI LEVIN LIEBER, B.A., M.A.	Manhattan
SHIRLEY C. BROWN, B.A., M.A., Ph.D.	Albany
NORMA GLUCK, B.A., M.S.W.	Manhattan
ADELAIDE L. SANFORD, B.A., M.A., P.D.	Hollis
WALTER COOPER, B.A., Ph.D.	Rochester
CARL T. HAYDEN, A.B., J.D.	Elmira
DIANE O'NEILL MC GIVERN, B.S.N., M.A., Ph.D.	Staten Island

President of The University and Commissioner of Education
THOMAS SOBOL

Executive Deputy Commissioner of Education
THOMAS E. SHELDON

Deputy Commissioner for Elementary, Middle, and Secondary Education
ARTHUR L. WALTON

Assistant Commissioner for General and Occupational Education
LORRAINE R. MERRICK

Acting Director, Division of Occupational Education
LEE A. TRAVER

Chief, Bureau of Home Economics and Technology Education Programs
JEAN C. STEVENS

The State Education Department does not discriminate on the basis of age, color, religion, creed, disability, marital status, veteran status, national origin, race, gender or sexual orientation in the educational programs and activities which it operates. Portions of this publication can be made available in a variety of formats, including braille, large print or audiotape, upon request. Inquiries concerning this policy of equal opportunity and affirmative action should be referred to the Department's Affirmative Action Officer, NYS Education Building, 89 Washington Avenue, Albany, NY 12234.

USE IN SEQUENCE: **Elective course**

This course is one of the New York State approved electives in Technology Education. It is one of several electives courses designed to give students a firm but broad exploration of the technical world in which they live.

Students completing a high school sequence in Technology Education must take a total of 1-3 units of elective course work to fulfill the "elective" portion of their sequence requirement. This course may also be taken by any student as an elective. If the instructor uses this syllabus as a guide for instruction, students may be granted Regents credit for the experience.

Several courses within Technology Education offerings can be offered on a 1/2-unit or 1-unit basis. Course work earning 1/2-unit must comprise a minimum of 54 hours of instruction and course work earning 1-unit must comprise a minimum of 108 hours of instructional time.

Students with Disabilities

The Board of Regents, through the part 100 Regulations of the Commissioner, the Action Plan, and The Compact for Learning, has made a strong commitment to integrating the education of students with disabilities into the total school program. According to Section 100.2(s) of the Regulations of the Commissioner of Education, "Each student with a handicapping condition as such term is defined in Section 200.1(ii) of this Chapter, shall have access to the full range of programs and services set forth in this Part to the extent that such programs and services are appropriate to such student's special educational needs." Districts must have policies and procedures in place to make sure that students with disabilities have equal opportunities to access diploma credits, courses, and requirements.

The majority of students with disabilities have the intellectual potential to master the curricula content requirements for a high school diploma. Most students who require special education attend regular education classes in conjunction with specialized instruction and/or related services. These students must attain the same academic standards as their nondisabled peers to meet graduation requirements, and, therefore, must receive instruction in the same content areas, at all grade levels. This will ensure that they have the same informational base necessary to pass statewide testing programs and meet diploma requirements.

Teachers certified in the subject area should become aware of the needs of students with disabilities who are participating in their classes. Instructional techniques and materials must be modified to the extent appropriate to provide students with disabilities the opportunity to meet diploma requirements. Information or assistance is available through special education teachers, administrators, the Committee on Special Education (CSE) or student's Individualized Education Program (IEP).

Strategies for Modifying Instructional Techniques and Materials

1. Students with disabilities may use alternative testing techniques. The needed testing modification must be identified in the student's Individualized Education Program (IEP). Both special and regular education teachers need to work in close cooperation so that the testing modifications can be used consistently throughout the student's program.

2. Identify, define and pre-teach key vocabulary. Many terms in this syllabus are specific and some students with disabilities will need continuous reinforcement to learn them. It would be helpful to provide a list of these key words to the special education teacher in order to provide additional reinforcement in the special educational setting.

3. Assign a partner for the duration of a unit to a student as an additional resource to facilitate clarification of daily assignments, timelines for assignments, and access to daily class notes.

4. When assigning long-term projects or reports, provide a timeline with benchmarks as indicators for completion of major sections. Students who have difficulty with organizational skills and time sequence may need to see completion of sections to maintain the organization of a lengthy project or report.

Infusing Awareness of Persons with Disabilities Through Curriculum

In keeping with the concept of integration, the following subgoal of the Action plan was established.

In all subject areas, revisions in the syllabi will include materials and activities related to generic subgoals such as problem solving, reasoning skills, speaking, capacity to search for information, the use of libraries and increasing student awareness of and information about the disabled.

The purpose of this subgoal is to ensure that appropriate activities and materials are available to increase student awareness of disabilities.

This curriculum, by design, includes information, activities, and materials regarding persons with disabilities. Teachers are encouraged to include other examples as may be appropriate to their classroom or the situation at hand.

STUDENT LEADERSHIP SKILLS

Development of leadership skills is an integral Part of occupational education in New York State. The New York State Education Department states that, "Each education agency should provide to every student the opportunity to participate in student leadership development activities. All occupational education students should be provided the opportunity to participate in the educational activities of the student organization(s) which most directly relate(s) to their chosen educational program."

Leadership skills should be incorporated in the New York State occupational education curricula to assist students to become better citizens with positive qualities and attitudes. Each individual should develop skills in communications, decision making/problem solving, human relations, management, and motivational techniques.

Leadership skills may be incorporated into the curricula as competencies (Performance Objectives) to be developed by every student or included within the Suggested Instructional Strategies. Teachers providing instruction through occupational educational curricula should familiarize themselves with the competencies. Assistance may be requested from the State advisor of the occupational student organization related to the program area.

Students who elect to become active members of one of the student leadership organizations chartered by the New York State Education Department have the advantage of the practical forum to practice leadership skills in an action oriented format and have the potential for recognition of their achievements at the local, State, and national level.

Overview and Rationale

Throughout history construction has been a major human endeavor. Today, construction continues to impact our lives, the economy, and society. It satisfies our needs and wants by providing society with shelter, structures for the production of various products, and the infrastructure that enables our transportation and energy production systems to function. In addition, other technologies including modern communication systems and biotechnologies could not exist without construction.

This course is designed to take a broad look at construction. It covers light and heavy construction including residential, commercial, and industrial. The students will have the opportunity to explore the similarities and differences among many different types of construction. The course has been designed to provide hands-on activities. Through the universal systems model the student will learn about the inputs, resources, processes, outputs, and impacts of construction.

Although each topic in the syllabus has suggested instructional strategies the teacher might teach this course by using a thematic approach. By using the thematic approach the instructor can provide opportunities for individual as well as team projects. One possibility would be to focus on the design and construction of a new airport which would be built near the community. An airport incorporates many types of structures, systems, and emerging technologies. By utilizing the airport theme students will have the opportunity to examine the interrelationships of many technologies.

SYLLABUS OBJECTIVES

Through the implementation of this syllabus, the student will:

1. Apply the universal systems model as it relates to construction, engineering, and management.

2. Discuss the importance of construction and how it affects the economy, society, and other technologies.

3. Identify similarities and differences between light and heavy construction.

4. Utilize the problem-solving process to plan and implement solutions to individual and team activities.

5. Demonstrate the skills required to safely operate tools and machines used in construction.

6. Experience hands-on activities in major construction processes.

SYLLABUS OUTLINE
Table of Contents

Construction, Engineering, and Management

	Estimated Learning Time
I. Module: **Introduction to Construction, Engineering, and Management**	**4 hours**
Topics:	
A. Construction as a System	2 hours
B. Construction Throughout History	2 hours
II. Module: **Management**	**1 hour**
Topic:	
A. The Role of Management in Construction	1 hour
III. Module: **Engineering**	**1 hour**
Topic:	
A. The Role of Engineering in Construction	1 hour
IV. Module: **Construction Systems and Resources**	**8 hours**
Topic:	
A. The Universal Systems Model	4 hours
B. Resources for Construction	4 hours
V. Module: **Types of Construction**	**17 hours**
Topic:	
A. Light and Heavy Construction	1 hour
B. Buildings	4 hours
C. Civil Construction Projects	6 hours
D. Other Structures	6 hours

VI. Module: **Research and Planning for Construction** **15 hours**

Topic:

A. Needs Assessment	2 hours
B. Site Selection	2 hours
C. The Design Process	6 hours
D. Estimating and Contracting	3 hours
E. Scheduling	2 hours

VII. Module: **Construction Processes** **8 hours**

Topic:

A. Site Preparation	2 hours
B. The Foundation	4 hours
C. Types of Superstructures	2 hours
TOTAL LEARNING TIME	**54 hours**

D. Building a Superstructure	16 hours
E. Enclosing the Structure	12 hours
F. Utility Systems	4 hours
G. Completing the Interior	4 hours

VIII. Module: **Controlling Construction Systems** **6 hours**

Topic:

A. Financial Control	2 hours
B. Quality Assurance	4 hours

IX: Module: **Post Construction** **8 hours**

Topic:

A. Finishing the Interior	2 hours
B. Finishing the Exterior	2 hours
C. Landscaping	2 hours
D. Maintenance and Repair	2 hours

X. Module: **The Impact of Construction** **4 hours**

Topic:

A. How Construction Affects Our Lives	2 hours
B. Construction in the Future	2 hours
TOTAL LEARNING TIME	**108 hours**

Estimated
Learning Time

I. Module: **Introduction to Construction, Engineering, and Management**

A. Topic: **Construction as a System** — **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that construction is an essential part of our lives.

Competencies to be Developed:

After studying this topic, the student will:

a. Define the difference between needs and wants in our society. (K)
b. Explain how different people can view the same constructed item as either a need or a want. (A)
c. Identify examples of constructed items in the community. (K)

Suggested Instructional Strategies:

1. Have students keep a log in which they list all the constructed items that they use, observe, or come in contact with.
2. Create a collage of pictures cut from magazines that show examples of constructed items.
3. Give students a list of constructed items. Have them identify and explain how each one will satisfy their individual needs or wants.
4. Discuss the importance of construction to other technological systems.

B. Topic: **Construction Throughout History** — **2 Hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will identify major historical developments in residential and non-residential construction.

Competencies to be Developed:

After studying this topic, the student will:

a. Give examples of how different civilizations contributed to construction technology. (K)
b. Explain how construction engineering innovations contributed to the development of new construction technologies. (K)

Suggested Instructional Strategies:

1. Have students view slides of important construction engineering achievements.
2. Have students develop a time line that identifies important construction technologies as they occurred during different civilizations and/or time periods.
3. Visit a historic site to examine construction techniques of that era. Take slides for class use.
4. Have students construct models that illustrate historical and modern construction techniques.

II. Module: **Management**

A. Topic: **The Role of Management in Construction** **1 hour**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that key management functions in construction include planning, organizing, directing, and controlling.

Competencies to be Developed:

After studying this topic, the student will:

a. Explain how most human activities require some kind of management. **(K)**
b. Describe how management gathers, evaluates, and uses information. **(K)**
c. Utilize acquired information to help the student team achieve its goals. **(S)**

Suggested Instructional Strategies:

1. Invite a construction manager as a guest speaker to discuss the importance of management in all aspects of construction.
2. Have the students brainstorm all the areas in which management plays an important role in construction. Afterwards, explain how poor management can prevent a company from achieving its goals.
3. Divide the class into two groups: labor and management. Each group will meet separately to prepare a set of proposals related to working conditions for a student construction activity. Representatives from each group will present their proposals and attempt to negotiate a collective bargaining agreement. The teacher will serve as a mediator or arbitrator.

III. Module: **Engineering**

A. Topic: **The Role of Engineering in Construction** **1 hour**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that engineers apply the concepts of science and mathematics in the design of construction projects.

Competencies to be Developed:

After studying this topic, the student will:

a. List the five major branches of engineering: chemical, civil, electrical, mining and metallurgical, and mechanical. (K)
b. Explain how each of the major branches of engineering contributes to construction. (K)
c. Utilize mathematical and science concepts in planning and evaluating the student construction activity. (S)
d. Understand the need for the "Engineers' Code of Ethics." (A)

Suggested Instructional Strategies:

1. Invite an engineer currently working on a large construction project to discuss his or her role.
2. Use the *Occupational Outlook Handbook* and other resources to prepare a report that describes one of the engineering specialties that relate to construction.
3. Utilize simulation software to illustrate how computers are used in the design of construction projects. Include a design which includes accessibility modifications for the disabled

IV. Module: **Construction Systems and Resources**

A. Topic: **The Universal Systems Model** **4 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that all systems have a goal, an input, a process, an output, and that feedback is used to assure that the system achieves its goal.

Competencies to be Developed:

After studying this topic, the student will:

a. Identify the various components of the universal systems model. **(K)**
b. Discuss the interrelationships of the universal systems model components. **(K)**
c. Use the universal systems model to analyze a simple construction project. **(S)**

Suggested Instructional Strategies:

1. Discuss the role of each input in a construction system. For example, what kind of information would be needed to construct a backyard shed.
2. Have students investigate one construction system that serves the needs of the community. Use the universal systems model to explain how the system works.
3. Use the universal systems model to describe a system for cleaning the technology laboratory at the end of each class period.
4. Have the students describe how feedback was used to improve a task that they have performed. Discuss how feedback can be used in construction to improve quality.

B. Topic: **Resources for Construction** **4 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will know that seven categories of resources are required by every construction system.

Competencies to be Developed:

After studying this topic, the student will:

a. List the seven categories of resources: people, information, materials, tools and machines, energy, capital, and time. **(K)**
b. Explain how construction systems combine resources to achieve a desired goal. **(K)**

Suggested Instructional Strategies:

1. Identify specific resources from each category that will be needed for a class construction project.
2. Have student teams research the costs of the resources required for the class construction project.
3. Invite a representative from a local company to speak to the class on human resources management.

4. Show students examples of how information such as plans and specifications are used in construction
5. Have students create a notebook of pictures of materials commonly used in construction. The pictures should be labeled and should include a brief description of the material and what it is used for.
6. Lead a class discussion on the recycling of construction materials.
7. Have students research some of the high tech tools and machines now in use in construction.
8. Ask students to describe the importance of energy conservation building codes for new construction.
9. Discuss how delays in obtaining resources can increase costs.

V. Module: **Types of Construction**

A. Topic: **Light and Heavy Construction** **1 hour**

Performance Statement

Upon satisfactory completion of this topic, the student will be able to explain the differences between light and heavy construction.

Competencies to be Developed:

After studying this topic, the student will:

a. Classify construction projects as light or heavy depending on the methods and materials used. (S)
b. Differentiate between light and heavy construction techniques. (K)
c. Safely utilize common hand tools to fabricate models. (S)

Suggested Instructional Strategies:

1. Have student teams photograph light and heavy construction projects that are currently under construction in the community.
2. Discuss the similarities and differences between light and heavy construction.
3. Have student teams construct models that illustrate light and heavy construction framing techniques.

B. Topic: **Buildings** **4 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will be able to classify buildings as to their intended purpose such as residential, industrial, and commercial.

Competencies to be Developed:

After studying this topic, the student will:

a. Define the terms residential, industrial, and commercial. (K)
b. Give examples of different types of residential, industrial, and commercial structures. (K)

Suggested Instructional Strategies:

1. Have students identify and categorize illustrations of buildings into one of the three types.
2. Make a list of ten industrial and commercial buildings that are located in the community.
3. Have student teams build a model suitable for a specified type of business or industry, such as a fast food restaurant.

C. Topic: **Civil Construction Projects** **6 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will identify civil construction projects as those which involve earthmoving and the use of heavy equipment.

Competencies to be Developed:

After studying this topic, the student will:

a. Give examples of different types of civil construction projects. **(K)**
b. Discuss how civil construction projects can have positive and negative impacts on the community. **(A)**
c. Describe the various occupational titles that are associated with civil construction. **(K)**
d. Construct models of civil construction projects. **(S)**

Suggested Instructional Strategies:

1. As a homework assignment have students clip out and bring in classified advertisements for jobs in civil construction.
2. Have student teams construct models of civil construction projects such as highway systems, bridges, tunnels, dams, and canals.
3. Guide the students in a debate that focuses on the construction of a mass burn incinerator in their neighborhood.
4. Have students develop a three dimensional time line that illustrates civil construction projects of historical importance.
5. Invite a civil engineer to address the class on the nature of his or her work in civil engineering.

D. Topic: **Other Structures** **6 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will give examples of other types of construction projects such as pipelines, towers, and recreational facilities.

Competencies to be Developed:
After studying this topic, the student will:
a. Give examples of these types of structures which are located in the community. (K)
b. Design and construct model structures. (S)

Suggested Instructional Strategies:
1. Have student teams design and construct a model of a playground for physically challenged children.
2. Students will research and sketch various designs of towers that are used to support high voltage electric cables.
3. Construct models of the towers.
4. Develop a device to test the strength of the towers.

VI. Module: **Research and Planning for Construction**

A. Topic: **Needs Assessment** **2 hours**

Performance Statement:
Upon satisfactory completion of this topic, the student will understand that needs assessment is the first step in planning a construction project.

Competencies to be Developed:
After studying this topic, the student will:
a. Identify criteria that must be considered in determining whether or not to build a housing development. (S)
b. Investigate reasons why industrial and commercial firms would want to build a new facility. (S)
c. Explain why governments plan new construction projects to meet the needs of growing and changing populations. (K)

Suggested Instructional Strategies:
1. Have students make a list of new construction projects that they feel would benefit the community.
2. Invite a speaker from a governmental planning agency to speak about the ways in which the needs of the public are assessed.
3. Have students make a list of rooms and other features that they would want an architect to include in the design of a future home.
4. Have atudents make a list of accessibility modifications for specific disabilities (e.g. braille elevator buttons for the blind, wheel-chair ramps for the physically disabled).

B. Topic: **Site Selection** **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will discuss the different factors that must be considered in selecting a site.

Competencies to be Developed:

After studying this topic, the student will:

a. Name important factors that a family should consider when selecting a site for a new home. (K)
b. Identify the factors that a specific industrial or commercial firm should consider when selecting a site for a new facility. (K)
c. Describe why governments have chosen the sites for existing facilities such as parks, government offices, and sewage treatment plants. (S)

Suggested Instructional Strategies:

1. Obtain a copy of the zoning regulations for the community. Individual students should then write an essay that summarizes some of the regulations.
2. Have the students contact real estate agents to compare the cost of land sites in different parts of the community.
3. Lead the class in a discussion about the ideal site for a particular business, such as a 24 hour convenience store.
4. Invite a local politician to discuss the problems of locating certain projects and the "Not In My Back Yard" (NIMBY) syndrome.

C. Topic: **The Design Process** **6 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will utilize problem solving and drawing skills to design a class or team construction project.

Competencies to be Developed:

After studying this topic, the student will:

a. Be able to state the steps of the problem-solving process. (K)
b. Develop sketches of potential designs. (S)
c. Use traditional and/or computer aided design equipment to draw the plans for the class, team, or individual projects. (S)

Suggested Instructional Strategies:

1. Discuss the steps of the problem-solving method and how it is utilized to determine the final solution.

2. Have students sketch the floor plan of their house or apartment. Include approximate dimensions of each room. Ask students to discuss the advantages and disadvantages of the layout.
3. Demonstrate how to properly utilize traditional or CAD equipment for architectural drawing.

D. Topic: **Estimating and Contracting** **3 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand why estimates of construction costs are important to the owners and builders of a new project and how contracts are established.

Competencies to be Developed:

After studying this topic, the student will:

a. Calculate rough estimates based upon the area of a structure and per square foot building costs. (S)
b. Explain why an owner should obtain more than one estimate for a potential project and why the lowest estimate is not always the best. (K)
c. Discuss why contractors should prepare accurate estimates. (A)
d. Explain how the formal bidding process is used for large public and private projects. (K)
e. Identify the important things that an owner needs to consider in choosing a contractor for a project. (K)

Suggested Instructional Strategies:

1. Have students estimate the cost of constructing a 8' x 12' backyard shed.
2. Have students visit a lumberyard or home improvement center to determine the actual costs of materials for the above shed.
3. Lead a discussion on the problems associated with "cost plus" estimates for public projects.
4. Invite a representative from the local consumer affairs department to discuss the importance of investigating a firm before a formal contract is signed.

E. Topic: **Scheduling** **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will explain how scheduling determines the sequence of events necessary for the construction of a project.

Competencies to be Developed:
After studying this topic, the student will:
a. Describe the critical path and bar chart methods of scheduling a project. (K)
b. Utilize one of those two methods to schedule their class or team construction project. (S)

Suggested Instructional Strategies:
1. Have students use graph paper and colored pencils to make a bar chart schedule for a class or team construction project.
2. Discuss the factors, such as weather and late arrival of materials, which could delay a construction project. Ask the students to explain how they would deal with those problems.

VII. Module: **Construction Processes**

A. Topic: **Site Preparation** **2 hours**

Performance Statement:
Upon satisfactory completion of this topic, the student will know the major steps of site preparation.

Competencies to be Developed:
After studying this topic, the student will:
a. Utilize the site plan as a guide in laying out the location of a structure. (S)
b. Properly use surveying and measuring equipment. (S)
c. Place batter boards to guide the excavation of a real or simulated project. (S)

Suggested Instructional Strategies:
1. Show students how to interpret a site plan.
2. Demonstrate the proper use of a transit and other surveying equipment.
3. Discuss the advantages and disadvantages of saving trees on a site.
4. Conduct a percolation test to determine the drainage characteristics of soil.
5. Have students work in small groups to lay out a full size site for an excavation.
6. Have students check the layout by taking diagonal measurements.

B. Topic: **The Foundation** **4 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand the purposes of a foundation and identify the types currently being used.

Competencies to be Developed:

After studying this topic, the student will:

a. Identify the various components of a foundation. (K)
b. List the advantages and disadvantages of different types of foundations. (K)
c. Differentiate between the types of foundations used for light and heavy construction. (K)
d. Use forms in preparation for a poured concrete foundation. (S)
e. Properly mix and pour concrete. (S)
f. Accurately lay a level and plumb concrete block foundation. (S)

Suggested Instructional Strategies:

1. Develop problems that require students to calculate the volume and cost of concrete needed for a foundation of a specified size.
2. Explain how forms are laid out and tied together.
3. Demonstrate how to properly mix the various materials required for a poured concrete foundation.
4. Allow student teams to place the forms and pour the foundation.
5. Demonstrate the use of a plumb and level.
6. Have students construct a corner section of a concrete block foundation.

C. Topic: **Types of Superstructures** **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will identify different types of superstructures.

Competencies to be Developed:

After studying this topic, the student will:

a. Name the common types of superstructures. (K)
b. List the advantages and disadvantages of different types of superstructures. (K)
c. Differentiate between the types of superstructures used for light and heavy construction. (K)
d. Give examples of mass superstructures. (K)

Suggested Instructional Strategies:

1. Take photographs of different types of superstructures that are under construction in the community.

2. Have students collect pictures which depict different types of superstructures.
3. Take a field trip to a commercial construction site. Have the project engineer explain the function of each component of the superstructure.

D. Topic: **Building a Superstructure** **16 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will demonstrate the skills needed to safely and accurately construct a superstructure.

Competencies to be Developed:

After studying this topic, the student will:

a. Identify the components that are required to fabricate a superstructure. (K)
b. Describe the different techniques used for building the superstructure in light and heavy projects. (K)
c. Describe similarities and differences between framing with wood and metal members. (K)
d. Utilize common tools to construct a superstructure. (S)
e. Demonstrate safe working practices. (A)
f. Explain how steel and concrete are used for framing commercial and industrial buildings. (K)
g. Construct floors, walls, ceilings, and roofs using light and heavy construction techniques and materials. (S)

Suggested Instructional Strategies:

1. Demonstrate the safe and proper use of hand and power tools.
2. Demonstrate how to cut and assemble wood and metal framing members to form an exterior wall.
3. Have student teams build superstructures using materials and techniques common to light and heavy construction.
4. Obtain samples of steel beams and columns. Explain or demonstrate how they are joined using fasteners or welding.
5. Have an engineer visit the class to explain the application of mathematics and science in the design of superstructures.
6. Have students use balsa wood to construct a model roof truss to scale. Afterwards have the students design an assembly fixture that could be used for mass production of the trusses.

E. Topic: **Enclosing the Structure** **12 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will demonstrate the skills needed to safely and properly enclose a structure.

Competencies to be Developed:

After studying this topic, the student will:

a. Describe the tasks that are performed in order to enclose a superstructure. (K)
b. List the materials that are commonly used for roofing. (K)
c. List the materials that are commonly used for siding. (K)
d. Use various catalogues to select doors and windows for a given structure. (S)
e. Utilize common tools to enclose a structure. (S)
f. Demonstrate safe working practices. (A)
g. Differentiate between techniques that are used to enclose residential, commercial, and industrial structures. (K)

Suggested Instructional Strategies:

1. Demonstrate the safe and proper use of hand and power tools.
2. Construct a model that includes the use of heavy construction roofing and siding materials.
3. Discuss the advantages and disadvantages of different types of doors and windows.
4. Have student teams install a door and window in a model structure.

F. Topic: **Utility Systems** **4 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that electrical, plumbing, communication, and climate control systems are integral parts of buildings.

Competencies to be Developed:

After studying this topic, the student will:

a. Describe why utilities are usually installed in two stages. (K)
b. Utilize tools and materials to wire a simple circuit. (S)
c. Use common plumbing materials and tools to assemble a water feed line and a waste line. (S)
d. Compare the advantages and disadvantages of different type of piping materials. (K)
e. Use sensors and other electronic components to install a security system in a model structure. (S)

f. Describe common types of climate control systems. (K)
g. Demonstrate safe working practices. (A)
h. Compare techniques and materials that are used for utility systems in residential, commercial, and industrial structures. (K)

Suggested Instructional Strategies:

1. Demonstrate the safe and proper use of hand and power tools.
2. Have students install rough plumbing and electrical systems in the model structure.
3. Have student teams install plumbing and electrical fixtures in the model structure.
4. Allow students to assemble and install a window security system.
5. Compare the cost of different types of plumbing materials such as copper and PVC pipe.

G. Topic: **Completing the Interior** **4 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will identify and utilize the various materials that are needed to complete the interior of a structure.

Competencies to be Developed:

After studying this topic, the student will:

a. Describe why insulation is needed and differentiate between the different types of insulating materials that are used in light and heavy construction. (K)
b. List the advantages and disadvantages of different types of materials used to cover walls, ceilings, and floors. (K)
c. Compare the different construction techniques that are used to cover walls, ceilings, and floors in light and heavy construction. (K)
d. Demonstrate the skills required to properly install a hung ceiling. (S)
e. Properly install and finish drywall. (S)

Suggested Instructional Strategies:

1. Discuss the concept of "R-values" and how it varies among different insulating materials.
2. Have students insulate the model structure.
3. Install and finish drywall.
4. Demonstrate the proper techniques and have the student teams install a suspended ceiling in their model structure.

VIII. Module: **Controlling Construction Systems**

A. Topic: **Financial Control** **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that financial control involves keeping the costs of a project within the limits set for it.

Competencies to be Developed:

After studying this topic, the student will:

a. Differentiate between budgeting and accounting. (K)
b. Identify the expenses and income that are associated with a construction project. (K)
c. Keep financial records of the class construction project. (S)

Suggested Instructional Strategies:

1. Have students keep a log in which they list all the costs for the materials used on the team projects.
2. Students should prepare a budget that includes their estimated income and expenses for the next week. They should keep accurate records and compare their actual and estimated expenses. Ask them to explain how this process is similar to the financial control of a construction project.

B. Topic: **Quality Assurance** **4 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that quality assurance is the process of making sure that a project is built correctly.

Competencies to be Developed:

After studying this topic, the student will:

a. Identify the areas of the construction process that are regulated by building codes. (K)
b. Describe how building codes specify the methods and materials that can be used for each aspect of construction. (K)
c. Explain why quality control is an ongoing process throughout the construction of a project. (K)
d. Identify the various stages at which the building inspector must approve completed work. (K)
e. Understand that the function of the building inspector is to protect both the client and the community from improper construction. (A)

Suggested Instructional Strategies:

1. Have the students determine the requirements for obtaining a building permit.

2. Invite a building inspector to speak to the class about the importance of constructing a structure to the appropriate building codes.
3. Have the students go through their house or apartment and make a list that identifies items that require correction.
4. Visit a local lumberyard. Have students ask about the grading of construction lumber and exterior plywood. Inquire why different grades are sold and which sell the best.

IX. Module: **Post-Construction**

A. Topic: **Finishing the Interior** **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that interior finishing includes painting and the installation of wallpaper, paneling, flooring, and cabinets.

Competencies to be Developed:

After studying this topic, the student will:

a. Differentiate between the different types of interior paints and finishes. (K)
b. Apply a strip of wallpaper. (S)
c. Use appropriate tools to cut and install paneling. (S)
d. Utilize a variety of materials to cover floors. (S)
e. Design a cabinet layout for a given kitchen. (S)
f. Compare the costs of materials and labor when choosing decorating materials such as paint, wallpaper, and paneling. (S)

Suggested Instructional Strategies:

1. Obtain samples of interior finishing materials from local dealers. Compare those used in residential and commercial construction.
2. Use graph paper and pencil to design a kitchen cabinet layout. If possible demonstrate or have students use CAD to complete this activity.
3. Have different student teams decorate the walls with a variety of wall coverings.
4. Have students calculate the number of gallons of paint or rolls of wallpaper to cover a room of a specified size.

B. Topic: **Finishing the Exterior** **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that exterior finishing includes painting, staining, and sealing.

Competencies to be Developed:
After studying this topic, the student will:
a. Differentiate between the different types of exterior paints and finishes. (K)
b. Use appropriate tools to apply exterior finishing materials. (S)
c. Understand the importance of cleaning and maintaining finishing equipment. (A)

Suggested Instructional Strategies:
1. Obtain samples of exterior finishing materials from local dealers. Compare those used in residential and commercial construction.
2. Demonstrate the different techniques that could be employed in applying exterior finishes such as brushes, rollers, pads, and spray guns.
3. Have students use an exterior finish on their model structure.
4. Have students design a test to compare the durability of different types of exterior finishes.

C. Topic: **Landscaping** **2 hours**

Performance Statement:
Upon satisfactory completion of this topic, the student will understand that landscaping involves final earthwork, constructed features, and plantings.

Competencies to be Developed:
After studying this topic, the student will:
a. Identify constructed features such as driveways, walks, patios, fences, and swimming pools. (K)
b. Explain that one of the important functions of earthwork is to contour the land so that water flows away from the structure. (K)
c. Understand that plantings decorate the property surrounding the structure and add value. (A)

Suggested Instructional Strategies:
1. Invite a landscape architect to speak to the class.
2. Have students draw a landscape plan for a building in the community. Include the structure, accesses, constructed features, and plantings in the drawing.
3. Have students plan and implement a school beautification project.

D. Topic: **Maintenance and Repair** **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will know that maintenance and repairs continue throughout the life of the construction project.

Competencies to be Developed:

After studying this topic, the student will:

a. Differentiate between maintenance and repairs. **(K)**
b. Define preventative maintenance. **(K)**
c. Give examples of where service contracts can be used as part of a preventative maintenance program. **(K)**

Suggested Instructional Strategies:

1. Have students replace the water feed mechanism on a water closet.
2. For homework, have students prepare a maintenance plan for their house or apartment. Ask them to list specific activities that will help keep the interior and exterior in good condition.
3. Have the school district supervisor of buildings and grounds address the class to describe the nature of his or her work.

X. Module: **The Impact of Construction**

A. Topic: **How Construction Affects Our Lives** **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will understand that construction has positive and negative impacts on people and the environment.

Competencies to be Developed:

After studying this topic, the student will:

a. Describe how construction benefits the economy by creating jobs. **(K)**
b. Recognize the need for affordable housing. **(A)**
c. Identify the positive impacts that commercial construction has on the communities tax base. **(K)**
d. Describe some of the environmental impacts that construction can have, such as pollution and the depletion of resources. **(K)**
e. Recognize the need for making buildings accessible to the physically challenged. **(A)**

Suggested Instructional Strategies:

1. Have students bring in articles describing positive and negative impacts of construction.

2. Visit the public buildings, stores, and restaurants within a specified part of your community to determine which structures are accessible to the physically challenged. Combine the information you obtain with the data collected by other students to publish a directory of accessible buildings.
3. Lead a discussion about how the needs of an aging population will affect the construction industry.

B. Topic: **Construction in the Future** **2 hours**

Performance Statement:

Upon satisfactory completion of this topic, the student will explain some of the important changes in construction technology that are expected to occur in the future.

Competencies to be Developed:

After studying this topic, the student will:

a. Describe how construction and manufacturing techniques will be combined. (K)
b. Identify how computers will be used to manage buildings. (K)
c. Describe the need for continued energy conservation and the development of more energy efficient structures. (K)
d. Describe some of the new construction sites that will be used in the future such as underground, in airspace, and under the sea. (K)

Suggested Instructional Strategies:

1. Have students write a 150 word scenario that describes a house constructed in the year 2020.
2. Construct a model habitat that could be used by a team of researchers underground, undersea, or on another planet. Make a display that includes a description of the materials to be used, where the habitat will be constructed, and how it will be transported to its final location.
3. Have students build a "smart building." Use electronic components - including a photocell, a battery, a relay, and a bulb - to assemble a system that turns on a light when someone enters a room and turns it off when the person leaves.