Ganado Unified School District
Donna DeNoble PLTW/STEM 6th Grade
Semester 1 Design & Modeling
Semester 2 Computers for Innovators and Makers

PACING Guide SY 2018-19

Timeline & Resources	**AZ College and Career Readiness Standard**	**Essential Question (HESS Matrix)**	**Learning Goal**	**Vocabulary (Content/Academic)**
1st Quarter *15 days*				
Unit 1: What is Engineering • PLTW Website • Internet • Computers • Poster paper • Printing paper • Notebook •	***Science Standards for Grade 6*** **Strand 1: Inquiry Process** Concept 1: Observation, Questions, and Hypotheses based on observation. P.O. 3 – Locate research information, not limited to a single source, for use in the design of a controlled investigation **Strand 2: History and Nature of Science** Concept 1: History of Science and Human Endeavor	• What is the purpose of a portfolio for a student? • What is the purpose of a portfolio for an engineer? • Why is it important for engineers to document their work in their engineering notebook?	Utilize standard procedures to use and maintain an engineering notebook. Use guidelines for developing and maintaining an engineering notebook to evaluate and select pieces of one's own work for an inclusion in a portfolio Describe the relationship between science, technology, engineering, and math	1.) Agriculture 2.) Artifact 3.) Biotechnology 4.) Communication 5.) Construction 6.) Energy 7.) Engineering 8.) Environment 9.) Ergonomics 10.) Industrial 11.) Innovation 12.) Invention

	P.O. 3 – Describe the use of technology in science-related careers <u>Concept 2: Nature of Scientific Knowledge</u> P.O. 1 – Describe how science is an ongoing process that changes in response to new information and discoveries. **<u>Strand 3: Science in Personal and Social Perspectives</u>** <u>Concept 2: Science and Technology in Society</u> P.O. 2 – Compare possible solutions to best address an identified need or problems P.O. 4 – Describe a technological discovery that influences science ***<u>Math ACCRS Standards for Grade 6</u>*** **<u>Understand ratio concepts and solve</u>** <u>6.RP.A.1</u>- Understanding the concept of a ratio and use ratio	• How are our lives impacted by engineers? • What is the difference between an invention and innovation? • How does the use of technology affect the way that you live?	Identify the difference between invention and innovation Operate as an effective member of a team to complete an investigation Describe engineering and explain how engineers participate in or contribute to the invention and innovation of products	13.) Manufacturing 14.) Math 15.)Nanotechnology 16.) Process 17.) Science 18.) System 19.) Technology 20.) Transportation

	language to describe a ratio relationship between two quantities.			
1st Quarter *10 days* **Unit 2:** Design Process • PLTW Website • Internet • Computers • Poster paper • Printing paper • Notebook	***Science Standards for Grade 6*** **Strand 1: Inquiry Process** Concept 1: Observation, Questions, and Hypotheses based on observation. P.O. 1 – Differentiate among a question, hypothesis, and prediction P.O. 2 – Formulate questions based on observations that lead to the development of a hypothesis **Strand 2: History and Nature of Science** Concept 1: History of Science and Human Endeavor P.O. 4 – Describe the use of technology in science-related careers Concept 2: Nature of Scientific Knowledge P.O. 1 – Describe how science is an ongoing process that changes in response to new information and discoveries. P.O. 2 – Describe how scientific knowledge is subject to change as	• What is the design process and how is it used? • Why is brainstorming important when modifying or improving a product? • Why do people work in teams when solving design problems? • What is meant by constraints and criteria? • Which step in the design process uses a design brief? And Why? • Which step in the design process uses a decision matrix? And Why? • Why design elements are considered when engineers and designers invent or innovate a product?	Describe the design process and how it is used to aid in problem solving Describe the elements of design Recognize design criteria and constraints Describe the purpose and importance of working in a team Use the design process to solve a technical problem Apply the elements of design to the design process Explain a design brief and apply the concept when using a design process Operate effectively as a member of a team to complete a design project Using a matrix to select the best solution to a design	1.) Aesthetics 2.) Annotate 3.) Brainstorming 4.) Constraints 5.) Consumer 6.) Criteria 7.) Decision Matrix 8.) Design 9.) Design Brief 10.)Design Elements 11.) Design Process 12.) Designer 13.) Dimension 14.) Engineer 15.) Ergonomics 16.) Evaluate 17.)Experimentation 18.) Exponentially 19.) Investigate 20.) Model 21.) Modify 22.) Optimize 23.)Problem Solving 24.) Process 25.) Prototype

	new information and/or technology challenges prevailing theories			26.) Requirement 27.) Research 28.) Specification 29.) Testing 30.) Texture 31.) Trade-off 32.) Visualization
1st Quarter *25 days* **Unit 3:** Measurements • PLTW Website • Internet • Computers • Printing paper • Notebook • Ruler • Graph paper • Tape measures	***Science Standards for Grade 6*** **Strand 1: Inquiry Process** Concept 2: Scientific Testing P.O. 4 – Perform measurements using appropriate scientific tools P.O. 5 – Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and computer logs Concept 4: Communication P.O. 2 – Display data collected from a controlled investigation ***Math ACCRS Standards for Grade 6*** **Apply and extend previous understanding of multiplication and division** **6.NS.A.1.** Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using	• Do you think the U.S. should convert to all metric measuring, or should the U.S. stay with using both the Standard and Metric systems? And Why? • Why don't we use such measurements forms as the hand span, cubit, and pace very, often today? • Give two reasons why precision measuring tools are not always accurate.	Select the appropriate value from a conversation chart to convert between standard and metric units. Convert between standard and metric measurements including inches, feed, yards, millimeters, centimeters, and meters. Demonstrate the ability to measure accurately with different devices and scales using both the standard and metric systems Explain how to measure in different contexts	1. Accuracy 2. Caliper 3. Customary System 4. Denominator 5. Measurement 6. Metric System 7. Micrometer 8. Numerator 9. Precision 10. Unit

	visual fraction models and equations to represent the problem. **6.NS.B.2.** Fluently divide multi-digit numbers using the standard algorithm. **6.NS.B.3.** Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.			
2nd Quarter *15 days* **Unit 4:** Sketching & Dimensioning • PLTW Website • Internet • Computers • Printing paper • Notebook • Graph Paper • Rulers • Tap measures	***Science Standards for Grade 6*** **Strand 1: Inquiry Process** Concept 2: Scientific Testing P.O. 4 – Perform measurements using appropriate scientific tools P.O. 5 – Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and computer logs Concept 3: Analysis and Conclusions P.O. 2 – Form a logical argument about a correlation between variables or sequence of events P.O. 4 – Interpret simple tables and graphs produced by others ***Math ACCRS Standards for Grade 6***	• What are pictorial drawing and how are they used by engineers? • What is an orthographic drawing and how is it used by engineers? • Why is it important to follow the "rules" of sketching and dimensioning?	Summarize the reasoning for using sketching as a communication tool. Use visualization, spatial reasoning, and geometric shapes to sketch two and three dimensional shapes. Recognize thumbnail, perspective, isometric, and orthographic sketches. Recognize one and two point perspective drawings. Communicate ideas for a design using various sketching methods, notes, and drafting views Dimension an orthographic sketch following the guidelines of dimensioning	1.) Annotation 2.) Centerline 3.) Construction Line 4.) Depth 5.) Diameter 6.) Dimension 7.) Dimension Line 8.) Extension Line 9.) Height 10.) Hidden Line 11.) Isometric 12.) Leader Line 13.) Line Conventions 14.) Line Weight 15.) Location Dimension 16.) Object Line 17.) One-point Perspective

	<u>Apply and extend previous understanding of multiplication and division</u> **<u>6.NS.A.1.</u>** Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. **<u>6.NS.B.2.</u>** Fluently divide multi-digit numbers using the standard algorithm. **<u>6.NS.B.3.</u>** Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. **<u>Apply and extend previous understanding of the system of rational numbers</u>** **6.NS.C.6.** Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. **6.NS.C.8.** Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to			18.) Orthographic Projection 19.) Perspective Drawing 20.) Plane 21.) Radius 22.) Scale 23.) Size Dimension 24.) Sketch 25.) 3D 26.) Two Point Perspective 27.) Vanishing Point 28.) Views 29.) Visualize 30.) Width

	find distances between points with the same first coordinate or the same second coordinate. **Geometry** **6.G.A.1.** Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems			
2nd Quarter *30 days*				
Unit 5: Designing for Production • PLTW Website • Internet • Computers • Printing paper • Autodesk Inventor	***Science Standards for Grade 6*** **Strand 1: Inquiry Process** Concept 1: Observation, Questions, and Hypotheses based on observation. P.O. 1 – Differentiate among a question, hypothesis, and prediction P.O. 2 – Formulate questions based on observations that lead to the development of a hypothesis	• Why would engineers use 3D modeling when solving technological problems? • How do assembly constraints differ from geometric and numeric constraints?	Describe the coordinate system and how geometric shapes work together to create objects Create a three-dimensional model of an object Apply geometric and dimension constraints to design CAD- modeled parts	1.) CAD (Computer-Aided Design) 2.) Chamfer 3.) Coincident 4.) Collinear 5.) Concentric 6.) Constraint 7.) Counterbore 8.) Countersink

	Math ACCRS Standards for Grade 6 **Apply and extend previous understanding of multiplication and division** **6.NS.A.1.** Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. **6.NS.B.2.** Fluently divide multi-digit numbers using the standard algorithm. **6.NS.B.3.** Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. **Apply and extend previous understanding of the system of rational numbers** **6.NS.C.6.** Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.	• What is the difference between a hand drawn sketch, a working drawing, and a 3D model? • What is the difference between a part file an assembly file and working drawing? • What is the difference between a model, a mockup, and a prototype? • What purpose do annotation serve in an assembly drawing? • Why is it important to follow the design process when creating a solution to a problem?	Assemble the product using the CAD modeling program Demonstrate the ability to produce various annotated working drawings of a 3D model. Identify the difference between a prototype, a model and a mock-up Analyze what circumstance call for the use of a prototype, a model, and a mock-up Brainstorm and sketch possible solutions to an existing design problem Create a decision-making matrix	9.) Design 10.) Dimension Constraints 11.) Edit 12.) Extend 13.) Feature 14.) Fillet 15.) Fabricate 16.) Fix 17.) Functional 18.) Mockup 19.) Horizontal 20.) Offset 21.) Parallel 22.) Revolve 23.) Trim 24.) Tangent 25.) Vertical

	6.NS.C.8. Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. **<u>Geometry</u>** **6.G.A.1.** Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.			
3rd Quarter Computers for				

Innovators and Makers Computer Science for Innovators and Makers Will allow students to discover computer science concepts and skills by creating personally relevant, tangible, and shareable projects. Throughout the unit, students will learn about programming for the physical world by blending hardware design and software development. They will design and develop a physical computing device, interactive art installation, or wearable, and plan and develop code for				

micro-controllers that bring their physical designs to life. Physical computing projects will promote student awareness of interactive systems, including Internet of Things (IoT) devices, and broaden their understanding of abstract computer science concepts through meaningful and authentic applications.				
Mindset: Ethics, analytical thinking, creativity, persistence, iteration, and the positive role of failure are important	**LO1.1A**: Describe and/or analyze moments within a problem solving process where persistence, iteration, and the positive aspect of failure played an important role in gaining understanding about a problem or unexpected observation. **LO1.1B:** Demonstrate creativity and courage to take risks in proposing designs.	OA – How do you express yourself and your creativity through computer science? Q1 – How can algorithmic thinking skills be used across multiple Disciplines Q2 - How can computer programs solve problems?	**KS1.1A1**: Recognize that identifying complex problems, defining them clearly, **KS1.1A2:** Describe how failure can produce positive outcomes by improving u **KS1.1B1**: Describe the importance of creativity and risk taking in engineering, **KS1.1B2:** Develop solutions employing non-traditional techniques; novel comb process. (P1.5) **KS1.1C1**: Identify various models that may be used, which include but are not 3D representations. (A1.2, P1.5)	

mindsets and habits of action. They are developed over time in problem solving processes, inquiry, and computational thinking.	**LO1.1C:** Describe how models are used to make predictions and/or learn about a phenomenon, situation, or design.			
			•	
Computational Thinking: Computational thinking is the thought processes involved in formulating problems and solutions that can be effectively carried out by a computer or electronic device. Common concepts of computational thinking include: the use of algorithms, abstraction, problem decomposition,	https://www.okcareertech.org/educators/science-technology-engineering-and-mathematics-stem-1/programs/gateway/InnovatorsandMakersMathStandards.pdf	**LO1.3A:** Apply computational thinking to solve problems. **LO2.1A**: Collect, process, and analyze real or simulated data. **LO2.2A:** Analyze and create algorithms. **LO2.4A:** Analyze the structure and functionality of a program. **LO2.4B**: Create programs by developing and testing code in a modular, incremental approach. **LO2.4C:** Adapt or improve existing code. **LO2.5A**: Describe the hardware components of an electronic	**KS1.3A2**: Choose appropriate computational practices when solving a problem. (A1.4) **KS31.3A3**: Demonstrate the ability to decompose a problem into smaller parts. (A1.4) **KS2.1A1** Understand that computers enable rapid processing of information. (A1.1) **KS2.2A1**: Create an algorithm or sequence of steps to accomplish a task. (A1.2, P1.5) **KS2.2A2**: Identify different algorithms that can be used to solve the same problem. (A1.2, A1.4, P1.5) **KS2.2A3**: Analyze, break down, and explain the logic of an algorithm.(A1.2, A1.4, P1.5) **KS2.2A4**: Locate and debug errors within an algorithm. (A1.4, P1.5) **KS2.4A1**: Identify and describe the high-level structures of a program, such as	

and data analysis and processing. **D2.1 Data:** With the aid of computational power, a tremendous quantity of data can quickly and efficiently processed and analyzed to help solve a problem. **D2.2 Algorithms:** A wide range of professionals use algorithms, a sequence of steps used to solve a problem. This can be accomplished with or without coding. **D2.4 Programming:** Creating a set of statements processed by an electronic device to perform a task. **D2.4 Programmi**		device and how they interact with software and the environment. **LO2.5B:** Identify methods in which electronic devices communicate with each other. **LO2.6A**: Analyze the implications of computing in society. **LO3.1A:** Collaborate effectively on a diverse team. **LO3.2A**: Communicate effectively for specific purposes and settings. **LO3.2B:** Document a process appropriately. **LO3.3A**: Demonstrate the ability to manage multiple resources throughout a project. **LO3.5B**: Describe the role, connections between disciplines, and impact of engineering, biomedical science, and/or computer science on society.	user interface components, data components, event handlers, and procedures.(A1.3) **KS2.4A2**: Describe the appropriate code blocks and convention used in the programming language. (A1.3, A1.4, P1.5) **KS2.4A3**: Identify possible events that can occur during runtime and select the appropriate event-handler blocks to respond to these events. (A1.3, A1.4, P1.5) **KS2.4B1**: Plan a program using appropriate strategies such as natural language or flowcharting. (A1.3, P1.5) **KS2.4B3**: Test code frequently as it is being developed. (A1.3, P1.5) **KS2.4B4**: Debug programs using a variety of strategies to isolate and identify problems, including analyzing error messages, analyzing variable values line-by-line, generating output, or commenting out code. (A1.4, P1.5) **KS2.4C1**: Find code relevant to a problem and extend or apply it to a new purpose. (A1.4, P1.5) **KS2.4C2**: Improve readability of code by creating or improving documentation, using descriptive variables and procedure names, and using comments. (A1.4, P1.5) **KS2.5A1**: Describe the modular components of computer hardware, particularly input devices, processors, memory, and output devices. (A1.1, P1.5)	

ng: Creating a set of statements processed by an electronic device to perform a task.			**KS2.5A2**: Describe the interaction between computing devices and the surrounding environment. (A1.1, P1.5)	
D2.5 Computer Systems: Effectively harnessing computing power requires an understanding of how computers work			**KS2.5B1**: Recognize various ways of transferring data from one electronic device to another, such as USB connection, Wi-Fi, or Bluetooth ®.(A1.1, A1.3) **KS2.5B2**: Use a systematic process to identify the source of a problem within individual and connected devices (e.g. restart device, check connections, and swap in working components). (A1.3, A1.4, P1.5)	
D2.6 Social Impacts of Computing : Computer science solutions have global impacts in economic, environmental, and societal contexts.			**KS2.6A1**: Identify ways that computing has changed or is changing society. (P1.5) **KS2.6A2**: Give examples of technologies that assist or extend human capabilities. (P1.5)	
			KS3.1A1: Describe how diverse perspectives in collaboration typically produce the best results in a process. (A1.2) **KS3.1A3**: Recognize individual strengths when defining roles and responsibilities. (A1.2)	
			KS3.2A1: Communicate to meet the needs of the audience and be appropriate to the situation. (A1.2, A1.3, P1.5) **KS3.2A2**: Use accurate and appropriate terminology. (A1.2, A1.3, P1.5)	
D3.1 Collaboration: Effective			**KS3.2B1**: Present data and information through a variety of accepted means such as: graphs, charts, images, video,	

collaboration requires an ability to function within teams and is often necessary for successful problem solving, experimentation or design work. **D3.2 Communication:** Effectively communicating orally and in writing for a given audience is an essential skill for success in all fields. **D3.3 Project Management:** The discipline of carefully projecting or planning, organizing, motivating			schematics, code, 3D models, or simulations. (A1.2, A1.3, P1.5) **KS3.3A3:** Manage digital files appropriately. (A1.3, P1.5) **KS3.5B2**: Describe the impact of engineering, biomedical science, or computer science on invention and innovation. (A1.1) Activity 1.1 The Brain 2–3 days Activity 1.2 What To Do 3 days Activity 1.3 How To Do It 3 days Activity 1.4 Crush the Bug 2 days Project 1.5 The Blinking Message 4 days Lesson 1 Assessment 1 Total 15 days Activity 2.1 Need Input 3 days Activity 2.2 Responding Output 3–5 days	

and controlling resources to achieve specific goals and meet specific success criteria. **D3.5 Career Awareness :** It is important to prepare a flexible education plan that matches your interests, knowing that you can change or modify that plan as you discover more about career opportunities.			Activity 2.3 Get Connected 3 days Project 2.4 Secrets and Safes 10 days Lesson 2 Assessment Activity Total 21 days 3.1 Clean Up Your Code 2 days Problem 3.2 Interactions 10-15 days Unit Assessment 1 Units Total 18 weeks https://makecode.microbit.org/courses/csintro **abstraction** A simplified representation of something more complex.	

			accessibility The design of products, devices, services, or environments taking into consideration the ability for all users to access, including people who experience disabilities or those who are limited by older or slower technology. **algorithm** A list of steps to finish a task. **binary** A way of representing information using only two options. **binary alphabet** The two options used in your binary code. **bit** A contraction of "Binary Digit". A bit is the single unit of information in a computer, typically represented as a 0 or 1. **block-based programming language** Any programming language that lets users create programs by manipulating "blocks" or graphical programing elements, rather than writing code using text. Examples include Code Studio, Scratch, Blockly, and Swift. (Sometimes called visual coding, drag and drop programming, or graphical programming blocks) **Blockly**	

			The visual programming language used in Code.org's online learning system for K-5 students. **bug** An error in a program that prevents the program from running as expected. **byte** The most common fundamental unit of digital data eg. Kilobyte, Megabyte, etc. A single byte is 8 bits-worth of data. **call (a variable)** Use a variable in a program. **call (a function)** This is the piece of code that you add to a program to indicate that the program should run the code inside a function at a certain time. **click** Press the mouse button. **code** The language that programmers create and use to tell a computer what to do. **command** An instruction for the computer. Many commands put together make up algorithms and computer programs.	

			computational thinking Modifying a problem in such a way that it can be modeled or solved using a computer or machine. Strategies include: decomposition, pattern matching, abstraction, algorithms. **computer science** Using the power of computers to solve problems. **conditionals** Statements that only run under certain conditions. **crowdsourcing** Getting help from a large group of people to finish something faster. **cyberbullying** Doing something on the internet, usually again and again, to make another personal feel angry, sad, or scared. **data** Information. Often, quantities, characters, or symbols that are the inputs and outputs of computer programs. **debugging** Finding and fixing problems in an algorithm or program. **decompose**	

			Break a problem down into smaller pieces. **define (a function)** Figure out the details of the problems that you are trying to solve. **digital citizen** Someone who acts safely, responsibly, and respectfully online. **digital footprint** The information about someone on the Internet. **DNS (domain name service)** The service that translates URLs to IP addresses. **double-click** Press the mouse button very quickly two times. **drag** Click your mouse button and hold as you move the mouse pointer to a new location. **drop** Release your mouse button to "let go" of an item that you are dragging. **DSL/cable** A method of sending information using telephone or television cables.	

			event An action that causes something to happen. **event handler** A monitor for a specific event or action on a computer. When you write code for an event handler, it will be executed every time that event or action occurs. Many event-handlers respond to human actions such as mouse clicks. **F.A.I.L** First Attempt In Learning **fiber optic cable** A connection that uses light to transmit information. **for loop** A loop with a predetermined beginning, end, and increment (step interval). **frustrated** Feeling annoyed or angry because something is not the way you want it. **function** A piece of code that you can easily call over and over again. **function call**	

			The piece of code that you add to a program to indicate that the program should run the code inside a function at a certain time. **function definition** The code inside a function that instructs the program on what to do when the function is called. **if-statement** The common programming structure that implements "conditional statements". **input** A way to give information to a computer. **Internet** A group of computers and servers that are connected to each other. **IP address** A number assigned to any item that is connected to the Internet. **iteration** A repetitive action or command typically created with programming loops. **loop** The action of doing something over and over again. **online**	

			Connected to the Internet. **output** A way to get information out of a computer. **packets** Small chunks of information that have been carefully formed from larger chunks of information. **pattern matching** Finding similarities between things. **Parameter** An extra piece of information passed to a function to customize it for a specific need. **persistence** Trying again and again, even when something is very hard. **pixel** Short for "picture element", the fundamental unit of a digital image, typically a tiny square or dot that contains a single point of color of a larger image. **program** An algorithm that has been coded into something that can be run by a machine. **programming**	

			The art of creating a program. **repeat** To do something again. **run program** Cause the computer to execute the commands you've written in your program. **search engine** A program that searches for and identifies items in a database that correspond to keywords or characters specified by the user, used especially for finding particular sites on the World Wide Web. **servers** Computers that exist only to provide things to others. **toolbox** The tall grey bar in the middle section of Code.org's online learning system that contains all of the commands you can use to write your program. **trustworthy** Able to be relied on as honest or truthful. **try** Attempt to do something **URL (universal resource locator)**	

			An easy-to-remember address for calling a web page (like www.code.org). **username** A name you make up so that you can see or do things on a website, sometimes called a "screen name." **variable** A placeholder for a piece of information that can change. **website** A collection of interlinked web pages on the World Wide Web. **while loop** A loop that continues to repeat while a condition is true. **Wi-Fi** A wireless method of sending information using radio waves. **workspace** The white area on the right side of Code.org's online learning system where you drag and drop commands to build your program.	