# Southern Lehigh School District

UbD Curriculum Template

Course: **6th grade STEM** Unit: **Structural Design** Grades: **6**

Teacher Team: **Bennett / McDonald** Date: **June, 2016**

## Stage 1 – Desired Results

### Established Goals

1. What 21st Century Essentials included in the mission statement will this unit address?
   *Problem-solving*
   *Transfer of Learning*
   *Effective Communication Skills*
   *Adaptation and flexibility*

2. What content standards will this unit address?

   - ELA PA Core State Standards
     CC.3.5.6-8.C
     Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
     CC.3.5.6-8.D
     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 6–8 texts and topics.
     CC.3.6.6-8.I
     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.

### Enduring Understandings/Transfer

**Written as a declarative statement, an enduring understanding is a "big idea" that focuses on larger concepts, principles, and processes that go beyond discrete facts or skills. Enduring Understandings are applicable to new situations across content areas and TRANSFERABLE (the ability to learn in one context and apply to a new situation, particularly outside of the classroom) to the real world.**

3. List the Enduring Understanding(s):
   *No design is perfect and changes can always be made to improve a design.*
   *Communication and collaboration are essential to efficient and effective problem solving.*
   *The use of the engineering design process and technological design loop are how creative ideas are turned into inventions and innovations.*
   *Manufacturing takes many processes to complete a desired product.*
   *Manufactured products can have advantages and disadvantages.*
   *Structures are designed to provide solutions to a human need.*

4. What do you want students to do with this knowledge or skill beyond this course? What is Transfer?
   ** Students will understand the steps of The Technological Design Loop to create a product.*
   ** Students will understand how to safely handle tools.*
   ** Students will understand how to use a ruler to take measurements.*
   ** Students will understand how to make predictions and reflect on them.*
   ** Students will understand how to build and test a structure.*

### Essential Questions

**What thought-provoking questions will foster inquiry, meaning-making, and transfer?**

5. List the Essential Question(s) that students should ponder, wonder about or explain by the end of this unit:
   *What are the steps of The Technological Design Loop?*
   *How does The Technological Design Loop help design a product?*
   *What does it look like to work as a team to solve a problem?*
   *How do structures stand?*

| | Acquisition | |
|---|---|---|
| • Math PA Core State Standards<br><br>• PA Content Standards<br>*3.1.6.A9*<br>• *Understand how theories are developed.*<br>• *Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions.*<br>• *Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations.*<br>• *Describe relationships using inference and prediction.*<br>• *Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations.*<br>• *Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories.*<br>• *Analyze alternative explanations and understanding that science advances through legitimate skepticism.*<br>• *Use mathematics in all aspects of scientific inquiry.*<br>• *Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.*<br>*3.4.6.A1*<br>*Identify how creative thinking and* | **Students will know...**<br><br>6. What facts should students know and be able to use to gain further knowledge?<br>*Students will know how to create multiveiw and isometric drawings of a design of a structure.*<br>*Students will know how to take multiview and isometric drawings that they previously drew and draw them on a computer aided drafting program.*<br>*Students will know how to build a model of a product that they designed.*<br>*Students will know how to design, build, and test a structure for engineering efficiency and load capacity*<br><br>7. What vocabulary should students know and be able to recall?<br>*Computer aided design, Isometric drawings, Multiview drawings, Technological Design Loop, brainstorming, problem solving, Accucad, product design, dimensions, top view, side view, front view, measurement, joints, stress, load, tension, truss bridge, torsion, deck, engineer, span, compress.*<br><br>8. What basic concepts should students know and be able to recall and apply?<br>*Follow the steps of The Technological Design Loop to create a product.*<br>*Safe handling of tools.*<br>*Make predictions about a product's functionality and reflect on them.*<br>*Build and test a structure.* | **Students will be skilled at... (be able to do)**<br><br>9. What discrete skill and processes should students be able to demonstrate?<br>*S6.A.1.1.1 Explain how certain questions can be answered through scientific inquiry and/or technological design (e.g., consumer product testing, common usage of simple machines, modern inventions).*<br>*S6.A.1.1.2 Use evidence to support inferences and claims about an investigation or relationship (e.g., common usage of simple machines).*<br>*S6.A.1.2.2 Identify variables that cause changes in natural or human-made systems.*<br>*S6.A.2.2.1 Describe ways technology extends and enhances human abilities for specific purposes (e.g., make observations of cells with a microscope and planets with a telescope).*<br><br>*Students will be skilled at measuring to the nearest 1/16"*<br>*Students will be skilled at sketching multiple designs of ideas for their structure.*<br>*Students will be skilled at drawing full-sized orthographic drawings of their structure.*<br>*Students will be skilled at using a computer aided drafting program to draw full-sized structural drawings.*<br>*Students will be skilled at troubleshooting to solve any problems they encounter.* |

| | | |
|---|---|---|
| *economic and cultural influences shape technological development.*<br>*3.4.6.A2*<br>*Describe how systems thinking involves considering how every part relates to others.*<br>*3.4.6.A3*<br>*Explain how knowledge from other fields of study (STEM) integrate to create new technologies.*<br>*3.4.6.B4*<br>*Demonstrate how new technologies are developed based on people's needs, wants, values, and/ or interests.*<br>*3.4.6.C1*<br>*Recognize that requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.*<br>*3.4.6.C2*<br>*Show how models are used to communicate and test design ideas and processes.*<br>*3.4.6.C3*<br>*Explain why some technological problems are best solved through experimentation.*<br>*3.4.6.D1*<br>*Apply a design process to solve problems beyond the laboratory classroom.*<br>*3.4.6.D2*<br>*Use computers appropriately to access and organize and apply information.*<br>*3.4.6.E7*<br>*Explain how the type of structure determines the way the parts are put together.* | | |

| Stage 2 – Evidence | |
|---|---|
| **NETS for Students** | **PERFORMANCE TASK(S)—can include transfer tasks and Project-Based Learning** |
| **NETS—National Educational Technology Standards; i.e., the standards for evaluating the skills and knowledge students need to learn effectively and live productively in an increasingly global and digital world.**<br><br>*Communication and Collaboration*<br>*Critical Thinking*<br>*Technology Operations* | *Examples include but are not limited to:*<br>*Labs, open-ended essays, voice recordings, videos, presentations, discussion boards, graphic organizers, songs, skits, dioramas, visual projects (posters, dioramas)*<br><br>List the task(s), then explain how the student will demonstrate the transfer of knowledge or skill involved in the task(s) (reference Stage 1, Item #4):<br>*Use a checklist to complete orthographic sketches of structures of their choice, by hand, on paper. (Transfer: Students will be creating sketches for other projects in higher grades)*<br>*Use a checklist to complete full-sized drawings to scale of structures of their choice, by hand, on paper. (Tranfer: Students will be creating full-sized drawings for other projects in higher grades)*<br>*Use a checklist to complete orthographic drawings of structures to scale, off of hand drawings previously completed, on a computer aided drafting program. (Transfer: students will be drawing an orthographic drawings using a computer aided drafting program for other projects in higher grades)*<br>*Use tools to create a structure to be tested. (Transfer: students will be using tools and machines to create projects in higher grades.)* |
| | **OTHER SUMMATIVE ASSESSMENTS—can include factual recall** |
| | *Examples include but are not limited to final projects, research papers, quizzes and tests.*<br><br>List the assessments:<br>*Bridge Research*<br>*Hand-drawing checklist*<br>*Quick checks of drawings before grading.*<br>*Structural design rubric* |

| Stage 3 – Learning Plan | | |
|---|---|---|
| **NETS for Students** | **Learning Activities** | **Progress Monitoring/Formative Assessment** |
| **NETS—National Educational Technology Standards; i.e., the standards for evaluating the skills and knowledge students need to learn effectively and live productively in an increasingly global and digital world.**<br><br>*Creative and Innovation*<br>*Communication and Collaboration* | Questions to consider while planning:<br>• Are transfer and acquisition addressed in the learning plan?<br>• Does the learning plan reflect principles of learning and best practices?<br>• Is there tight alignment with Stages 1 and 2?<br>• Is the plan likely to be engaging and effective for all students? | • **How will you monitor students' progress toward acquisition, meaning, and transfer during learning activities?**<br>Observation<br>Discussion<br>Modeling<br>Quick-Checks of buildings<br>• **What are potential rough spots and student misunderstandings?**<br>Measuring difficulties |

<table>
<tr><td rowspan="2">Research and Information Fluency<br>Critical Thinking</td><td colspan="2"></td><td>How to envision their shape to draw the views correctly.<br>Building difficulties<br>• How will students get the feedback they need?<br>Quick-checks of drawings<br>Collaboration with partner<br>While they are working I observe for safety issues and building issues</td></tr>
<tr><td>List planned activities<br>(examples include but are not limited to: experiments, guided reading, worksheets, discussions, note-taking, research, games):<br><br>Structure research worksheet,<br>Structure design sheet (designing four ideas),<br>Final chosen structure sheet,<br>Full sized orthographic drawing of structure by hand on paper,<br>Full sized orthographic drawing of structure by hand on computer aided drafting program,<br>Structure building activity,<br>Structure testing activity,<br>Structure testing reflection.</td><td>List resources required<br>(examples include but are not limited to: laptops, iPads, websites, digital cameras, magazines, Blackboard, textbooks, novels, primary source documents, other non-fiction text, lab equipment, maps, translator, calculators)<br>Graph paper, 1/16" rulers, Structure research worksheet, Structure design sheet, final chosen structure sheet, Laptops, Computer aided drafting program, Drawing checklist, Computer aided drafting program set-up list, 1/8"x1/8" balsa wood, balsa wood cutters, sand paper, wood glue, wax paper, tape, structure tester, sand, two plastic buckets, scale.</td><td>FORMATIVE ASSESSMENTS—any non-graded, diagnostic assessment administered prior to or during a unit that reflects prior knowledge, skill levels, and potential misconceptions.<br><br>Examples include but are not limited to: Pre-tests, clickers (CPS), mini whiteboards, entrance and exit tickets, CDTs, DIBELS, Aimsweb<br><br>Drawing Checklist<br>Observation of work<br>Performance task on cutting balsa wood</td></tr>
</table>

# Southern Lehigh School District

UbD Curriculum Template

Course: **6th grade STEM** Unit: **Product Design** Grades: **6**

Teacher Team: **Bennett / McDonald** Date: **June, 2016**

<table>
<tr><th colspan="3">Stage 1 – Desired Results</th></tr>
<tr><th>Established Goals</th><th colspan="2">Enduring Understandings/Transfer</th></tr>
<tr><td rowspan="6">1. What 21st Century Essentials included in the mission statement will this unit address?<br>Problem-solving<br>Transfer of Learning<br><br>2. What content standards will this unit address?<br><br>• ELA PA Core State Standards<br>CC.3.5.6-8.C<br>Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.<br>CC.3.5.6-8.D<br>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 6–8 texts and topics.<br>CC.3.5.6-8.G<br>Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).<br>CC.3.6.6-8.E<br>Use technology, including the Internet, to produce and publish writing and</td><td colspan="2">Written as a declarative statement, an enduring understanding is a “big idea” that focuses on larger concepts, principles, and processes that go beyond discrete facts or skills. Enduring Understandings are applicable to new situations across content areas and TRANSFERABLE (the ability to learn in one context and apply to a new situation, particularly outside of the classroom) to the real world.<br><br>3. List the Enduring Understanding(s):<br>No design is perfect and changes can always be made to improve a design.<br>Communication and collaboration are essential to efficient and effective problem solving.<br>The use of the engineering design process and technological design loop are how creative ideas are turned into inventions and innovations.<br>Manufacturing takes many processes to complete a desired product.<br>Manufactured products can have advantages and disadvantages.<br><br>4. What do you want students to do with this knowledge or skill beyond this course? What is Transfer?<br>* Students will understand the steps of The Technological Design Loop to create a product.<br>* Students will understand how to safely handle tools.<br>* Students will understand how to use a ruler to take measurements.<br>* Students will understand how to use a computer aided drafting program.</td></tr>
<tr><th colspan="2">Essential Questions</th></tr>
<tr><td colspan="2">What thought-provoking questions will foster inquiry, meaning-making, and transfer?<br><br>5. List the Essential Question(s) that students should ponder, wonder about or explain by the end of this unit:<br>What is The Technological Design Loop?<br>How does The Technological Design Loop help design a product?<br>What does it look like to work as a team to solve a problem?<br>How is computer aided design utilized in the manufacturing and product design process?</td></tr>
<tr><th colspan="2">Acquisition</th></tr>
<tr><td>Students will know...<br><br>6. What facts should students know and be able to</td><td>Students will be skilled at... (be able to do)<br><br>9. What discrete skill and processes should students</td></tr>
</table>

| | | |
|---|---|---|
| present the relationships between information and ideas clearly and efficiently.<br><br>• Math PA Core State Standards<br>M07.C-G.1.1.4 Describe the two-dimensional figures that result from slicing three-dimensional figures. Example: Describe plane sections of right rectangular prisms and right rectangular pyramids.<br>• PA Content Standards<br>*3.1.6.A9*<br>• *Understand how theories are developed.*<br>• *Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions.*<br>• *Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations.*<br>• *Describe relationships using inference and prediction.*<br>• *Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations.*<br>• *Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories.*<br>• *Analyze alternative explanations and understanding that science advances through legitimate skepticism.* | use to gain further knowledge?<br>*Students will know how to build a prototype of a product that they designed.*<br>*Students will know how to create multi-view and isometric drawings.*<br>*Students will know how to take multi-view and isometric drawings and draw them on a computer aided drafting program.*<br>7. What vocabulary should students know and be able to recall?<br>*Computer aided design, Isometric drawings, Multiview drawings, Technological Design Loop, brainstorming, problem solving, Accucad, product design, dimensions, top view, side view, front view, measurement, full erase, partial erase, object line, hidden line, hotkeys*<br>8. What basic concepts should students know and be able to recall and apply?<br>*Follow the steps of The Technological Design Loop to create a product.*<br>*Safe handling of tools.*<br>*Make predictions about a product's functionality.*<br>*Create multiview and isometric drawings of a product to be manufactured.* | be able to demonstrate?<br>*S6.A.1.1.1 Explain how certain questions can be answered through scientific inquiry and/or technological design (e.g., consumer product testing, common usage of simple machines, modern inventions).*<br>*S6.A.2.2.1 Describe ways technology extends and enhances human abilities for specific purposes (e.g., make observations of cells with a microscope and planets with a telescope).*<br><br>*Students will be skilled at measuring to the nearest 1/16"*<br>*Students will be skilled at sketching multiple designs of ideas for their product.*<br>*Students will be skilled at drawing full-sized orthographic drawings.*<br>*Students will be skilled at using a computer aided drafting program to draw orthographic drawings.*<br>*Students will be skilled at troubleshooting to solve any problems they encounter.* |

| | | |
|---|---|---|
| • *Use mathematics in all aspects of scientific inquiry.*<br>• *Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.*<br>*3.4.6.A2*<br>*Describe how systems thinking involves considering how every part relates to others.*<br>*3.4.6.A3*<br>*Explain how knowledge from other fields of study (STEM) integrate to create new technologies.*<br>*3.4.6.B4*<br>*Demonstrate how new technologies are developed based on people's needs, wants, values, and/ or interests.*<br>*3.4.6.C1*<br>*Recognize that requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.*<br>*3.4.6.D2*<br>*Use computers appropriately to access and organize and apply information.* | | |

| Stage 2 – Evidence | |
|---|---|
| **NETS for Students** | **PERFORMANCE TASK(S)—can include transfer tasks and Project-Based Learning** |
| **NETS—National Educational Technology Standards; i.e., the standards for evaluating the skills and knowledge students need to learn effectively and live productively in an increasingly global and digital world.**<br><br>*Communication and Collaboration*<br>*Critical Thinking*<br>*Technology Operations* | *Examples include but are not limited to:*<br>*Labs, open-ended essays, voice recordings, videos, presentations, discussion boards, graphic organizers, songs, skits, dioramas, visual projects (posters, dioramas)*<br><br>List the task(s), then explain how the student will demonstrate the transfer of knowledge or skill involved in the task(s) (reference Stage 1, Item #4):<br>*Use a checklist to complete orthographic sketches of objects of their choice, by hand, on paper. (Transfer: Students will be creating sketches for their structural design project of a product, and other projects in higher grades)*<br>*Use a checklist to complete full-sized drawings to scale of objects of their choice, by hand, on paper. (Tranfer: Students will be creating full-sized drawings for their structural design project of a product, and other projects in higher grades)*<br>*Use a checklist to complete orthographic drawings of objects to scale, off of hand drawings previously completed, on a computer aided drafting program. (Transfer: students will be drawing an orthographic drawing using a computer aided drafting program for their structural design project of a product, and other projects in higher grades)* |
| | **OTHER SUMMATIVE ASSESSMENTS—can include factual recall** |
| | *Examples include but are not limited to final projects, research papers, quizzes and tests.*<br><br>List the assessments:<br>*Measuring Activity*<br>*Hand-drawing checklist*<br>*Quick checks of drawings before grading.*<br>*Architectural drawing rubric* |

| Stage 3 – Learning Plan | | |
|---|---|---|
| **NETS for Students** | **Learning Activities** | **Progress Monitoring/Formative Assessment** |
| **NETS—National Educational Technology Standards; i.e., the standards for evaluating the skills and knowledge students need to learn effectively and live productively in an increasingly global and digital world.** | Questions to consider while planning:<br>• Are transfer and acquisition addressed in the learning plan?<br>• Does the learning plan reflect principles of learning and best practices?<br>• Is there tight alignment with Stages 1 and 2?<br>• Is the plan likely to be engaging and effective for all students? | • **How will you monitor students' progress toward acquisition, meaning, and transfer during learning activities?**<br>Observation<br>Discussion<br>Modeling<br>Quick-Checks of drawings<br>• **What are potential rough spots and student misunderstandings?**<br>Measuring difficulties<br>How to line up their drawings correctly.<br>How to envision their shape to draw the views |

| | | | |
|---|---|---|---|
| | | | correctly.<br>• **How will students get the feedback they need?**<br>Quick-checks of drawings<br>Peer edits<br>While they are drawing I observe them drawing and discuss issues they may have. |
| | **List planned activities**<br>*(examples include but are not limited to: experiments, guided reading, worksheets, discussions, note-taking, research, games)*:<br><br>Measuring to the 1/16" activity, Activity on sketching three views of objects, activity on drawing full-sized views of objects, Activity on how to draw your name on a computer aided drafting program, Activity on drawing full-sized views of an object on a computer aided drafting program. | **List resources required**<br>*(examples include but are not limited to: laptops, iPads, websites, digital cameras, magazines, Blackboard, textbooks, novels, primary source documents, other non-fiction text, lab equipment, maps, translator, calculators)*<br>Graph paper, 1/16" rulers, objects to measure (legos, wooden blocks, previously drawn objects), Laptops, Computer aided drafting program, Drawing checklist, Computer aided drafting program set-up list. | **FORMATIVE ASSESSMENTS—any non-graded, diagnostic assessment administered prior to or during a unit that reflects prior knowledge, skill levels, and potential misconceptions.**<br><br>*Examples include but are not limited to: Pre-tests, clickers (CPS), mini whiteboards, entrance and exit tickets, CDTs, DIBELS, Aimsweb*<br><br>Exit ticket on three view sketches<br>Drawing Checklist<br>Observation of work<br>Performance task on drawing student name on computer aided drafting program to learn program tools |