Branchburg Township Public Schools

Office of Curriculum and Instruction

Grade 7 Technology Curriculum

Adopted by the Board of Education September 2023

This curriculum is aligned with the 2020 New Jersey Student Learning Standards in Computer Science and Design Thinking

Curriculum Scope and Sequence			
Content Area	Technology	**Course Title/Grade Level:**	7th Grade Design & Modeling

Topic/Unit Name		Suggested Pacing (Days/Weeks)
Topic/Unit #1	Networks and the Internet	2 weeks
Topic/Unit #2	Measuring and Sketching (2D)	2 weeks
Topic/Unit #3	Digital Drawing and 3-D Design (3D)	6 weeks

Topic/Unit 1 Title	Networks and the Internet	Approximate Pacing	2 weeks

STANDARDS

Computer Science and Design Thinking

8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.
8.1.8.CS.3: Justify design decisions and explain potential system trade-offs.
8.1.8.NI.1: Model how information is broken down into smaller pieces, transmitted as addressed packets through multiple devices over networks and the Internet, and reassembled at the destination.
8.1.8.NI.2: Model the role of protocols in transmitting data across networks and the Internet and how they enable secure and errorless communication.
8.1.8.NI.3: Explain how network security depends on a combination of hardware, software, and practices that control access to data and systems.
8.1.8.NI.4: Explain how new security measures have been created in response to key malware events.
8.1.8.IC.2: Describe issues of bias and accessibility in the design of existing technologies.

Interdisciplinary Connections:	Career Readiness, Life Literacies, and Key Skills:
Social Studies Practice: Gathering and Evaluating Sources **RI.7.8:** Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. **RI.7.9:** Analyze and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) how two or more authors writing about the same topic shape their presentations of key information by emphasizing different evidence or advancing different interpretations of facts. Example: In partners, students will research 2 news articles covering a recent security breach. They will determine the credibility of the information across the two articles, decipher which facts are most important, and share the impact of the event with their classmates.	**9.4.8.DC.2:** Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8). Example: Students will include appropriate citations into their cybersecurity research projects, including articles, photos, and videos. **9.4.8.TL.2:** Gather data and digitally represent information to communicate a real-world problem Example: Students will explore and research already-existing extensions to make recommendations to better serve a specific demographic. Students will use a digital engineering notebook to communicate the real-world problem and their proposed solution.

UNIT/TOPIC ESSENTIAL QUESTIONS AND ENDURING OBJECTIVES/UNDERSTANDINGS

Essential Questions:

- How has cybersecurity evolved over time?
- What new technologies have been developed as a result of cyber attacks?
- How is information transmitted across networks?
- What are best practices in cybersecurity to control access to data and systems?
- How can engineering help improve computer usage for underserved populations?
- Why is it important to consider both the benefits and tradeoffs of new technologies?

STUDENT LEARNING OBJECTIVES	
Key Knowledge	**Process/Skills/Procedures/Application of Key Knowledge**
Students will know: Packets, Network, Internet, Cybersecurity, protocol, malware, data breach, encryption, firewall, phishing, ransomware, Virus, IP Address, Multi-Factor Authentication, Extensions, trade offs, demographics	***Students will be able to:*** - Analyze cybersecurity articles and connect them to real world impacts. - Determine what practices can keep their information safe when online. - Collaborate and share online safety practices to prevent breaches. - Incorporate Design Thinking skills to research and recommend improvements to existing extensions to benefit a specific demographic (language learners, individuals with visual or auditory impairments, individuals with limited motion, underserved populations.) - Explain the benefits and tradeoffs of an existing extension, and document thoughts in an engineering notebook

ASSESSMENT OF LEARNING	
Summative Assessment (Assessment at the end of the learning period)	Cybersecurity research project Engineering notebook for computer usage design challenge

Formative Assessments (Ongoing assessments during the learning period to inform instruction)	Graphic organizers for each article containing important information about the problem and solution (if applicable) Class check-ins
Alternative Assessments (Any learning activity or assessment that asks students to *perform* to demonstrate their knowledge, understanding and proficiency)	Class presentation of cybersecurity research project and/or computer usage design challenge
Benchmark Assessments (used to establish baseline achievement data and measure progress towards grade level standards; given 2-3 X per year)	Students demonstrate their growth in creating isometric and orthographic drawings in the beginning and end of this 10 week course.

RESOURCES

Core instructional materials:

- Google News
- https://www.sciencenews.org/topic/tech
- https://www.pbs.org/newshour/classroom/
- Cybersecurity Vocabulary
- Google Chrome web store
- Engineering notebook template

Supplemental materials:

- News articles/videos collection

Modifications for Learners

See appendix

Topic/Unit 2 Title	Measuring and Sketching	**Approximate Pacing**	2 weeks

STANDARDS	
Computer Science and Design Thinking	
8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign it for another purpose. 8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product. 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer. 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem. 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). 8.2.8.ED.5: Explain the need for optimization in a design process. 8.2.8.ED.6: Analyze how trade-offs can impact the design of a product. 8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches). 8.2.8.ETW.2: Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).	
Interdisciplinary Connections:	**Career Readiness, Life Literacies, and Key Skills:**
Math: **7.G.A.2:** Draw technology, with ruler and protractor, as well as freehand) geometric shapes with given conditions. Example: Students use a ruler to make sketches based on given conditions. **Science: RST.6-8.3:** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. Example: Students take measurements as they carefully follow the steps needed to plan and design their technical sketches.	**9.2.8.CAP.12**: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential. Example: Students reflect on their technical drawing, building/prototyping, and digital design skills as they relate to potential career options.
UNIT/TOPIC ESSENTIAL QUESTIONS AND ENDURING OBJECTIVES/UNDERSTANDINGS	
Essential Questions: 1. What makes a design sketch communicate a design idea effectively? 2. How do design specifications influence the design of the solution? 3. How do time limitations influence the designing and building of the solution? Enduring Understandings: 1. Fair, definitive decision making helps the team make choices quickly and easily.	

2. Designers use sketching to brainstorm design ideas
3. The success of a design solution is based on how well it meets the problem statement and design specifications

STUDENT LEARNING OBJECTIVES	
Key Knowledge	**Process/Skills/Procedures/Application of Key Knowledge**
Students will know: metric system, customary system, unit, working drawing, sketch, isometric, orthographic, dimensions, precision, design specifications, subsystems, caliper, metric ruler, perspective, Computer Aided Design Programs (CAD),	***Students will be able to:*** ● Identify the similarities and differences between orthographic drawings and isometric drawings in the design process. ● Utilize both metric system and customary system to make precise calculations in working drawings. ● Use measurement tools such as metric rulers and calipers to create sketches used in the design process.

ASSESSMENT OF LEARNING	
Summative Assessment (Assessment at the end of the learning period)	Performance Tasks reflections Record/Analysis of the Development Cycle Final copy of Isometric - MultiView Drawing
Formative Assessments (Ongoing assessments during the learning period to inform instruction)	Measuring; Isometric-2D; Scaling Rough drafts of sketches including appropriate measurements and labels
Alternative Assessments (Any learning activity or assessment that asks students to *perform* to demonstrate their knowledge, understanding and proficiency)	Final copy of Isometric - MultiView Drawing
Benchmark Assessments (used to establish baseline achievement data and measure	Students demonstrate their growth in creating isometric and orthographic drawings in the beginning and end of this 10 week course.

progress towards grade level standards; given 2-3 X per year)	

RESOURCES

Core instructional materials:

- Calipers and Rulers (metric and customary units)
- 3-dimensional objects (legos, plastic cups, boxes of various sizes, etc)
- working drawing paper
- Tinkercad, Sketchup, Onshape

Supplemental materials:

- Instructional tutorials, visuals, simulations, Youtube, online Ruler Games
- Teach Engineering video: Drawing Designs in Detail

Modifications for Learners

See appendix

Topic/Unit 3 Title	Digital Drawing and 3-D Design (3D)	**Approximate Pacing**	6 weeks

STANDARDS

Computer Science and Design Thinking

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

8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies.
8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign it for another purpose.
8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product.
8.2.8.ITH.2: Compare how technologies have influenced society over time.
8.1.8.CS.2: Design a system that combines hardware and software components to process data
8.1.8.CS.4: Systematically apply troubleshooting strategies to identify and resolve hardware and software problems in computing systems
8.1.8.DA.3: Identify the appropriate tool to access data based on its file format.
8.2.8.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs.

Interdisciplinary Connections:	Career Readiness, Life Literacies, and Key Skills:
Language Arts: NJSLSA.R7: Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words Example: Students will integrate their ideas from their drawings into a digital format, which is then developed into a three-dimensional format. Students explain their design thinking in words to the class. **Math: 7.G.3:** Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. Example: While using CAD Software, students will slice 3D objects and group them to make irregular figures.	**9.2.8.CAP.10:** Evaluate how careers have evolved regionally, nationally, and globally. Example: Periodic class discussions about 21st century technology career paths and the experience necessary to obtain those positions. **9.4.8.IML.3**: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b). Example: When creating 3d models using the 3d printer, students must carefully consider the quantity of material that will be required to build their design and balance it with the amount of time available for printing.

UNIT/TOPIC ESSENTIAL QUESTIONS AND ENDURING OBJECTIVES/UNDERSTANDINGS

1. What makes a digital design sketch communicate a design idea effectively?
2. How do design specifications influence the design of the solution?
3. How do time limitations influence the designing and building of the solution?
4. How does the process of 3-d printing work, and what are its limitations(ie size, time,materials,color)?
5. What troubleshooting techniques will best help overcome a design error?
6. How can a project/device be broken up into subsystems to provide each team member a part to work on during construction time?
7. What are the similarities and differences between various CAD programs?

Enduring Understandings:

1. Designers use sketching to brainstorm design ideas.
2. Designers must create a product that meets the problem statement and design specifications of the design challenge.
3. If a product/design is malfunctioning, troubleshooting is used to identify ways to repair the product/design.
4. The success of a design solution is based on how well it meets the problem statement and design specifications.
5. Having experience using multiple CAD programs helps students understand they are not the same, but skills can be transferable.

STUDENT LEARNING OBJECTIVES

Key Knowledge	Process/Skills/Procedures/Application of Key Knowledge
Students will know: metric system, customary system, caliper, metric ruler, unit, dimensions, working drawing, sketch, isometric, orthographic, precision, design specifications, subsystems, design process, 3-D printer, stl file, troubleshoot, prototype, fillets, chamfers, shell, holes, axis, plane/surface, faces, edges, origin point, endpoint, rotation, grouping, scaffolding	***Students will be able to:*** ● Create design sketches to brainstorm multiple design solutions ● Apply CAD design techniques from one program to another ● Evaluate all proposed design solutions and select the solution that best meets the design challenge ● Use digital tools to alter the size, shape, and appearance of 3-d drawings ● Apply time management skills and design constraints ● Evaluate the physical characteristics of the materials supplied for the design challenge ● Develop appropriate subsystems of the overall device/prototype ● Build a prototype for a manufacturing design challenge ● Analyze problems that are encountered and trouble shoot to find solutions ● Evaluate practice testing results to drive modifications that optimize design solution

ASSESSMENT OF LEARNING

Summative Assessment (Assessment at the end of the learning period)	Performance Tasks reflections; Record/Analysis of the Development Cycle; Isometric - MultiView 3-d Drawing

Formative Assessments (Ongoing assessments during the learning period to inform instruction)	Measuring; Isometric-2D; Scaling
Alternative Assessments (Any learning activity or assessment that asks students to *perform* to demonstrate their knowledge, understanding and proficiency)	Design Projects, both Virtual and 3D printed, such as Tetris blocks
Benchmark Assessments (used to establish baseline achievement data and measure progress towards grade level standards; given 2-3 X per year)	Students demonstrate their understanding of isometric and orthographic drawings in the beginning and end of this 10 week course.
RESOURCES	
Core instructional materials: ● Graphical programs, such as, TinkerCad, Onshape, Sketchup, Inventor 2020	
Supplemental materials: ● Calipers and Rulers, metric and customary ● Instructional tutorials, simulations and handouts, such as Project Lead the Way, Youtube, online Ruler Games, Gizmos (such as Measurement) ● 3D Printer, filament ● Sketchup School Resources ● 22 Tips for Designing Faster in Tinkercad	
Modifications for Learners	
See appendix	