Fundamentals of
SUSTAINABLE DESIGN

version 1.0

New Jersey Green Program of Study

New Jersey Department of Education – Office of Career Readiness

10th Grade

TABLE OF CONTENTS

UNIT SEQUENCE

Primary Authors: Greg Simon ; John Henry, Marianne Leone, Pilot Teachers (revised)

Grade Level: 10

Unit Plan 1: The Nature of Design

This unit introduces students to fundamental principles of design as they pertain to the natural environment.

Unit Plan 2: Dwelling for the Birds

This unit is composed of essential factors to consider when designing a structure built for habitation.

Unit Plan 3: Sustainable Design Strategies

(Digital Modeling) Skills will be developed through tutorials proved by the instructor. Students will demonstrate their skill acquisition through projects related to sustainable components/ system design.

Unit Plan 4: Place of My Own

Students will study a particular building type by conducting a case study. They will then create a "Place of Their Own" taking into consideration their personal needs and desires while considering aspects of form, function, and sustainable design.

Unit Plan 5: Biophilic Design

(Botanical Gardens Visitors Center) This unit introduces students to the many factors that go into the design and construction of a structure. It asks them to define, analyze, and consider these factors during the process of designing a visitors' center for a local botanical gardens. The project will also require students to produce a well constructed, well considered, proposals that incorporate sustainable systems.

UNIT 1
OVERVIEW

UNIT 1 OVERVIEW

Content Area: Career and Technical Education

Unit Title: Sustainable Design and Architecture Module - The Nature of Design

Target Course/Grade Level: 10th

Unit 1: The Nature of Design

Introduction

This introductory unit consists of foundational knowledge and technical skills for the architecture and construction career cluster with an emphasis on fostering an appreciation for the natural environment. Students collect and analyze information, make discoveries, and document their findings. Flexibility is designed into the projects to accommodate student interest by allowing room for choice while maintaining continuity. Industry, global, and technological perspectives are woven throughout the unit, strengthening the student's academic proficiency. All of these components create well rounded, critical and creative participants in the natural environment.

UNIT SUMMARY:

Schools may modify the title and content of this course as needed.

This unit introduces students to fundamental principles of design as they pertain to the natural environment.

Primary interdisciplinary connections:

Career and Technical Education, Technology, Environmental Science, Construction and Architectural Drafting & Design, Art

21st century themes:

Core Subjects and 21st Century Themes, Learning and Innovation Skills, Creativity and Innovation, Critical Thinking and Problem Solving, Communication and Collaboration, Information, Media and Technology Skills, Information Literacy, Media Literacy, ICT Literacy, Life and Career Skills

See 21st Century Framework

Unit Rationale:

An appreciation of nature and the natural environment is not inherent in human beings but must be carefully cultivated. Before you can value nature, one must be made aware of its complexity, fragility and impact on our existence. In order to appreciate nature, one needs to be immersed in it. It is strongly recommended that students be afforded to opportunity to attend field trips ranging from hikes at local wildlife preserves, to multi day camping trips. Attending these trips will be a worthwhile initial investment to prepare students to buy in to the subsequent objectives.

Learning Targets

COMMON CORE STATE STANDARDS

English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- College & Career Readiness for Speaking and Listening http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 48
- Reading Standards for Science and Technical Subjects - Grades 9 and 10 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 62
- Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 65

Mathematics Standards

- High School Geometry
- http://www.corestandards.org/Math/Content/HSG/

NEXT GENERATION SCIENCE STANDARDS

- HS.Interdependent Relationships in Ecosystems
- HS.Natural Selection and Evolution
- HS.Earth's Systems
- HS.Human Sustainability
- HS.Engineering Design

NEW JERSEY CORE CURRICULUM CONTENT STANDARDS

9.2 Career Awareness, Exploration and Preparation

- Career Preparation http://www.state.nj.us/education/cccs/2014/career/92.pdf page 2

9.3 – Career & Technical Education (CTE) Content Area: 21st Century Life and Careers

- CAREER CLUSTER® : ARCHITECTURE & CONSTRUCTION (AC)PATHWAY http://www.nj.gov/education/cccs/2014/career/93.pdf page 4
- DESIGN/PRE- CONSTRUCTION (AC- DES) http://www.nj.gov/education/cccs/2014/career/93.pdf page 5
- VISUAL ARTS (AR-VIS) http://www.nj.gov/education/cccs/2014/career/93.pdf page 7-8

CPI # CUMULATIVE PROGRESS INDICATOR (CPI)

RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently

WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

SL.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively

SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.

9.3.12.AC.2 Use architecture and construction skills to create and manage a project.

9.3.12.AC- DES.1 Justify design solutions through the use of research documentation and analysis of data.

9.3.12.AC- DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.

9.3.12.AC- DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.

9.3.12.AC- DES.7 Employ appropriate representational media to communicate concepts and project design.

9.3.12.AC- DES.8 Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.

9.3.12.AR.1 Analyze the interdependence of the technical and artistic elements of various careers within the Arts, A/V Technology & Communications Career Cluster.

9.3.12.AR- VIS.2 Analyze how the application of visual arts elements and principles of design communicate and express ideas.

9.3.12.AR- VIS.3 Analyze and create two and three- dimensional visual art forms using various media.

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

UNIT ESSENTIAL QUESTIONS	UNIT ENDURING UNDERSTANDINGS
• How can font be manipulated to be utilized as a visual medium? • What are the various types of balance and how do they relate to objects found in nature. • What is an Earthwork?	• An inherent and enduring appreciation of nature. • Project planning and execution • Graphic Design software skill acquisition • Critical observational and analytic skills

UNIT LEARNING TARGETS

STUDENTS WILL ...

- Develop an understanding and affinity for their natural environment though observation, collection, and creation of projects.
- Understand the basic principles of balance in composition and nature.
- Demonstrate the ability to use basic graphic design software.

EVIDENCE OF LEARNING

SUMMATIVE ASSESSMENT:

- At the end of this unit, students will participate on a capstone project, students will work in groups to create a conceptual design of a earthwork.

- Design and Architectural Journal including vocabulary words and reflective comments
- Unit Final Presentation

Equipment needed:

Computers, Graphic Design Program (Adobe Illustrator, Adobe Photoshop , internet/websites, measuring equipment, a collection of natural materials. (Earthworks Project: Equipment and tools will vary based scope of project.)

Teacher Resources:

- http://www.adobe.com/products/illustrator/features.html
- http://tv.adobe.com/product/illustrator/
- http://planetgreen.discovery.com/slideshows/
- http://www.flickr.com/groups/naturegroup/
- http://www.audubon.org/

Formative Assessments

- Group Discussions
- Individual and Group Projects and/or Presentations
- Sketches and Architectural drawings
- Reflection Journals
- Student created wiki for resource sharing and documentation
- Rubric

Back to Unit Sequence

LESSON PLANS

LESSON PLANS

LESSON	TIMEFRAME
Lesson 1: Text as Narrative	5 days
Lesson 2: Balance in Nature	10 days
Lesson 3: Earthwork	20 days
Lesson 4: Unit 1 Design/Sketch Problems	1 per week (or week 1 draft, week 2 final)

TEACHER NOTES:

For more information on AutoCAD, AutoCAD Architecture, and Revit Architecture software you may visit the following website: http://www.adobe.com http://www.adobe.com http://www.adobe.com

CAD software may include any of the following: Google SketchUP, AutoCAD, AutoCAD Architecture, and Revit Architecture.

CAD software such as SketchUP is free or a nominal fee for a site license: (Google Sketchup 7 is free)

Instructional Methods and Strategies:

Problem Based Learning -

- http://www.cotf.edu/ete/teacher/teacherout.html
- http://www.bie.org/
- http://www.edutopia.org/ http://www.edutopia.org/ http://www.edutopia.org/

Classroom Instruction That Works (technology integration) http://t4.jordan.k12.ut.us/professional_development/strategies/

Cooperative Learning http://www.teach-nology.com/currenttrends/cooperative_learning/

Curriculum Development Resources:

Lesson 1

Text as Narrative

Content Area: 21st Century Life and Careers

Lesson Title: Text as Narrative

Timeframe: 5 days

This lesson helps students learn the importance of typography while simultaneously gaining experience in how to use various tools in Adobe Illustrator. After selecting an image from nature, students will use it to create a reinterpretation using only type characters. The content of the image must relate to the physical characteristics of the object as well as how it reacts to its physical environment. They will discover that typography is not just about choosing a nice typeface but about style, size, color, and placement within the context of other characters. Appropriate considerations are necessary to ensure that the message or image is perceived in the intended way.

LESSON COMPONENTS

Interdisciplinary Connections:

History, Environmental Science, Architecture and Construction

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php Adobe Illustrator, PowerPoint

Equipment needed:

Computers, Projector

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
• Interpret and express ideas visually using techniques in typographic design • Develop two dimensional graphic design techniques by analyzing and reinterpreting objects found in nature	LESSON TIMELINE/PROCEDURE: The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered. **Step 1:** Upon entering the classroom students view various examples of typographic portraits projected onto the screen at the front of the room. They will be told that they will be learning various techniques used by the artist to create similar visual compositions. (Search typographic portraits on the web to find examples) Project the lessons objective on the screen and clarify to students.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Student documents:

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
• Critically analyze the physical characteristics of an natural object • Identify how natural living things interact with their environments	**Step 2:** Explain to students that the creators of the previously viewed works used an image as a template to compose their compositions. They are to find a photograph from the internet that zooms in to focus on an element from nature, a leaf, a branch, and caterpillar, etc. Once selected, students will conduct research to uncover specific characteristics of the object, species, cell composition, preferred climate, etc. These attributes will eventually be used as type to define the composition. **Step 3:** The instructor will conduct a mini-lesson outlining the basic interface and functions of Adobe Illustrator necessary for the activity. On a projection screen, model the process of using various font types, colors, sizes, etc. to define contours, tones, and other characteristics found in the sample image found previously. Special attention should be given to the use of area type tool to define spaces and the pen tool to define text paths. **Step 4:** If some students finish before others, have them focus on developing the details of the images. This will give the other students time to catch up. When students are finished, have them pin-up their compositions and hold an informal gallery walk. Students will then be asked to reflect on their final piece as well as the compositions created by their peers.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments. Students will be given the option to create a wiki to collaborate with classmates, share information and reflect on lesson progress. www.wikispaces.com

RESOURCES PROVIDED:

- http://www.adobe.com/products/illustrator/features.html
- http://tv.adobe.com/product/illustrator/
- http://planetgreen.discovery.com/slideshows/
- http://www.flickr.com/groups/naturegroup/
- http://www.audubon.org/

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Lesson 2

Balance in Nature

Content Area: 21st Century Life and Careers

Lesson Title: Balance in Nature

Timeframe: 5 days

LESSON COMPONENTS

Interdisciplinary Connections:

Environmental Science, Architecture and Construction

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php Wikispaces www.wikispaces.com Bubbl http://www.bubbl.us/

Equipment needed:

Materials will vary by student

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Identify organic formal characteristics and variety found in the natural world. • Demonstrate understanding of the principles of balance by the manipulation of natural objects • Development of analytical and high level thinking skills by participating in a deliberate selection process.	LESSON SEQUENCE: The activities in this lesson will be conducted in a project based learning method, teacher facilitated and student centered. **Step1:** Prior to this lesson students should be immersed in the natural environment. This could vary in scope from a walk through a local park to a camping trip. During their field experience, students are to critically analyze and collect various natural objects. **Step 2:** Students should first be introduced to the various types of balance. Students will then research the work of Andy Goldsworthy relationship between his artistic philosophy and his work. They will also collect examples of his work demonstrating radial, symmetrical, and a-symmetrical balance.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 3: Using the objects collected during the previous trip, students begin the process of creating compositions depicting radial, symmetrical, and a-symmetrical examples of balance. Each student creates 5 iterations for each type of balance. After the student has taken all 15 photographs, he/she will choose the best 3 from each balance group. **Step 4:** Students will then print out their final selections which will be arranged and mounted on presentation boards. The photographs should be should be uniform in scale and arranged in a simple 3 by 3 grid. **Extension:** Teachers wishing to teach students digital layout software may choose to have students use Adobe InDesign when creating their final layouts.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

http://www.morning-earth.org/

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Lesson 3

Earthworks

Content Area: 21st Century Life and Careers

Lesson Title: Earthworks

Timeframe: 5 days

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Environmental Science, Architecture and Construction

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php Wikispaces www.wikispaces.com Bubbl http://www.bubbl.us/

Equipment needed:

Computers

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Identify organic formal characteristics and variety found in the natural world. • Students work together as a team to plan and create an original piece of art. • Development of analytical and high level thinking skills by participating in a deliberate selection process.	LESSON SEQUENCE: The activities in this lesson will be conducted in a project based learning method, teacher facilitated and student centered. **Step 1:** Upon entering the classroom students view various examples of earthworks by Robert Smithson, Beverly Pepper, and Maya Lin, projected onto the screen at the front of the room. Ask students if they see any resemblance to their previously create balance projects. **Step 2:** After reviewing the final compositions from the last project, all of the students will agree on one design to be used as a point of departure for this project. **Step 3:** Prior to any development of a proposal, students, teachers, parents must select and agree on an appropriate location for an installation of an earthwork to be created by the students. This installation could be permanent or temporary.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Student documents:

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 4: Once a site location is established, students must decide on what types of materials will be used. They should consider how the materials characteristics offer in terms of obstacles or opportunities. **Step 5** Students should be broken into groups to devise a step by step construction process plan. Student groups will present their plans to the class. The teacher will then facilitate a discussion highlighting the strong points from the group's proposals to assemble a master plan. **Questions to consider:** • What materials should be used and how will they be acquired? • What community resources are available to support the project? • What tools and equipment will be needed? • Step 5: Depending on the size and scope of the installation, construction time, techniques, and costs may vary. Be sure to consider time restraints when planning the construction process plan with the students. **Step 6:** Celebrate! Students organize a opening for their earthwork inviting parents, administration, staff, and community members. **Extension:** To provide students with an authentic experience, teachers could arrange a trip to Storm King Sculpture Park to see the exhibit titled "Storm King Wavefield" by Maya Lin. Images are also available on their website.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

http://www.morning-earth.org/

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Lesson 4

Unit 1 Sketch/Design Problems

Content Area: 21st Century Life and Careers

Lesson Title: Unit 1 Sketch/Design Problems

Design Problems are weekly sketch assignments requiring students to critically observe and explore the spatial and visual world around them. These activities are observational and broad in nature; their purpose: to introduce students to various principles of sustainable design including sustainable site planning, water conservation, energy & atmosphere conservation, material and resource conservation, indoor environmental quality, and innovative design. These problems improve both drawing and critical thinking skills. Pin-ups are held weekly to strengthen presentation and critiquing skills.

Timeframe: 1 every other week.

Additional days may be necessary for this lesson if time permits

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Environmental Science, Visual Arts, Architecture and Construction

Integration of Technology:

NA

Equipment needed:

Sketchbooks, pencil or pen

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Development of observational, and analytical skills • Development of sketching/ drawing skill and technique • Strengthening of visual and oral communication skills	LESSON SEQUENCE: The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered. **Sketch/Design Problem Sample 1: Observing Point, Line and Plane** 1. Students are asked to observe the natural world around you for interesting examples and/ compositions of points, lines, and planes.	• Class activities and class participation • Homework Assignments • Small and large group discussions • Checklists • Lesson Rubric

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	2. In their sketchbook, they are asked to sketch and render 3 examples of each. Each sketch should be a minimum of 5 inches x 5 inches. Students should attempt Use varying line weight and render to indicate light, shadow and tonal values. 3. Points and lines can be positive or negative, large or small, active or static, single or in groups. **Evaluation:** Each week students will participate in an informal presentation of their sketches to their peers explaining how their selections meet the criteria of the assignment. **Other Possible Sketch Problem Topics:** • Rhythm and Balance • Variety • Harmony	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

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LESSON REFLECTION TEMPLATE

LESSON REFLECTION TEMPLATE

Reflect on the lesson you have developed and rate the degree to which the lesson **Strongly**, **Moderately** or **Weakly** meets the criteria below.

LESSON ACTIVITIES	STRONGLY	MODERATELY	WEAKLY
Are challenging and require higher order thinking and problem solving skills			
Allow for student choice			
Provide scaffolding for acquiring targeted knowledge/skills			
Integrate global perspectives			
Integrate 21st century skills			
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills			
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills			
Are varied to address different student learning styles and preferences			
Are differentiated based on student needs			
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process			
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives			
Provide opportunities for student reflection and self- assessment			
Provide data to inform and adjust instruction to better meet the varying needs of learners			

UNIT 2 OVERVIEW

UNIT 2 OVERVIEW

Content Area: Career and Technical Education

Unit Title: A Dwelling for the Birds

Target Course/Grade Level: 10th

Unit 2: A Dwelling for the Birds

Introduction

This unit introduces students to the many factors that go into the design and construction of a structure. It asks them to define, analyze, and consider these factors during the process of designing a dwelling for a local bird species. The project will also require students to produce a well constructed, well considered, proposal and the option to create a highly functional final product.

UNIT SUMMARY:

This unit is composed of essential factors to consider when designing a structure built for habitation. It begins with an introduction to the design process. Next, the notion of shelter, followed by occupant & scale, context, material considerations, and presentation. Students discover the importance of these factors as they make connections and draw relationships between them on their journey toward creating a "Dwelling for the Birds."

Primary interdisciplinary connections:

Career and Technical Education, Technology, Environmental Science, Construction and Architectural Drafting & Design

21st century themes:

Core Subjects and 21st Century Themes, Learning and Innovation Skills, Creativity and Innovation, Critical Thinking and Problem Solving, Communication and Collaboration, Information, Media and Technology Skills, Information Literacy, Media Literacy, ICT Literacy, Life and Career Skills

See 21st Century Framework

UNIT RATIONALE:

Architects and designers must consider many factors when creating our built environment. In order to make responsible decisions during the design process, one must consider the potential effects on people, their culture, and the natural world.

Learning Targets

COMMON CORE STATE STANDARDS

English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- College & Career Readiness for Speaking and Listening http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 48
- Reading Standards for Science and Technical Subjects - Grades 9 and 10 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 62
- Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 65

Mathematics Standards

- High School Geometry http://www.corestandards.org/Math/Content/HSG/

NEXT GENERATION SCIENCE STANDARDS

- HS.Interdependent Relationships in Ecosystems
- HS.Natural Selection and Evolution
- HS.Earth's Systems
- HS.Human Sustainability
- HS.Engineering Design

NEW JERSEY CORE CURRICULUM CONTENT STANDARDS

9.2 Career Awareness, Exploration and Preparation

- Career Preparation http://www.state.nj.us/education/cccs/2014/career/92.pdf page 2

9.3 – Career & Technical Education (CTE) Content Area: 21st Century Life and Careers

- CAREER CLUSTER® : ARCHITECTURE & CONSTRUCTION (AC)PATHWAY http://www.nj.gov/education/cccs/2014/career/93.pdf page 4
- DESIGN/PRE-CONSTRUCTION (AC-DES) http://www.nj.gov/education/cccs/2014/career/93.pdf page 5
- VISUAL ARTS (AR-VIS) http://www.nj.gov/education/cccs/2014/career/93.pdf page 7-8

CPI # CUMULATIVE PROGRESS INDICATOR (CPI)

RST.9-10.1 Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.

RST.9-10.2 Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.

RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently

WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a

single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

SL.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively

SL.9-10.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

SL.9-10.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

SL.9-10.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.

9.3.12.AC.2 Use architecture and construction skills to create and manage a project.

9.3.12.AC.4 Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.

9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.

9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.

9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.

9.3.12.AC-DES.7 Employ appropriate representational media to communicate concepts and project design.

9.3.12.AC-DES.8 Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.

9.3.12.AR-VIS.2 Analyze how the application of visual arts elements and principles of design communicate and express ideas.

9.3.12.AR-VIS.3 Analyze and create two and three- dimensional visual art forms using various media.

HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios

HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

UNIT ESSENTIAL QUESTIONS	UNIT ENDURING UNDERSTANDINGS
• What is the iterative design process? • What is meant by scale? • How does the structure's context affect its design? • What is meant by material Performance?	• Engage in the design process, considering aspects of function, context and scale to produce an appropriate structure for its intended inhabitants. • Many factors must be considered when designing a structure. • The form of an object/structure has a direct relationship to its function.

UNIT LEARNING TARGETS

STUDENTS WILL ...

- Understand the various phases of the design process.
- Understand the concept of an iterative process.
- Identify various examples and characteristics of vernacular architecture
- Consider relationships between location, material composition, structure, building processes and occupants.
- Discover, analyze, and document the relationships between occupant and the built environment.
- Understand the role scale plays in the perception of space and form
- Uncover the importance of meeting the requirements of a client/occupant.
- Document their design process and validate their design decisions based on their research and knowledge acquired throughout the unit.
- Understand the relationship between a structure and it context/site.
- Identify the various factors that affect the design of a designed object.
- Engage in the design process, considering aspects of context and environmental factors.
- Depict how the physical characteristics of the materials are affected by the natural environment.
- Identify factors that are considered when selecting building materials.
- Understand what is meant by material performance.
- Engage in the design process, considering material properties, characteristics, and performance.
- Effectively communicate their designs both visually and orally.
- Give and receive constructive criticism.

EVIDENCE OF LEARNING

Summative Assessment:

- Design and Architectural Journal including vocabulary words and reflective comments
- Unit Final Presentation

Equipment needed:

- Wire
- Ruler/tape measure
- Architectural Scale
- Straight Edges
- 18" x 24" Vellum Drawing Paper
- Pencils/Lead Holders and/or mechanical Pencils
- Erasers
- Triangle
- Drafting Tape
- Sketch Paper
- Examples of bird house designs
- * Construction materials will vary by student
- * Appropriate power tools and equipment

Formative Assessments

- Group Discussions
- Individual and Group Projects and/or Presentations
- Sketches and Architectural drawings
- Electronic Green Reflection Journals/wiki's or student blogs
- Green Design and Architecture Checklist
- Student created wiki for resource sharing and documentation
- Tests/Quizzes

Back to Unit Sequence

LESSON PLANS

LESSON PLANS

LESSON	TIMEFRAME
Lesson 1: The Design Process	25 days
Lesson 2: Shelter	5 days
Lesson 3: Occupant & Scale	5 days
Lesson 4: Context	5 days
Lesson 5: Material Characteristics and Considerations	5 days
Lesson 6: Final Review	5 days

TEACHER NOTES:

Construction materials and construction methods will vary by students.

Components of Reuse and Recycling can be incorporated

Instructional Methods and Strategies:

Problem Based Learning

- http://www.cotf.edu/ete/teacher/teacherout.html
- http://www.bie.org/

The Five E's -

- http://enhancinged.wgbh.org/research/eeeee.htmlhttp://enhancinged.wgbh.org/research/eeeee.html
- http://www.miamisci.org/ph/lpintro5e.htmlhttp://www.miamisci.org/ph/lpintro5e.html
- http://www.teachersnetwork.org/ntol/howto/science/fivees.htm

Classroom Instruction That Works (technology integration) http://t4.jordan.k12.ut.us/professional_development/strategies/

Cooperative Learning http://www.teach-nology.com/currenttrends/cooperative_learning/

Curriculum Development Resources:

- NJCCCS
- USGBC

Common Core Standards for LAL and Math

It is highly recommended that teacher supplement lessons with additional coursework related to the Common Core Standards. Resources to additional lessons, projects, etc. are located in the resources section of the curriculum.

Lesson 1

The Design Process

Content Area: Career and Technical Education

Lesson Title: The Design Process

Timeframe: 5 days

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

History, Environmental Science, Technology, Visual Arts, Architecture and Construction

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php , PowerPoint, Adobe Indesign and or Photoshop

Equipment needed:

Computers, Projector

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
• Understand the various phases of the design process. • Understand the concept of an iterative process.	LESSON SEQUENCE: The activities in this lesson will be conducted in a project based learning method, teacher facilitated and student centered. **Step 1:** The teacher will facilitate a guided discussion with students about the integrated design process's ability to guide one in their quest to create something from nothing. Design starts from an idea. Students should not simply create something you've seen before, but strive to create something unique that is specific to its set of conditions. Explain that just as a research paper takes many drafts to refine, so does the designing of an object. Their research and ideas should yield the ingredients from which you will shape and mold your structure. The design process will guide them through their journey to produce appropriate final products and solutions.	• Group discussion • Project Deliverables: sketches, drawings, built objects, etc. • Informal presentation • Informal Desk critique by instructor • Progress Assessment Rubric • Informal instructor observation • Student documents:

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 2: The teacher will help to guide students through the various stages of the process using the attached diagram titled: "The Design Process" created by The Chicago Architecture Foundation. • Define the problem • Collect Information • Brainstorm and analyze ideas • Develop solutions/sketch-build-test • Present your ideas to other for feedback • Improve your design **Step 3:** Students will conduct research on the scientific method. They will create charts/ diagrams which depict similarities and differences between the design process and the scientific method. Finally, they will discuss and compare their findings in an open forum. **Link to Culminating Project:** Over the course of the following lessons, students will engage in this process by creating sketches, drawings, physical and/or digital models, etc. Time should be provided at each step for design development based on new considerations uncovered during the lessons.	

DIFFERENTIATION:

Lesson components will be discussed at the beginning of each class session. The instructor should frame each class with a student driven discussion regarding their progress, obstacles they may currently be facing, etc. The instructor should take notes from the discussion on the board/projector outlining major discussion points that would pertain to the majority of the students in the class. It should then be concluded by a round-robin discussion where each student briefly explains their goal for what will be accomplished for that day. The instructor should then monitor student progress by meeting with each student individually throughout the work session. Supplementary handouts should also be distributed when necessary.

RESOURCES PROVIDED:

- http://www.adobe.com/products/illustrator/features.html
- http://tv.adobe.com/product/illustrator/
- http://planetgreen.discovery.com/slideshows/
- http://www.flickr.com/groups/naturegroup/
- http://www.audubon.org/

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Lesson 2

Shelter

Content Area: Career and Technical Education

Lesson Title: Shelter

Timeframe: 5 days

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

History, Environmental Science, Visual Arts, Architecture and Construction

Integration of Technology:

Internet Research, PowerPoint

Equipment needed:

Computers, Projector, Poster board, Drawing Materials

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
• Identify various examples and characteristics of vernacular architecture • Uncover similarities between shelters constructed by birds and those created by humans. • Consider relationships between location, material composition, structure, building processes and occupants.	LESSON SEQUENCE: The activities in this lesson will be conducted in a project based learning method, teacher facilitated and student centered. **Step 1:** Students will view a PowerPoint presentation depicting various types of shelters. The examples should vary drastically from one to another. Include shelters composed of a variety of building material types, shapes, permanent or temporary types, etc.	• Group discussion • Project Deliverables: sketches, drawings, built objects, etc. • Informal presentation • Informal Desk critique by instructor • Progress Assessment Rubric • Informal instructor observation • Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 2: Students will be asked to answer the following questions including sketching images depicting examples of the following: • How is it supported? • What are the purposes for openings in walls? • Why are roofs typically sloped? How do flat roofs address this concern? • How does the form of a house relate to its function: to shelter us from the natural environment? **Step 3:** After answering the questions, students should conduct research looking for various types of ways that birds build nests/ shelters for themselves. They should try to find nest various shapes and sizes, materials, locations, and structural types. See: adherent nests; ground nests; scrape nests; burrow nests; cavity nests; platform nests; cupped nests; pendulous nests **Step 4:** Students should then be introduced to the term Vernacular Architecture and challenged to find examples with similar relationships to one of the previously researched bird nest types. **Step 4:** Students will then create venn-diagrams depicting similarities and differences between a vernacular architectural structure and a bird nest type. The presentation board should also include detailed drawings of the bird type/species, the nest, and the human scaled structure it is being compared to. Step 5: When students are finished, have them pin-up their diagrams and drawings. Hold an informal discussion about their discoveries. Students will then be asked to reflect on their final piece as well as the compositions created by their peers.	

DIFFERENTIATION:

Lesson components will be discussed at the beginning of each class session. The instructor should frame each class with a student driven discussion regarding their progress, obstacles they may currently be facing, etc. The instructor should take notes from the discussion on the board/projector outlining major discussion points that would pertain to the

majority of the students in the class. It should then be concluded by a round-robin discussion where each student briefly explains their goal for what will be accomplished for that day. The instructor should then monitor student progress by meeting with each student individually throughout the work session. Supplementary handouts should also be distributed when necessary.

RESOURCES PROVIDED:

- http://www.viewnestingbirds.com/
- http://www.greenhomebuilding.com/vernacular.htm
- http://www.audubon.org/
- http://www.vernaculararchitecture.com/
- http://www.fernbank.edu/Birding/nestecology.htm

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Lesson 3

Occupant and Scale

Content Area: Career and Technical Education

Lesson Title: Occupant and Scale

Timeframe: 5 days

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Environmental Science, Visual Arts, Architecture and Construction

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php Wikispaces www.wikispaces.com Bubbl http://www.bubbl.us/

Equipment needed:

Computers,

GOALS/OBJECTIVES

STUDENTS:

- Discover, analyze, and document the relationships between occupant and the built environment.
- Understand the role scale plays in the perception of space and form
- Uncover the importance of meeting the requirements of a client/occupant.
- Engage in the design process, considering aspects of function and scale.
- Document their design process.

LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES

LESSON SEQUENCE:

The activities in this lesson will be conducted in a project based learning method, teacher facilitated and student centered.

Step 1: The culminating project for this unit will be a bird dwelling designed specifically for a local bird species. For this lesson, each student should select a local bird species to identify size, necessities for living, and other programmatic/living requirements.

Step 2: Students will be asked to answer the following questions:

- How does the entry allow the birds in and keep predators or others out?
- How many occupants/birds do they house?
- Will this particular bird species nest in a manmade birdhouse?
- Will the species nest in structures with multiple dwellings?

FORMATIVE ASSESSMENT TASKS

- Class participation
- Homework Assignments
- Small and large group discussions
- Quiz
- Reflection Journals
- Checklists
- Lesson Rubric
- Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 3: Students should conduct research and document their findings. **Link to Culminating Project:** Over the course of these lessons, students will engage in the process by creating sketches, drawings, physical and/or digital models, etc. Time should be provided at each step for design development based on new considerations uncovered during the lessons. (Teachers can establish requirements at their discretion) **Extension:** Reading of "A House Made by its Own Needs," an excerpt from The Fountainhead, Ayn Rand. [New York: Scribner, 2000 (originally published 1946. (pp. 136-137) PS3535.A547F68] Ask students a series of questions relating to the themes of the reading in regard to the relationship of scale, form and function.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

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Lesson 4

Context/Site Analysis

Content Area: Career and Technical Education

Lesson Title: Context/Site Analysis

Timeframe: 5 Days

Architects often refer to the intended location of a structure as its site. This will allow them to take into account how it could be influenced by the characteristics of its "site."

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Technology, Environmental Science, Architecture and Construction

Integration of Technology:

Internet,

Equipment needed:

Computers, Cameras, Poster Board, Drawing Materials

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Understand the relationship between a structure and it context/site. • Identify the various factors that affect the design of a designed object. • Engage in the design process, considering aspects of context and environmental factors. • Document their design process.	LESSON SEQUENCE: The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered. **Step 1:** Students will view a PowerPoint presentation to demonstrate how contextual factors affect the function, purpose and meaning of an object. Through this presentation and discussion students will discover that meaning is context bound; that an object's meaning is directly influenced by the contexts in which it resides.	• Class activities and class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Student documents: http://greenschoolsforteachers.wikispaces.com/Student+Documents

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Understand the relationship between a structure and it context/site. • Identify the various factors that affect the design of a designed object. • Engage in the design process, considering aspects of context and environmental factors. • Document their design process.	**Step 2:** Students will be asked to answer the following questions: • Where will your structure be located? (Hanging from a tree, mounted to an existing surface, atop a pole, etc.) • How will its eventual location affect the design of your structure? • Does it need to face a specific direction? **Step 3:** Students will then document the final location by taking photographs and creating sketches. They should be confident that their selected bird species will reside in the selected site location. (for example, some birds will only reside in free-hanging structures) **Link to Culminating Project:** Over the course of these lessons, students will engage in the design process by creating sketches, drawings, physical and/or digital models, etc. Time should be provided at each step for design development based on new considerations uncovered during the lessons. (Teachers can establish requirements at their discretion)	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

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Lesson 5

Material Characteristics & Considerations

Content Area: Career and Technical Education

Lesson Title: Material Characteristics & Considerations

Timeframe: 5 Days

Students will select a variety of building materials to investigate how they would perform when exposed to the elements. They will then document their findings by creating sketches and diagrams depicting how the physical characteristics of the materials are affected by these factors.

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Architecture, Construction and Drafting, Technology, Mathematics, Language Arts.

Integration of Technology:

Internet, computer software

Equipment needed:

Computers

GOALS/ OBJECTIVES

STUDENTS:

- Depict how the physical characteristics of the materials are affected by the natural environment.
- Identify factors that are considered when selecting building materials.
- Understand what is meant by material performance.
- Engage in the design process, considering material properties, characteristics, and performance.
- Document their design process.

LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES

LESSON SEQUENCE:

The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered.

Step 1: Students will view a PowerPoint presentation to be introduced to various characteristics of building materials as well as manufacturing processes. Students will begin to understand how the materials react to environmental factors such as direct sunlight, exposure to water, as well as the manufacturing processes and their affect of the environment.

FORMATIVE ASSESSMENT TASKS

- Class participation
- Homework Assignments
- Small and large group discussions
- Quiz
- Reflection Journals
- Checklists
- Lesson Rubric
- Practice Drawing
- Student documents: http://greenschoolsforteachers.wikispaces.com/Student+Documents

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 2: By this point, students should have developed a tentative list of materials to use for their project. This list will be refined after considering the following questions: • Is the material readily available? • Is it affordable? • Is it durable and weather resistant? • Will it attract too much heat? • Is it environmentally friendly? • It is recycled or recyclable? • Does it contain any undesirable toxins/ chemicals? • How is the material created? • Where is the material created and how does it arrive at location? • Will it adequately shelter the occupant from the elements? **Step 3:** Students should conduct research and document their findings. **Link to Culminating Project:** Over the course of these lessons, students will engage in the design process by creating sketches, drawings, physical and/or digital models, etc. Time should be provided at each step for design development based on new considerations uncovered during the lessons. (Teachers can establish requirements at their discretion)	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED

http://en.wikipedia.org/wiki/Architectural_drawing
Jefferis, A., Madsen, D.A., (2004) Architectural Drafting and Design, (5th ed.). Clifton Park, NY: Thomson Delmar Learning

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Lesson 6

Final Review

Content Area: Career and Technical Education

Lesson Title: Final Review

Timeframe: 5 days

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Architecture, Construction and Drafting, Technology, Mathematics, Language Arts.

Integration of Technology:

Internet, computer software

Equipment needed:

Computers, Projector

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Effectively communicate their designs both visually and orally. • Validate their design decisions based on their research and knowledge acquired throughout the unit. • Give and receive constructive criticism.	LESSON SEQUENCE: The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered. **Step 1**: Up to this stage, students have been engaged in the design process and should begin to prepare for their final presentations. Students will utilize previously acquired drawing skills and techniques to create scale floors plans, sections, and elevations of their proposed structures. **Step 2:** Teachers should take time to review drawing techniques such as accurate use of line-weight, drawing layout and composition, labeling, dimensioning, etc.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Practice Drawing • Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 3: The final presentation offers students the opportunity to demonstrate understanding of previously covered skills such as graphic design/layout and should include text descriptions, images and sketches. Students will be assessed by their design progress, oral and visual clarity of their presentations and graphic design/layout. **Extension:** Students will begin the safe construction of their "bird dwellings." This project allows for a great deal of student choice so construction materials and methods will vary greatly from student to student. Depending on the expertise of the instructor, this could be modified to relate more specifically to any given trade.	

Differentiation:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

Resources Provided

Architectural Drawing: A Visual Compendium of Types and Methods - 3rd Edition by Rendow Yee
Jefferis, A., Madsen, D.A., (2004) Architectural Drafting and Design, (5th ed.).
Clifton Park, NY: Thomson Delmar Learning

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Lesson 7

Unit 2 Design Problems

Content Area: Career and Technical Education

Lesson Title: Unit 2 Design Problems

Timeframe: 1 Per Week

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Architecture, Construction and Drafting, Technology, Mathematics, Language Arts.

Integration of Technology:

Internet, computer software

Equipment needed:

Sketchbook, Pencil or Pen

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Development of observational, and analytical skills • Development of sketching/drawing skill and technique • Strengthening of visual and oral communication skills	LESSON SEQUENCE: The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered. **Sketch/Design Problem 2:** Rendering Texture 1. Students Select (3) different surface with perceivable textural qualities. 2. They are to study the way light interacts with the surface, analyzing which elements/surfaces receive: • Little or no tone (probably receiving the most light), • Medium and/or dark tones • Deep shade and shadows (receiving least amount of light.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Practice Drawing • Student documents: http://greenschoolsforteachers.wikispaces.com/Student+Documents

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	3. Students sketch (1) 5"x5" square section of each material, zoomed in to a level that expresses the textural quality of your selected materials/ surfaces. **Evaluation:** Each week students will participate in an informal presentation of their sketches to their peers explaining how their selections meet the criteria of the assignment. Other topics could include: • Unity • Threshold • Movement	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED

http://en.wikipedia.org/wiki/Architectural_drawing
Jefferis, A., Madsen, D.A., (2004) Architectural Drafting and Design, (5th ed.). Clifton Park, NY: Thomson Delmar Learning

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LESSON REFLECTION TEMPLATE

LESSON REFLECTION TEMPLATE

Reflect on the lesson you have developed and rate the degree to which the lesson **Strongly**, **Moderately** or **Weakly** meets the criteria below.

LESSON ACTIVITIES	STRONGLY	MODERATELY	WEAKLY
Are challenging and require higher order thinking and problem solving skills			
Allow for student choice			
Provide scaffolding for acquiring targeted knowledge/skills			
Integrate global perspectives			
Integrate 21st century skills			
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills			
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills			
Are varied to address different student learning styles and preferences			
Are differentiated based on student needs			
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process			
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives			
Provide opportunities for student reflection and self- assessment			
Provide data to inform and adjust instruction to better meet the varying needs of learners			

UNIT 3 OVERVIEW

UNIT 3 OVERVIEW

Content Area: Career and Technical Education

Unit Title: Sustainable Design Strategies

Target Course/Grade Level: 10th

Unit 3: Sustainable Design Strategies

Introduction

This unit introduces students to the basic elements of passive solar design and digital modeling techniques. Passive design is defined as the utilization of the sun's energy, the geographical climate, and the properties of different materials to heat, cool, and light buildings. Students will study the relationship between these factors by creating models, testing their proposals, and making improvements to their designs. An introduction to computer aided drafting and digital modeling software will help students see the advantages of creating digital simulations to study the relationship between a buildings and the natural environment.

UNIT SUMMARY:

These skills will be developed through tutorials proved by the instructor. Students will demonstrate their skill acquisition through projects related to sustainable components/ system design. Subsequent units will require implementation of these passive and active design strategies.

Primary interdisciplinary connections:

Career and Technical Education, Mathematics, Technology, Environmental Science, Construction and Architectural Drafting & Design

21st century themes:

Core Subjects and 21st Century Themes, Learning and Innovation Skills, Creativity and Innovation, Critical Thinking and Problem Solving, Communication and Collaboration, Information, Media and Technology Skills, Information Literacy, Media Literacy, ICT Literacy, Life and Career Skills

See 21st Century Framework

UNIT RATIONALE:

One of the key factors in sustainable design is sunlight. The way the sun moves across the sky in different geographic locations affects how architects design for each place. People concerned about energy usage can design to take advantage of radiant heat energy in the winter and create shading devices to reduce cooling loads in the summer. Students will understand how digital modeling are assisting to maximize efficiency and minimize the negative impact buildings have on the environment.

Learning Targets

COMMON CORE STATE STANDARDS

English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- College & Career Readiness for Speaking and Listening http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 48
- Reading Standards for Science and Technical Subjects - Grades 9 and 10 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 62
- Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 65

Mathematics Standards

- High School Geometry http://www.corestandards.org/Math/Content/HSG/

NEXT GENERATION SCIENCE STANDARDS

- HS.Interdependent Relationships in Ecosystems
- HS.Natural Selection and Evolution
- HS.Earth's Systems
- HS.Human Sustainability
- HS.Engineering Design

NEW JERSEY CORE CURRICULUM CONTENT STANDARDS

9.2 Career Awareness, Exploration and Preparation

- Career Preparation http://www.state.nj.us/education/cccs/2014/career/92.pdf page 2

9.3 – Career & Technical Education (CTE) Content Area: 21st Century Life and Careers

- CAREER CLUSTER® : ARCHITECTURE & CONSTRUCTION (AC)PATHWAY http://www.nj.gov/education/cccs/2014/career/93.pdf page 4
- DESIGN/PRE-CONSTRUCTION (AC-DES) http://www.nj.gov/education/cccs/2014/career/93.pdf page 5
- VISUAL ARTS (AR-VIS) http://www.nj.gov/education/cccs/2014/career/93.pdf page 7-8

CPI # CUMULATIVE PROGRESS INDICATOR (CPI)

RST.9-10.1 Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.

RST.9-10.2 Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.

RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently

WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

SL.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively

SL.9-10.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

SL.9-10.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

SL.9-10.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.

9.3.12.AC.2 Use architecture and construction skills to create and manage a project.

9.3.12.AC.4 Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.

9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.

9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.

9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings.

9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.

9.3.12.AC-DES.7 Employ appropriate representational media to communicate concepts and project design.

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

UNIT ESSENTIAL QUESTIONS

- What is a "green" building?
- How do climate and solar orientation on a building's energy use?
- What are the features of a green building and why are they important?
- What are the major differences between conventional building design and a high performance integrated building design?
- Why are the primary types of sketches important in design and architecture?
- What are the advantages for using both physical and digital modeling in the sustainable design process?

UNIT ENDURING UNDERSTANDINGS

- Understand the importance of considering passive design features as a first step in the green design process.
- Evaluate and estimate the impact of alternative massing strategies and building shapes on energy use.
- Understand the principles for designing and testing the effectiveness of roof overhangs and sun shading devices.
- Multiple systems make up the green features of a building. They work together resulting in a high-performance energy efficient building.
- What is the role of the designer in planning a "green" building?
- Technical skill acquisition: Computer Aided Drafting and 3D digital Modeling.
- Sustainable design and architecture is an essential step to improve the environment, conserve energy and other resources that go into the construction of and the life cycle of a building.
- Understand that sustainable design and architecture is a systems approach connecting the site, the building and functionality that maximize efficiency and minimize environmental impacts.

UNIT LEARNING TARGETS

STUDENTS WILL ...

- Explore the effect of geographic location, climate and solar orientation on a building's energy use.
- Become familiar with various elements of a green building (high performance design)
- Understand the advantages of creating physical and digital models in the sustainable design process.
- Understand the differences between 2D technical drafting and 3D digital modeling.
- Describe the advantages and limitations of CAD and digital modeling software.
- Identify features of CAD and digital modeling software.
- Construct and test day-lighting studies to evaluate effectiveness of passive design strategies.
- Explain the role of digital modeling in the process of creating a building.
- Learn the process of importing and exporting file formats between software.

EVIDENCE OF LEARNING

SUMMATIVE ASSESSMENT:

- At the end of this unit, students will participate on a capstone project, students will work in groups to create a conceptual design of a green building.
- Design and Architectural Journal including vocabulary words and reflective comments
- Unit Final Exam

Equipment needed:

Computers, CAD software, internet/websites, measuring equipment, basic drafting supplies

TEACHER RESOURCES:

- As an option, www.wikispaces.com students can create wikis to document, share and collaborate with unit activities.
- Jefferis, A., Madsen, D.A., (2004) Architectural Drafting and Design, (5th ed.). Clifton Park, NY: Thomson Delmar Learning
- Kicklighter, C. E., Brown, W. C., (2008) Drafting & Design – Engineering Drawing Using Manual and CAD Techniques. Tinley Park, IL: The Goodheart-Willcox Company, Inc.
- GreenBuildings--EPA http://www.epa.gov/greenbuilding
- Design Share Project Library http://www.designshare.com/index.php/home
- Learning by Design http://www.asbj.com/
- Sustainable by Design http://www.susdesign.com/
- Sustainable Jersey http://www.sustainablejersey.com/
- Green Communities http://www.epa.gov/greenkit/index.htm
- NJDEP, How to Become an Environmentally Sustainable Community - A primer http://www.nj.gov/dep/opsc/sustcomm.html

Sustainable sites

Ideas for sustainable land design, construction and maintenance practices.

- http://www.sustainablesites.org/
- NJ AIA http://www.aia-nj.org/
- NJ USGBC www.usgbcnj.org
- Collaborative for High Performance Schools CHPS http://www.chps.net/dev/Drupal/node
- USGBC www.usgbc.org
- Green Collar Careers http://greenpos.wikispaces.com/Green+Collar+Careers

Sustainable Sites

- Ideas for sustainable land design, construction and maintenance practices. LEED for Schools First Edition SS PPTLEED-NC Rating System Credits summarySustainable Sites Initiative PPT
- Sustainable Sites PDF http://www.sustainablesites.org/

Building Design

- Sustainable Design Guide
  Charrette Handbook
  Architectural Handbook
  Design Competition Curriculum
- K-12 Curriculum USGBC http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1887

Case Studies

- Alder Creek Middle School (PDF 690 KB)
- Desert Edge High School (PDF 804 KB)
- Fossil Ridge High School (PDF 383 KB)
- Homewood Middle School (PDF 515 KB)
- Northern Guilford Middle School (PDF 363 KB)
- Green Building by the Numbers Benefits of Green Schools
- http://www.cap-e.com/publications
- Green Schools: Attributes for Health and Learning

- Cost and Benefits for Building Green Costing Green: A Comprehensive Cost Database and Budgeting Methodology
- High performance building http://www.eere.energy.gov/buildings/database/mtxview.cfm?CFID=5060364&CFTOKEN=35132027

Formative Assessments

- Group Discussions
- Individual and Group Projects and/or Presentations
- Sketches and Architectural drawings
- Electronic Green Reflection Journals/wiki's or student blogs
- Green Design and Architecture Checklist
- Student created wiki for resource sharing and documentation
- Tests/Quizzes

Back to Unit Sequence

LESSON PLANS

LESSON PLANS

LESSON	TIMEFRAME
Lesson 1: Passive Solar Design (Physical modeling simulation)	20 days
Lesson 2: Intro to Digital Modeling	10-20 days
Lesson 3: Solar Simulation Study	15 days
Lesson 4: Sustainable Systems (Orthographic Drawing Techniques)	15 days
Lesson 5: Unit 3 Sketch/Design Problems	1 per week (or week 1 draft, week 2 final)

TEACHER NOTES:

CAD software may include any of the following: Google SketchUP, AutoCAD, AutoCAD Architecture, and Revit Architecture. CAD software such as SketchUP is free or a nominal fee for a site license: http://sketchup.google.com/download/ (Google Sketchup 7 is free)

For more information on AutoCAD, AutoCAD Architecture, Revit Architecture software and curriculum resources, you may visit the following websites:

- http://autodesk.com/
- http://students.autodesk.com/?nd=learning_center
- http://students.autodesk.com/?nd=content_box_layout_view&layout_id=213
- http://sustainabilityworkshop.autodesk.com/
- http://students.autodesk.com/?nd=download_center&tagent=EDU-FY12_email-AS-10-18-2011
- https://academy.autodesk.com/curriculum

Instructional Methods and Strategies:

Problem Based Learning -

- http://www.cotf.edu/ete/teacher/teacherout.html
- http://www.bie.org/

The Five E's - http://enhancinged.wgbh.org/research/eeeee.html

http://www.miamisci.org/ph/lpintro5e.html

http://www.teachersnetwork.org/ntol/howto/science/fivees.htm

Classroom Instruction That Works (technology integration) http://t4.jordan.k12.ut.us/professional_development/strategies/

Cooperative Learning http://www.teach-nology.com/currenttrends/cooperative_learning/

Curriculum Development Resources:

- NJCCCS
- USGBC

Lesson 1

Passive Solar Design

Content Area: Career and Technical Education

Lesson Title: Passive Solar Design

Timeframe: 20 days

LESSON COMPONENTS

Integration of Technology:

Internet Research, Digital Photography

Equipment needed:

Computers, Internet, Digital Camera, Lamps with stands, tape, model building supplies

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Understand the importance of considering passive design strategies as a preliminary step in the design process. • Explore the effect of geographic location, climate and solar orientation on a building's energy use. • Understand the purpose of designing and testing the effectiveness of passive solar design features. • Demonstrate safe and accurate model building techniques.	LESSON SEQUENCE: **Part 1: Solar Geography** **Step 1:** Prior to the lesson, have students view the following image of Solar Geometry and how it demonstrates the relationship of the sun to the earth at different locations, at different times of the year. Teachers should then facilitate a discussion including other images and diagrams for further clarification. **Step 2:** Have each student access the sun position calculator found at http://www.sunposition.info/. The teacher should then provide students with a predetermined site location to be used as the hypothetical site for the project. Students should then be asked to determine the solar altitude angles and azimuth angles at 12:00 noon for the following dates: Spring Equinox (March 21st); Summer solstice (June 21st); Fall Equinox (September 21st); Winter Solstice (December 21st).	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Refer back to the solar geography diagram to illustrate the position of the sun at various times of the year for the previously provided site location. Explain to students that the solar angles discovered in the lesson will play a major role in the next phase of the project. **Part 2: Group Research/Presentations** **Step 1:** The document titled "Passive Solar Design" should serve as the initial start of the research phase. Teachers may assign the reading prior to the start of this phase to introduce the concept of passive solar design. **Step 2:** Students should be put in groups (group sizes t.b.d. by teacher) to conduct research to understand the various passive design strategies to consider during the design process. (Explain the difference between passive and active design which will be introduced later on in the unit.) This should require students to use a case study building to identify key passive design features including but not limited to the following: • Geographical location and orientation Insulation • Windows including types and locations • Thermal Mass • Surface Colors • Ventilation and Circulation • Overhangs and shading, • Amount of space • Overall building orientation Students should be required to define the terminology used as well as use their case study building to explain how it functions to conserve energy or resources. Their presentations should include text descriptions, images, diagrams, aerial photographs, etc.	

Part 3: Physical Modeling

Step 1: For the next phase of this lesson, students are asked to design and construct a physical model demonstrating an understanding of passive solar design. The designing of their structures should be based on diagrams illustrating passive design principles and other information uncovered during research, materials distributed by teacher, and meet the design constraints listed below:

- Foot print of entire structure must be less than 200 sq. ft.
- Maximum height of 20 ft.
- Physical model should:
- Built at 1" =1'-0" scale
- Include a floor structure
- Have removable wall(s) for taking photographs of the interior
- Include wall and ceiling thicknesses
- Things for students to keep in mind:
- Objective: To design and build a one-room structure within the provided design constraints, utilizing passive design strategies discovered during their research.
- Orientation of structure on site
- Amount of Thermal Mass

Size of Structure

Intended Color/ Material Performance

Ventilation/Circulation

Step 2: Student Presentations Requirements

- Physical Model
- Drawings: Hand sketched Plan, Section, and Elevations (to scale)

Because site orientation is a major factor in passive solar design, it is recommended that teachers create a testing area to simulate the conditions of the site location. This can be done by indicating the site at 1"=1'-0" scale on the floor of the classroom using tape. Most importantly, a compass should be included indicating north for the specific site location.

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Now using the calculations from the previous Solar Geometry lesson, use the solar altitude angles for both summer and winter solstices to place to lighting sources directed at the site. The placement of these light sources will mimic the sun locations on the site at each of the solstices. For each presentation, students should place their models in the test area/site. Each light should be shined on the model independently to test how sunlight would interact with the structure at different times of the year. Students should explain then explain their proposal, discussing the concepts in their design, its successes and shortcomings, and how they might improve upon their design. Interior and exterior photographs should be taken of their proposals under the two lighting conditions for documentation purposes.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

- The Green Studio Handbook: Environmental Strategies for Schematic Design [Paperback]
- Alison Kwok (Author), Walter Grondzik (Author)
- http://www.solardecathlon.gov/education-curriculum.html
- http://curious.astro.cornell.edu/
- http://www.sunposition.info/
- http://www.nrel.gov/docs/fy01osti/29236.pdf

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Lesson 2

Digital Modeling: Level 1

Content Area: Career and Technical Education

Lesson Title: Digital Modeling: Level 1

Timeframe: 15 days

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Environmental Science, Technical Drafting, Architecture

Integration of Technology:

Digital modeling software, web-based digital modeling tutorials

Equipment needed:

Textbook, Computers, Internet, 3d Max or equivalent software.

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Explain the role of digital modeling in the design process. • Describe the advantages and limitations of digital design software. • Identify features of digital modeling and CAD software.	LESSON SEQUENCE: **Part 1** - Teacher will engage students in digital modeling technology by discussing the advantages, flexibility and accuracy of digital modeling in the design field. Teacher will also show examples of renderings created using digital modeling software. **Part 2** - Students will be trained in the digital modeling software selected by the instructor. The level of difficulty of each tutorial/activity should be determined by the teacher. Links to those resources may be found below. **Part 3** - Students will document their progress understanding of digital modeling in their journals/sketchbooks, student progress checklist and small group evaluations.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Student documents: http://greenschoolsforteachers.wikispaces.com/Student+Documents

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

- 3D Studio Max R3 Bible by Kelly L. Murdock in Books
  Kelly L. Murdock - IDG Books Worldwide (2000) – Paperback
- http://www.tutorialized.com/tutorials/3DS-MAX/1
- http://sketchup.google.com/training/videos.html

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Lesson 3

Solar Simulation Study

Content Area: Career and Technical Education

Lesson Title: Solar Simulation Study

Timeframe: 15 days

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Environmental Science, Technical Drafting, Architecture

Integration of Technology:

digital modeling software, web-based digital modeling tutorials

Equipment needed:

Textbook, Computers, Internet, 3d Max or equivalent software.

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Explain the role of digital modeling in the process of creating a building. • Describe the advantages and limitations of digital design software. • Identify features of digital modeling software.	LESSON SEQUENCE: For this lesson, students will create a digital simulation depicting the relationship of the sun to the structures designed in Lesson 1.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 1- Using the digital modeling skills and techniques learned in the previous less, students will begin modeling their previously created passive solar design structures. They should use their previously created technical drawings for information including scale, dimensions, etc. and conduct additional research to identify materials composition, properties, etc. They may also choose to make changes to their proposal taking into consideration the feedback received during their presentations. **Step 2** – After students create their digital models, teachers may want to cover advanced digital modeling techniques such as site/topography modeling, material mapping, or have students model more detailed building component such as doors, windows, etc. **Step 3** – (AutoDesk Revit, 3D Max or equivalent necessary for the remaining steps) Once the model is complete, students will prepare the virtual environment to create digital renderings animations and to conduct solar studies. This will require the setup of a "daylight system." By inserting a compass into the model environment and indicating location, date, and time, a virtual solar lighting system will be created. **Step 4** – In order for students to create renderings and animations of their structures, camera should be inserted into the model. These cameras will allow students to capture images and animations depicting the way daylight would interact with their structures. **Step 5** – The final presentation offers students the opportunity to demonstrate understanding of previously covered skills such as graphic design/layout and should include text descriptions, renderings, and animations. These should depict not only their final building proposal but also their process by which it was derived. Students will be assessed by their design progress, oral and visual clarity of their presentations and graphic design/layout.	• Checklists • Lesson Rubric • Student documents: http://greenschoolsforteachers.wikispaces.com/Student+Documents

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

- 3D Studio Max R3 Bible by Kelly L. Murdock in Books
- Kelly L. Murdock - IDG Books Worldwide (2000) – Paperback
- http://www.tutorialized.com/tutorials/3DS-MAX/1

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Lesson 4

Sustainable Systems

Content Area: Career and Technical Education

Lesson Title: Sustainable Systems

Timeframe: 20 days

(Orthographic Drawing Techniques)

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

CADD, Technical Drafting, Architecture

Integration of Technology:

CAD software, web-based CAD tutorials

Equipment needed:

Textbook, Computers, Internet, CAD software.

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Differentiate between passive and active solar design systems. • Describe the advantages of using digital modeling software. • Generate orthographic drawings from digital models.	LESSON SEQUENCE: **Step 1** – Students will be introduced to a wide variety of sustainable energy systems or system components that are used to improved the sustainable functionality of a building. For example: rain barrel, water catchment system, compost bin, recycling bin, photovoltaic cell, wind turbine, etc. (Complexity of the sustainable energy system or system component is at the discretion of the instructor.) **Step 2** – Students will then select a sustainable system or a component to a system to research. During this research phase, students should collect information regarding the functionality of the system as well as the essential components required. They should collect technical information including dimensions, materials composition, etc. **Step 3** – Students will then create a digital model of the system or system component using the technical skills acquired in the previous lesson. (For example, a student may decide to study how photovoltaic cells function and draw various views and details of a solar panel.) **Step 4** – After students have modeled their sustainable system/component, teachers will introduce them to the "Flashbox" function in AutoCAD to generate orthographic views of the 3-dimensional model. Students will first export their 3d Max files as a ".dwg" file which can be read by AutoCAD. Once the file is opened in AutoCAD, students can follow the following procedure: 1. Display the model in the orientation/viewport of the 2d view to be generated. 2. Initiate the Flatshot command. 3. Select the "insert as new block" option; select the color and line-type to be used for foreground and obscured lines. (obscured lines will typically be represented as hidden lines) 4. Create the "Flatshot" view/block.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Student documents: http://greenschoolsforteachers.wikispaces.com/Student+Documents

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 5: Once the block(s) is created, students should use it to create orthographic drawings for each view. Teachers should use this opportunity to stress the importance of drawing techniques in CAD such as accurate use of line-weights, drawing layout and composition, labeling, dimensioning, etc. **Step 6:** Students should then be given time and guidance while creating presentation boards of their models for critique. This affords students the opportunity to demonstrate understanding of previously covered skills such as graphic design/ layout and should include text descriptions, images and other technical information. Students will be assessed by the accurate use of line-weights, labeling, dimensioning, oral and visual clarity of their presentations and graphic design/layout.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

- Kicklighter, C. E., Brown, W. C., (2008) Drafting & Design – Engineering Drawing Using Manual and CAD Techniques. Tinley Park, IL: The Goodheart-Willcox Company, Inc.
- AutoCAD Architecture 2011 [Book] by Paul F. Aubin
- By Paul F. Aubin - Cengage Learning (2010) - Paperback
- 3D Studio Max R3 Bible by Kelly L. Murdock in Books
- Kelly L. Murdock - IDG Books Worldwide (2000) – Paperback
- http://www.tutorialized.com/tutorials/3DS-MAX/1

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Lesson 5

Unit 3 Sketch/Design Problems

Content Area: 21st Century Life and Careers

Lesson Title: Unit 3 Sketch/Design Problems

Design Problems are weekly sketch assignments requiring students to critically observe and explore the spatial and visual world around them. These activities are observational and broad in nature; their purpose: to introduce students to various principles of sustainable design including sustainable site planning, water conservation, energy & atmosphere conservation, material and resource conservation, indoor environmental quality, and innovative design. These problems improve both drawing and critical thinking skills. Pin-ups are held weekly to strengthen presentation and critiquing skills.

Timeframe: 1 every other week.

Additional days may be necessary for this lesson if time permits

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Environmental Science, Architecture and Construction, Visual Arts

Integration of Technology:

NA

Equipment needed:

NA

GOALS/ OBJECTIVES

STUDENTS:

- Development of observational, and analytical skills
- Development of sketching/drawing skill and technique
- Strengthening of visual and oral communication skills

LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES

LESSON SEQUENCE:

The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered.

Sketch/Design Problem Sample 3:

Rendering Transparency

1. Students select and observe (3) examples of transparency throughout the environment. Have them look for surfaces that are translucent, perforated, scratched, or reflective and study the way layers interact with each other. Do they intersect to create a new color or density? How does light effect transparency?

FORMATIVE ASSESSMENT TASKS

- Class activities and class participation
- Homework Assignments
- Small and large group discussions
- Checklists
- Lesson Rubric

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	2. Students will then sketch (1) 5"x5" square section of each example, zoomed in to a level that expresses the to emphasize the play of surfaces and varied levels of transparency. **Evaluation:** Each week students will participate in an informal presentation of their sketches to their peers explaining how their selections meet the criteria of the assignment. **Other Possible Sketch Problem Topics:** • Rhythm and Balance • Variety • Harmony	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

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LESSON REFLECTION TEMPLATE

LESSON REFLECTION TEMPLATE

Reflect on the lesson you have developed and rate the degree to which the lesson **Strongly**, **Moderately** or **Weakly** meets the criteria below.

LESSON ACTIVITIES	STRONGLY	MODERATELY	WEAKLY
Are challenging and require higher order thinking and problem solving skills			
Allow for student choice			
Provide scaffolding for acquiring targeted knowledge/skills			
Integrate global perspectives			
Integrate 21st century skills			
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills			
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills			
Are varied to address different student learning styles and preferences			
Are differentiated based on student needs			
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process			
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives			
Provide opportunities for student reflection and self- assessment			
Provide data to inform and adjust instruction to better meet the varying needs of learners			

UNIT 4 OVERVIEW

UNIT 4 OVERVIEW

Content Area: Career and Technical Education

Unit Title: Sustainable Design and Architecture Module – A Place of My Own (System Integration)

Target Course/Grade Level: 10th

Unit 4: A Place of My Own

Introduction

This unit introduces students to the scope and sequence of the design process and sustainable system integration into a newly created structure. Students apply previously gained knowledge of the design process and sustainable considerations when designing a structure for personal habitation.

UNIT SUMMARY:

Students will first study a particular building type by conducting a case study. They will then create a "Place of Their Own" taking into consideration their personal needs and desires while considering aspects of form, function, and sustainable design.

Primary interdisciplinary connections:

Career and Technical Education, Technology, Environmental Science, Construction and Architectural Drafting & Design

21st century themes:

Core Subjects and 21st Century Themes, Learning and Innovation Skills, Creativity and Innovation, Critical Thinking and Problem Solving, Communication and Collaboration, Information, Media and Technology Skills, Information Literacy, Media Literacy, ICT Literacy, Life and Career Skills

See 21st Century Framework

UNIT RATIONALE:

The needs and personal desires of the client must always be reflected in the design. Architects are challenged with the task of satisfying the needs of the client as well as their artistic intuition. These solutions must also be considered within the context of other variables present in the process of sustainable design.

Learning Targets

COMMON CORE STATE STANDARDS

English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- College & Career Readiness for Speaking and Listening http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 48
- Reading Standards for Science and Technical Subjects - Grades 9 and 10 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 62
- Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 65

Mathematics Standards

- High School Geometry http://www.corestandards.org/Math/Content/HSG/

NEXT GENERATION SCIENCE STANDARDS

- HS.Interdependent Relationships in Ecosystems
- HS.Natural Selection and Evolution
- HS.Earth's Systems
- HS.Human Sustainability
- HS.Engineering Design

NEW JERSEY CORE CURRICULUM CONTENT STANDARDS

9.2 Career Awareness, Exploration and Preparation

- Career Preparation http://www.state.nj.us/education/cccs/2014/career/92.pdf page 2

9.3 – Career & Technical Education (CTE) Content Area: 21st Century Life and Careers

- CAREER CLUSTER® : ARCHITECTURE & CONSTRUCTION (AC)PATHWAY http://www.nj.gov/education/cccs/2014/career/93.pdf page 4
- DESIGN/PRE-CONSTRUCTION (AC-DES) http://www.nj.gov/education/cccs/2014/career/93.pdf page 5
- VISUAL ARTS (AR-VIS) http://www.nj.gov/education/cccs/2014/career/93.pdf page 7-8

CPI # CUMULATIVE PROGRESS INDICATOR (CPI)

RST.9-10.1 Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.

RST.9-10.2 Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.

RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently

WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

SL.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively

SL.9-10.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

SL.9-10.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

SL.9-10.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.

9.3.12.AC.2 Use architecture and construction skills to create and manage a project.

9.3.12.AC.4 Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.

9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.

9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.

9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings.

9.3.12.AC-DES.4 Apply building codes, laws and rules in the project design.

9.3.12.AC-DES.5 Identify the diversity of needs, values and social patterns in project design, including accessibility standards.

9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.

9.3.12.AC-DES.7 Employ appropriate representational media to communicate concepts and project design.

9.3.12.AC-DES.8 Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.

9.3.12.AR-VIS.2 Analyze how the application of visual arts elements and principles of design communicate and express ideas.

9.3.12.AR-VIS.3 Analyze and create two and three-dimensional visual art forms using various media.

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that

account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

UNIT ESSENTIAL QUESTIONS

- How can a building reflect the personal needs and desires of the client?
- How does sustainable design impact the environment in a positive way?
- How is a sustainable system integrated in to the design of a building?

UNIT ENDURING UNDERSTANDINGS

- Product selection refers to reduction on existing natural resources, products that can be reused and recycled.
- Adaptation of building and design to environment and client.
- Sustainable design and architecture is an essential step to improve the environment, conserve energy and other resources that go into the construction of and the life cycle of a building.

UNIT LEARNING TARGETS

STUDENTS WILL ...

- Identify key features of green urban, suburban, and rural design.
- Integrate an engineered system into a building for resource efficiency.
- Utilize a green building material.
- Participate and understand the charrette process for sustainable design.
- Utilize the iterative design process to guide the evolution of their proposals.
- Identify the factors (context, history, geography, etc.) that exist at a site location that may play a role in the development of a building proposal.
- Describe the importance of sustainable sites and how it relates to the environment.
- Identify the criteria for sustainable site selection.
- Give and receive constructive criticism.
- Participate and understand the charrette process for sustainable design.
- Utilize the iterative design process to guide the evolution of their proposals.
- Effectively communicate their designs both visually and orally.
- Validate their design decisions based on their research and knowledge acquired throughout the course
- Become familiar with components and characteristics of a particular design type
- Identify sustainable systems present in a building/structure.

EVIDENCE OF LEARNING

Summative Assessment:

- At the end of this unit, students will participate on a capstone project, students will work in groups to create a conceptual design of a green building including the 5 main categories of a green building, cradle to cradle materials, energy conserving and production methods.
- Design and Architectural Journal including vocabulary words and reflective comments
- Unit Final Presentation

Equipment needed:

Computers, Graphic Design Program (Adobe Illustrator, Adobe Photoshop , internet/websites, measuring equipment, basic drafting supplies

TEACHER RESOURCES:

- http://planetgreen.discovery.com/slideshows/http://planetgreen.discovery.com/slideshows/
- http://www.flickr.com/groups/naturegroup/http://www.flickr.com/groups/naturegroup/

FORMATIVE ASSESSMENTS

- Group Discussions
- Individual and Group Projects and/or Presentations
- Sketches and Architectural drawings
- Electronic Green Reflection Journals/wiki's or student blogs
- Green Design and Architecture Checklist
- Student created wiki for resource sharing and documentation
- Tests/Quizzes

Back to Unit Sequence

LESSON PLANS

LESSON PLANS

LESSON	TIMEFRAME
Lesson 1: Case Study Analysis	10 days
Lesson 2: A Place of My Own	25 days
Lesson 3: Unit 4 Design/Sketch Problem	1 per week (or week 1 draft, week 2 final)

TEACHER NOTES:

For more information on AutoCAD, AutoCAD Architecture, and Revit Architecture software you may visit the following website: http://www.autodesk.com

Revit was found to be a challenging software product with a high degree of difficulty, new language, and not repetitive. AutoCAD can get the lesson done

The learning curve for Revit is steep compared to Inventor and AutoCAD.

Instructional Methods and Strategies;

Problem Based Learning

- http://www.cotf.edu/ete/teacher/teacherout.html
- http://www.bie.org/
- http://www.edutopia.org/

Classroom Instruction That Works (technology integration) http://t4.jordan.k12.ut.us/professional_development/strategies/

Cooperative Learning http://www.teach-nology.com/currenttrends/cooperative_learning/

Curriculum Development Resources:

Lesson 1

Sustainable Home Case Study

Content Area: 21st Century Life and Careers

Lesson Title: Sustainable Home Case Study

Timeframe: 5 days

Students will research contemporary methods of designing related to a specified building type. By conducting and presenting research, students will become familiar with elements and ideologies to consider when designing the particular building type.

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

History, Environmental Science, Architecture and Construction

Integration of Technology:

Internet, Microsoft PowerPoint

Equipment needed:

Computers, Projector

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Become familiar with components and characteristics of a particular design type • Effectively communicate their designs both visually and orally. • Identify sustainable systems present in a building/ structure.	ESSON TIMELINE/PROCEDURE: The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered. **Step1:** In order to conduct a comprehensive analytical study of a building, one must conduct research in order to first acquire necessary documentation. For the first step, students are asked to collect the following information for one of the case study buildings provided by the teacher: architect, geographical location, time of construction, building use, building square footage, etc.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric • Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	LIn addition, graphical documentation should include site plan(s), floor plan(s), section(s) and elevation(s). These drawings will be used to create analysis sketches and drawings at a later date. Students should also collect photographs of the overall building to thoroughly understand it's physically qualities, characteristics, and context. **Step 2:** Students are to select a case study building of a small residential home/structure with strong sustainable considerations. They are to identify, diagram, and present the following: **Site:** Sustainable landscape design, Building/site orientation, Topography, Vegetation. **Spaces:** Site uses and circulation, Program, Views, Natural light **Systems:** Energy, water, waste, occupant comfort **Structure:** Spans, forces and structural type, construction materials and techniques used, building envelope. **Step 3:** Students will then be asked to create a PowerPoint presentation including aerial photographs taken from Google Earth, Photographs, Drawings, Diagrams, and software. **Step 4:** In-class student presentations should be scheduled providing students with 8-10 min. to give their present their findings.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments. Students will be given the option to create a wiki to collaborate with classmates, share information and reflect on lesson progress.

RESOURCES PROVIDED:

Back to Lessons Plans

Lesson 2

A Place of My Own

Content Area: 21st Century Life and Careers

Lesson Title: A Place of My Own

Timeframe: Approx. 25 days

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Environmental Science, Architecture and Construction

Integration of Technology:

Internet, Adobe Photoshop, Adobe InDesign, AutoCAD, Revit, Google Sketch-up

Equipment needed:

Computers, Physical model building tools and supplies, Drafting/Sketching supplies and materials.

GOALS/OBJECTIVES

STUDENTS:

- Identify the factors (context, history, geography, etc.) that exist at a site location that may play a role in the development of a building proposal.
- Describe the importance of sustainable sites and how it relates to the environment.
- Identify the criteria for sustainable site selection.
- Give and receive constructive criticism.
- Participate and understand the charrette process for sustainable design.
- Utilize the iterative design process to guide the evolution of their proposals.
- Utilize a green building material.

LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES

LESSON SEQUENCE:

Part 1 - Site Analysis

For this project, students are asked to locate a site within parameters set by the teacher. Some teachers may choose to give students the opportunity to select from a variety to predetermined site locations; rural, suburban, or urban contexts. Others may allow students to select a site of their choosing.

After students have selected a site they should locate it using Google Earth. Have them save images of the site at a variety of zoom levels. Using graphic software, have students reduce the opacity to 50%. Then have them print out the aerial photographs, preferably at 11x17.

Students should then conduct a thorough site analysis documenting relationships to adjacent buildings, topographic and landscape conditions, orientation, views, site obstacles and opportunities.

FORMATIVE ASSESSMENT TASKS

- Class participation
- Homework Assignments
- Small and large group discussions
- Quiz
- Reflection Journals
- Checklists
- Lesson Rubric

Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
• Effectively communicate their designs both visually and orally. • Validate their design decisions based on their research and knowledge acquired throughout the course	From this information, students will then compose a clear and concise site analysis diagram indicating path of the sun, arrows indicating optimal views, site boundaries and other information collected during the research/analysis phase. **Part 2 – The Client:** Provide a PowerPoint presentation showing examples of buildings with strong connections to the people that inhabit them. "Does your personality influence the sorts of places in which you thrive and the objects that you cherish? You bet it does!" For example: It's important for a furniture maker to have a place to work; it's important for elderly residents to have a place to gather together. The more creative your narrative, the more information can inform your design decisions. For this project, students are designing a place of their own, a get-a-way if you will; so they will serve as their own client. Have them consider the following questions: • What things are important to you? • What are your hobbies and what spatial requirements that would be necessary to accommodate them? • Where you this place be located: urban, suburban, or rural environment. Why? • What kind of environment do you intend to create? Inner reflection, escape from the world, from people or for people, etc. • What types of activities would take place there? (Reading, sketching, dancing, etc.) • What time of the day would you spend the most time occupying your retreat? • Are there any special requirements associated with the activities that will take place within the structure? How will it affect the size and or shape of the structure? • Will there be any outdoor spaces? • Where is your current retreat? Why?	

Part 3 - Program: What would you do there?

Students should base early on in the design process what the activities will take place in their structure. At this point the teacher should establish min/maximum square footage requirements. (200 sq. ft. footprint will be sufficient) Including guidelines for both pervious and imperious surfaces. Have students estimate the square footage of their various spaces. If a multi-story structure, students may use ladders to access the upper levels; the square footage requirements do not allow for conventional stairs.

Part 4 – Schematic Design:

a. Bubble Diagram - Have students start by sketching bubble several bubble diagrams depicting spatial organizations and relationships of the spaces or components of the room. What spaces need to be adjacent to each other? Which shouldn't? (Have students keep in mind that it is the act of sketching that will get them to an appropriate solution; drawing is not just for documenting ideas but also cultivating them.)

b. Floor Plan - Once students have determined the relationships among these parts, they should consider those relationships in the context of their particular site location. Where does site want its structure to be located given the factors uncovered during the initial site analysis? Once that decision is determined students can begin the process of translating their bubble diagrams into floor plans, taking into consideration scale, sun exposure, and other site conditions. (It is suggested that students continue to draw by hand at this stage. Plans can be rough, but realistic in terms of scale.)

c. Elevation, Section: Students will conduct a massing study by building a rough study model at a scale predetermined by the instructor. Once satisfied with their floor plans and massing, students will sketch several elevations and determine height relationships, door and window locations, and roof covering options.

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 3: Students should then be given time and guidance while creating presentation boards of their design proposals for critique. This affords students the opportunity to demonstrate understanding of previously covered skills such as graphic design/layout and should include text descriptions, images and sketches. Students will be assessed by their current design progress, oral and visual clarity of their presentations and graphic design/layout.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

Back to Lessons Plans

Lesson 3

Unit Sketch/Design Problems

Content Area: 21st Century Life and Careers

Lesson Title: Unit Sketch/Design Problems

Timeframe: 1 per week

Additional days may be necessary for this lesson if time permits

Design Problems are weekly sketch assignments requiring students to critically observe and explore the spatial and visual world around them. These activities are observational and broad in nature; their purpose: to introduce students to various principles of sustainable design including sustainable site planning, water conservation, energy & atmosphere conservation, material and resource conservation, indoor environmental quality, and innovative design. These problems improve both drawing and critical thinking skills. Pin-ups are held weekly to strengthen presentation and critiquing skills.

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

Technology, Environmental Science, Architecture and Construction

Integration of Technology:

NA

Equipment needed:

Sketchbook, Pencil or Pen

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Development of observational, and analytical skills • Development of sketching/drawing skill and technique • Strengthening of visual and oral communication skills	LESSON SEQUENCE: The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered. **Sketch/Design Problem 4:** Connections 1. Students select and analyze (5) examples of how different materials can be connected to each other.	• Class activities and class participation • Homework Assignments • Small and large group discussions • Checklists • Lesson Rubric

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	2. Have them sketch them separately, zoomed in to a level that expresses how the connection works and how it functions. Utilize sketching/rendering techniques previously taught in class. Other Possible Sketch Problem Topics: • Contrast • Closed Loop Systems • Structure **Evaluation:** Each week students will participate in an informal presentation of their sketches to their peers explaining how their selections meet the criteria of the assignment.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

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LESSON REFLECTION TEMPLATE

LESSON REFLECTION TEMPLATE

Reflect on the lesson you have developed and rate the degree to which the lesson **Strongly**, **Moderately** or **Weakly** meets the criteria below.

LESSON ACTIVITIES	STRONGLY	MODERATELY	WEAKLY
Are challenging and require higher order thinking and problem solving skills			
Allow for student choice			
Provide scaffolding for acquiring targeted knowledge/skills			
Integrate global perspectives			
Integrate 21st century skills			
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills			
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills			
Are varied to address different student learning styles and preferences			
Are differentiated based on student needs			
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process			
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives			
Provide opportunities for student reflection and self- assessment			
Provide data to inform and adjust instruction to better meet the varying needs of learners			

UNIT 5 OVERVIEW

UNIT 5 OVERVIEW

Content Area: Career and Technical Education

Unit Title: Sustainable Design and Architecture Module – Biophilic Design

Target Course/Grade Level: 10th

Unit 5: Biophilic Design

Introduction

The natural world can provide us with a template for smarter buildings and more efficient designs. The theory of biophilic design suggests that we study, learn, and capitalize on nature's design genius. For this culminating project, students' concepts must be derived from this theory.

UNIT SUMMARY:

This unit introduces students to the many factors that go into the design and construction of a structure. It asks them to define, analyze, and consider these factors during the process of designing a visitors' center for a local botanical gardens. The project will also require students to produce a well constructed, well considered, proposals that incorporate sustainable systems.

Primary interdisciplinary connections:

Career and Technical Education, Technology, Environmental Science, Construction and Architectural Drafting & Design

21st century themes:

Core Subjects and 21st Century Themes, Learning and Innovation Skills, Creativity and Innovation, Critical Thinking and Problem Solving, Communication and Collaboration, Information, Media and Technology Skills, Information Literacy, Media Literacy, ICT Literacy, Life and Career Skills

See 21st Century Framework

UNIT RATIONALE:

The theory of biophilic design suggests that the natural world can provide architects/designers with a template for smarter buildings and more efficient design solutions. These solutions must also be considered within the context of other variables present in the process of sustainable design.

Learning Targets

COMMON CORE STATE STANDARDS

English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- College & Career Readiness for Speaking and Listening http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 48
- Reading Standards for Science and Technical Subjects - Grades 9 and 10 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 62
- Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12 http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf page 65

Mathematics Standards

- High School Geometry http://www.corestandards.org/Math/Content/HSG/

NEXT GENERATION SCIENCE STANDARDS

- HS.Interdependent Relationships in Ecosystems
- HS.Natural Selection and Evolution
- HS.Earth's Systems
- HS.Human Sustainability
- HS.Engineering Design

NEW JERSEY CORE CURRICULUM CONTENT STANDARDS

9.2 Career Awareness, Exploration and Preparation

- Career Preparation http://www.state.nj.us/education/cccs/2014/career/92.pdf page 2

9.3 – Career & Technical Education (CTE) Content Area: 21st Century Life and Careers

- CAREER CLUSTER® : ARCHITECTURE & CONSTRUCTION (AC)PATHWAY http://www.nj.gov/education/cccs/2014/career/93.pdf page 4
- DESIGN/PRE-CONSTRUCTION (AC-DES) http://www.nj.gov/education/cccs/2014/career/93.pdf page 5
- VISUAL ARTS (AR-VIS) http://www.nj.gov/education/cccs/2014/career/93.pdf page 7-8

CPI #	CUMULATIVE PROGRESS INDICATOR (CPI)

RST.9-10.1 Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.

RST.9-10.2 Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.

RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently

WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

SL.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing

their own clearly and persuasively

SL.9-10.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

SL.9-10.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

SL.9-10.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.

9.3.12.AC.2 Use architecture and construction skills to create and manage a project.

9.3.12.AC.4 Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.

9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.

9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.

9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings.

9.3.12.AC-DES.4 Apply building codes, laws and rules in the project design.

9.3.12.AC-DES.5 Identify the diversity of needs, values and social patterns in project design, including accessibility standards.

9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.

9.3.12.AC-DES.7 Employ appropriate representational media to communicate concepts and project design.

9.3.12.AC-DES.8 Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.

9.3.12.AR-VIS.2 Analyze how the application of visual arts elements and principles of design communicate and express ideas.

9.3.12.AR-VIS.3 Analyze and create two and three-dimensional visual art forms using various media.

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

UNIT ESSENTIAL QUESTIONS	UNIT ENDURING UNDERSTANDINGS
• What is biophilic design? • How does sustainable design impact the environment in a positive way? • What is a site analysis? • How do you read a topographic map?	• The natural world can provide us with a precedents for smarter and more efficient design solutions • Product Selection refers to reduction on existing natural resources, products that can be reused and recycled. • Sustainable design and architecture is an essential step to improve the environment, conserve energy and other resources that go into the construction of and the life cycle of a building.

UNIT LEARNING TARGETS

STUDENTS WILL ...

Identify the factors (context, history, geography, etc.) that exist at a site location that may play a role in the development of a building proposal.

Describe the importance of sustainable sites and how it relates to the environment.

Identify the criteria for sustainable site selection.

Construct a physical topographic model

Use design-thinking strategies to create conceptual ideas that consider the local environment and principles of biomimicry.

Understand how concepts of biomimicry and ecological design drive trends in architecture, past and present.

Students will think critically about regional ecosystemic systems

Critically analyze and document biological characteristics of organisms and ecosystems

Give and receive constructive criticism.

Consider characteristics found in the local bioregion in the designing of a structure.

Consider how architecture and design are influenced by biological phenomena

Participate and understand the charrette process for sustainable design.

Integrate an engineered system into a building for resource efficiency.

Utilize a green building material.

Utilize the iterative design process to guide the evolution of their proposals.

Effectively communicate their designs both visually and orally.

Validate their design decisions based on their research and knowledge acquired throughout the course

EVIDENCE OF LEARNING

Summative Assessment:

- At the end of this unit, students will participate on a capstone project, students will work in groups to create a conceptual design of a green building including the 5 main categories of a green building, cradle to cradle materials, energy conserving and production methods.
- Design and Architectural Journal including vocabulary words and reflective comments
- Unit Final Presentation

Equipment needed:

Computers, Graphic Design Program (Adobe Illustrator, Adobe Photoshop , internet/websites, measuring equipment, basic drafting supplies
Teacher Resources:

http://planetgreen.discovery.com/slideshows/

http://www.flickr.com/groups/naturegroup/

Formative Assessments

- Group Discussions
- Individual and Group Projects and/or Presentations
- Sketches and Architectural drawings
- Electronic Green Reflection Journals/wiki's or student blogs
- Green Design and Architecture Checklist
- Student created wiki for resource sharing and documentation
- Tests/Quizzes

Back to Unit Sequence

LESSON PLANS

LESSON PLANS

LESSON	TIMEFRAME
Lesson 1: Site Analysis/Contour Modeling	15 days
Lesson 2: Biophilic Design & Concept	10 days
Lesson 3: Schematic Design & Program Defined	15-20 days
Lesson 4: Design Development/System Integration	15-20 days
Lesson 5: Final Review Preparation	5 Days
Lesson 6: Unit 4 Design/Sketch Problems	1 per week (or week 1 draft, week 2 final)

TEACHER NOTES:

For more information on AutoCAD, AutoCAD Architecture, and Revit Architecture software you may visit the following website: http://www.adobe.com

Instructional Methods and Strategies;

Problem Based Learning -

- http://www.cotf.edu/ete/teacher/teacherout.html
- http://www.bie.org/
- http://www.edutopia.org/

Classroom Instruction That Works (technology integration) http://t4.jordan.k12.ut.us/professional_development/strategies/

Cooperative Learning http://www.teach-nology.com/currenttrends/cooperative_learning/

Curriculum Development Resources:

Lesson 1

Site Analysis/Contour Modeling

Content Area: Career and Technical Education

Lesson Title: Site Analysis/Contour Modelingh.2et92p0

Timeframe: 5 days

Students must first begin an analytical study of the site prior to considering any design intervention. The context of the problem extends beyond the physical presence of the surrounding buildings, but considers the purpose, program, local neighborhood, greater city, users, client, budget, site, and architect. It can be a complicated series of "forces" that influence the design of a particular problem on a particular site; many of which are not necessarily visual.

Therefore, students are asked to conduct a comprehensive analysis of the site. After documenting the existing conditions at the site, students will create a scale site model.

LESSON COMPONENTS

21ST CENTURY THEMES

Interdisciplinary Connections:

History, Environmental Science, Architecture and Construction, Visual Arts

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php Adobe Illustrator, PowerPoint

Equipment needed:

Computers, Projector

GOALS/OBJECTIVES

- Identify the factors (context, history, geography, etc.) that exist at a site location that may play a role in the development of a building proposal.
- Describe the importance of sustainable sites and how it relates to the environment.
- Identify the criteria for sustainable site selection.
- Construct a physical topographic model

LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES

LESSON TIMELINE/PROCEDURE:

The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered.

FORMATIVE ASSESSMENT TASKS

- Class participation
- Homework Assignments
- Small and large group discussions
- Quiz
- Reflection Journals
- Checklists
- Lesson Rubric

Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 1: Arrange a field trip to the site location(s) previously selected by the teacher. (Teachers may select multiple sites to be use by different groups of students if desired) Prior to the trip, have students locate the site using Google Earth. Have them save images of the site at a variety of zoom levels. Using graphic software, have students reduce the opacity to 50%. Then have them print out the aerial photographs, preferably at 11x17. These will be used for taking notes during the site visit. **Step 2:** Students will prepare an initial analysis/inventory of the site by hand, documenting their findings in their 11x17 aerial photograph packets. Students' observations should be thoughtful and acknowledge important information such as: **Natural Surface Features** • Vegetation: Type, size, location, shade pattern, aesthetics, ecology etc. • Slopes: Gradient, landforms, elevations, drainage patterns • Wild Life: ecology, species etc. • Climate: precipitation, annual rain/snow, humidity, wind direction, solar intensity & orientation, average/highest/lowest temperature **Cultural & Man-made Features** • Utilities: sanitary, water supply, gas, electrical etc. • Land use: Usage of site, adjacent use, zoning restrictions, easement etc. • Historic notes: archeological sites, landmarks, building type, size, condition • Circulation: linkages to transit roads, auto & pedestrian access, mass transit routes etc. • Social Factors: population, intensity, educational level, economic & political factors, ethnicity, cultural typology etc.	

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Aesthetic Factors: • – Perceptual: from an auto, by pedestrian, by bike etc. • – Spatial Pattern: views of the site, views from the site, spaces existing, potential for new areas, sequential relationship • – Natural Features: significant natural features of the site, water elements, rock formations, plant materials Students should also create sketches, take photographs, create charcoal rubbings, etc. to thoroughly document the site in a number of mediums. **Step 3:** Each student or group will then create diagrams, photo montages, drawings, etc. and assemble presentation boards depicting their site characteristics. Teachers may elect to incorporate the use of digital/graphic design software such as Adobe InDesign, Photoshop, or Illustrator into the production of the presentation boards. **Step 4:** The final presentation of the students' site analyses offers them the opportunity to demonstrate understanding of previously covered skills such as graphic design/layout and should include text descriptions, images and sketches. Students will be assessed by their ability to communicate their analytical studies both orally and visually. **Step 5:** Students will then engage in an activity introducing them to the process of translating a topographic map to a 3 dimensional topographic model. Teachers should explain how contours on a topographic map depict changes in elevation at regular intervals. Using only heavy-weight paper, scissors, and tape, have students create various types of geographic conditions. (For example, a hill, a cliff, a valley, or ridge)	

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 6: If possible, acquire a topographic map of the site. Have students work together to decide on an appropriate scale for the production of a topographic model of their site location. This model should be ideally constructed from chipboard. This model will be used to provide a scale context for the proposed models of the students' designs. (If a topographic map is not available for a particular site location, teachers can create an approximation for students to reference using aerial photographs and spot elevations)	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments. Students will be given the option to create a wiki to collaborate with classmates, share information and reflect on lesson progress. www.wikispaces.com

RESOURCES PROVIDED:

- Green Building Design Principles http://www.youtube.com/watch?v=R8gL-R5C0MA&feature=related
- Sustainable Sites http://www.youtube.com/watch?v=So2FvWd_sUw&feature=related
- www.sustainablesites.org/why/
  http://frontierassoc.net/greenaffordablehousing/FactSheets/Site.pdf
  http://en.wikipedia.org/wiki/Urban_planning
  www.plangreen.net/
  www.easywaystogogreen.com/sustainability/urban-planning/

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Lesson 2

Biophilic Design & Concept

Content Area: 21st Century Life and Careers

Lesson Title: Biophilic Design & Concept

Timeframe: 5 days

LESSON COMPONENTS

Interdisciplinary Connections:

Biology, Environmental Science, Architecture and Construction, Visual Arts

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php Wikispaces www.wikispaces.com Bubbl http://www.bubbl.us/

Equipment needed:

Computers,

GOALS/OBJECTIVES

STUDENTS:

- Use design-thinking strategies to create conceptual ideas that consider the local environment and principles of biomimicry.
- Understand how concepts of biomimicry and ecological design drive trends in architecture, past and present.
- Students will think critically about regional ecosystemic systems
- Critically analyze and document biological characteristics of organisms and ecosystems
- Give and receive constructive criticism.

LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES

LESSON SEQUENCE:

Part 1: Show students Michael Pawlyn: Using nature's genius in architecture | Video on TED.com and/or

Janine Benyus: Biomimicry in action | Video on TED.com Hold an informal discussion about the issues raised in the video lecture(s) and explain that the natural world can provide architects/ designers with a template for smarter buildings and more efficient design solutions.

Part 2: This project requires students to develop a design based on a specific concept derived from an organism or ecosystem found at their particular site location. This local plant or animal species, for example, will serve as the initial inspiration for students' designs'.

Part 3: Students will then conduct extensive research on their subject considering various elements and attributes including environmental features, natural shapes and forms, natural patterns and processes, light and space, place-based relationships, and evolved human-nature relationships.

FORMATIVE ASSESSMENT TASKS

- Class participation
- Homework Assignments
- Small and large group discussions
- Quiz
- Reflection Journals
- Checklists
- Lesson Rubric
- Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Part 4: Students will then create a series of analytical drawings of their particular subject. These should include drawings at different levels of magnification, diagrams, isolation of different systems, etc. Ultimately, students should come out of this exercise with a comprehensive understanding of their subject. **Step 5:** The final presentation of the students' conceptual studies will offer them the opportunity to demonstrate understanding of previously covered skills such as graphic design/layout and should include text descriptions, images and sketches. Students will be assessed by their ability to communicate their analytical studies both orally and visually. Extension: Reading from Robert Venturi's **Learning from Las Vegas:** The Forgotten Symbolism of Architectural Form. (Duck and the Decorated Shed.)	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

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Lesson 3

Schematic Design & Program Defined

Content Area: Career and Technical Education

Lesson Title: Schematic Design & Program Defined

Timeframe: 5 days

LESSON COMPONENTS

21st Century Themes							
x	Global Awareness	x	Financial, Economic, Business, and Entrepreneurial Literacy	x	Civic Literacy	x	Health Literacy
21st Century Skills							
x	Creativity and Innovation	x	Critical Thinking and Problem Solving	x	Communication and Collaboration	x	Information Literacy
x	Media Literacy	x	ICT Literacy	x	Life and Career Skills		

Interdisciplinary Connections:

Biology, Environmental Science, Architecture and Construction, Visual Arts

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php Wikispaces www.wikispaces.com Bubbl http://www.bubbl.us/

Equipment needed:

Computers,

GOALS/OBJECTIVES

STUDENTS:

- Consider characteristics found in the local bioregion in the designing of a structure.
- Consider how architecture and design are influenced by biological phenomena

LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES

LESSON SEQUENCE:

Part 1 – Students should be provided with square footage and programmatic requirements established by the teacher. This should include the numbers and types of rooms as well as square footage estimates.

FORMATIVE ASSESSMENT TASKS

- Class participation
- Homework Assignments
- Small and large group discussions
- Quiz
- Reflection Journals
- Checklists
- Lesson Rubric
- Student documents:

GOALS/OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
• Participate and understand the charrette process for sustainable design. • Utilize the iterative design process to guide the evolution of their proposals.	**Part 2** - From your research and classroom discussions, students will create a series of bubble diagrams describing the relationships of the programmatic spaces to one another. **Part 3** - Students will then engage in the schematic design process by creating draft-grade sketches, drawings, physical and/or digital models, etc. Teachers should guide students on their design journeys by offering personal critiques and informal pin-up presentation opportunities. This preliminary design phase should still address site conditions identified during the site analysis. (For determining building orientation for passive design opportunities)	

Differentiation:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

Resources Provided:

Slideshare to research information on lesson topics and view a variety of presentation on integrated and high-performance design http://www.slideshare.net/

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Lesson 4

Design Development/System Integration

Content Area: Career and Technical Education

Lesson Title: Design Development/System Integration

Timeframe: 10 days

LESSON COMPONENTS

Interdisciplinary Connections:

Biology, Environmental Science, Architecture and Construction, Visual Arts

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php Wikispaces www.wikispaces.com Bubbl http://www.bubbl.us/

Equipment needed:

Computers,

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
Goals/Objectives	Learning Activities/Instructional Strategies	Formative Assessment Tasks
STUDENTS: • Integrate an engineered system into a building for resource efficiency. • Utilize a green building material. • Consider how architecture and design are influenced by biological phenomena • Participate and understand the Charrette process for sustainable design. • Utilize the iterative design process to guide the evolution of their proposals.	LESSON SEQUENCE: **Part 1** – At the end of the schematic design phase, students should have rough sketches and models of their initial design ideas. The Design Development Phase requires students to refine those rough drawings into scaled floor plans, elevations, sections, and models. **Part 2** - This phase also requires students to consider how sustainable design principles previously covered. Sustainable design considerations: • Passive Design • Material Properties and Energy Impact • Water Use and Collection • Power Use and Generation • Day-lighting	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric Student documents:

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Part 3 - Students will continue to engage in the design development phase by creating refining their drawings, physical and/or digital models, etc. Teachers should continue to guide students on their design journeys by offering personal critiques and informal pin-up presentation opportunities.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

Slideshare to research information on lesson topics and view a variety of presentation on integrated and high-performance design http://www.slideshare.net/

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Lesson 5

Final Review Preparation

Content Area: Career and Technical Education

Lesson Title: Final Review Preparation

Timeframe: 5 days

LESSON COMPONENTS

Interdisciplinary Connections:

Biology, Environmental Science, Architecture and Construction, Visual Arts

Integration of Technology:

Internet, SlideShare http://www.slideshare.net/ Rubistar http://rubistar.4teachers.org/index.php Wikispaces www.wikispaces.com Bubbl http://www.bubbl.us/

Equipment needed:

Computers,

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Effectively communicate their designs both visually and orally. • Validate their design decisions based on their research and knowledge acquired throughout the unit. • Give and receive constructive criticism.	LESSON SEQUENCE: The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered. **Step 1:** Up to this stage, students have been engaged in the design process and should begin to prepare for their final presentations. Students will utilize previously acquired drawing skills and techniques to create scale floors plans, sections, and elevations of their proposed structures. **Step 2:** Teachers should take time to review drawing techniques such as accurate use of line-weight, drawing layout and composition, labeling, dimensioning, etc.	• Class participation • Homework Assignments • Small and large group discussions • Quiz • Reflection Journals • Checklists • Lesson Rubric Student documents:

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Step 3: The final presentation offers students the opportunity to demonstrate understanding of previously covered skills such as graphic design/ layout and should include text descriptions, sketches, and drawings. These should depict not only their final building proposal but also their process by which it was derived. Students will be assessed by their design progress, oral and visual clarity of their presentations and graphic design/ layout.	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

RESOURCES PROVIDED:

Slideshare to research information on lesson topics and view a variety of presentation on integrated and high-performance design http://www.slideshare.net/

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Lesson 6

Unit Sketch/Design Problems

Content Area: 21st Century Life and Careers

Lesson Title: Unit Sketch/Design Problems

Timeframe: 1 per week

Additional days may be necessary for this lesson if time permits

Design Problems are weekly sketch assignments requiring students to critically observe and explore the spatial and visual world around them. These activities are observational and broad in nature; their purpose: to introduce students to various principles of sustainable design including sustainable site planning, water conservation, energy & atmosphere conservation, material and resource conservation, indoor environmental quality, and innovative design. These problems improve both drawing and critical thinking skills. Pin-ups are held weekly to strengthen presentation and critiquing skills.

LESSON COMPONENTS

Interdisciplinary Connections: Environmental Science, Architecture and Construction, Visual Arts

Integration of Technology: NA

Equipment needed: Sketchbooks, Pencil or Pen

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
STUDENTS: • Development of observational, and analytical skills • Development of sketching/drawing skill and technique • Strengthening of visual and oral communication skills	ESSON SEQUENCE: The activities in this lesson will be conducted in a problem and project based learning method, teacher facilitated and student centered. **Sketch/Design Problem Sample 5:** The Module A module is a fixed element used within a larger system or structure. It can be as small as a pixel or as large as a city block. Its creation provides both opportunities and limitations. For this design problem ask students to construct a module and use it in a system or structure. This can be done in 2 or 3 dimensions.	• Class activities and class participation • Homework Assignments • Small and large group discussions • Checklists • Lesson Rubric

GOALS/ OBJECTIVES	LEARNING ACTIVITIES/ INSTRUCTIONAL STRATEGIES	FORMATIVE ASSESSMENT TASKS
	Evaluation: Each week students will participate in an informal presentation of their sketches to their peers explaining how their selections meet the criteria of the assignment. **Other Possible Sketch Problem Topics:** • Figure/Ground • Metamorphosis • Color	

DIFFERENTIATION:

Group discussions and assignments, individual work, afterschool and personalized homework assignments.

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LESSON REFLECTION TEMPLATE

LESSON REFLECTION TEMPLATE

Reflect on the lesson you have developed and rate the degree to which the lesson **Strongly**, **Moderately** or **Weakly** meets the criteria below.

LESSON ACTIVITIES	STRONGLY	MODERATELY	WEAKLY
Are challenging and require higher order thinking and problem solving skills			
Allow for student choice			
Provide scaffolding for acquiring targeted knowledge/skills			
Integrate global perspectives			
Integrate 21st century skills			
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills			
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills			
Are varied to address different student learning styles and preferences			
Are differentiated based on student needs			
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process			
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives			
Provide opportunities for student reflection and self- assessment			
Provide data to inform and adjust instruction to better meet the varying needs of learners			