

Verona Public School District Curriculum Overview

Fabrication & Design I



Curriculum Committee Members:
Jason Atkins

Supervisor:
Glen Stevenson

Curriculum Developed:
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Board Approval Date:
August 30, 2016

Verona Public Schools
121 Fairview Ave., Verona, NJ 07044
www.veronaschools.org

Verona Public Schools Mission Statement:

The mission of the Verona Public Schools, the center of an engaged and supportive community, is to empower students to achieve their potential as active learners and productive citizens through rigorous curricula and meaningful, enriching experiences.

Course Description:

Fabrication and Design 1 is for students interested in all aspects of woodworking and fabrication. Students learn about the properties of wood, the safe use of tools, and the procedures necessary to design and build their own projects.

Prerequisite(s):

None



Standard 8: Technology Standards

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| 8.1: Educational Technology: <i>All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.</i> | 8.2: Technology Education, Engineering, Design, and Computational Thinking - Programming: <i>All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.</i> |
| <ul style="list-style-type: none"> X A. Technology Operations and Concepts X B. Creativity and Innovation X C. Communication and Collaboration D. Digital Citizenship E. Research and Information Fluency X F. Critical thinking, problem solving, and decision making | <ul style="list-style-type: none"> X A. The Nature of Technology: Creativity and Innovation X B. Technology and Society X C. Design X D. Abilities for a Technological World E. Computational Thinking: Programming |

SEL Competencies and Career Ready Practices

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| Social and Emotional Learning Core Competencies: <i>These competencies are identified as five interrelated sets of cognitive, affective, and behavioral capabilities</i> | Career Ready Practices: <i>These practices outline the skills that all individuals need to have to truly be adaptable, reflective, and proactive in life and careers. These are researched practices that are essential to career readiness.</i> |
| Self-awareness: The ability to accurately recognize one's emotions and thoughts and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism. | <ul style="list-style-type: none"> X CRP2. Apply appropriate academic and technical skills. CRP9. Model integrity, ethical leadership, and effective management. CRP10. Plan education and career paths aligned to personal goals. |
| Self-management: The ability to regulate one's emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals. | <ul style="list-style-type: none"> CRP3. Attend to personal health and financial well-being. X CRP6. Demonstrate creativity and innovation. X CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity. |
| Social awareness: The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports. | <ul style="list-style-type: none"> X CRP1. Act as a responsible and contributing citizen and employee. CRP9. Model integrity, ethical leadership, and effective management. |
| Relationship skills: The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed. | <ul style="list-style-type: none"> X CRP4. Communicate clearly and effectively and with reason. CRP9. Model integrity, ethical leadership, and effective management. CRP12. Work productively in teams while using cultural global competence. |
| Responsible decision making: The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others. | <ul style="list-style-type: none"> CRP5. Consider the environmental, social, and economic impact of decisions. CRP7. Employ valid and reliable research strategies. X CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership, and effective management. |

Standard 9: 21st Century Life and Careers

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| 9.1: Personal Financial Literacy: <i>This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.</i> | 9.2: Career Awareness, Exploration & Preparation: <i>This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.</i> | 9.3: Career and Technical Education: <i>This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.</i> |
| <ul style="list-style-type: none"> A. Income and Careers B. Money Management C. Credit and Debt Management D. Planning, Saving, and Investing X E. Becoming a Critical Consumer F. Civic Financial Responsibility G. Insuring and Protecting | <ul style="list-style-type: none"> A. Career Awareness (K-4) B. Career Exploration (5-8) X C. Career Preparation (9-12) | <ul style="list-style-type: none"> A. Agriculture, Food & Natural Res. X B. Architecture & Construction C. Arts, A/V Technology & Comm. D. Business Management & Admin. E. Education & Training F. Finance G. Government & Public Admin. H. Health Science I. Hospital & Tourism J. Human Services K. Information Technology L. Law, Public, Safety, Corrections & Security X M. Manufacturing N. Marketing X O. Science, Technology, Engineering & Math P. Transportation, Distribution & Log. |

Course Materials

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| Core Instructional Materials: <i>These are the board adopted and approved materials to support the curriculum, instruction, and assessment of this course.</i> | Differentiated Resources: <i>These are teacher and department found materials, and also approved support materials that facilitate differentiation of curriculum, instruction, and assessment of this course.</i> |
| <ul style="list-style-type: none"> ● Characteristics of Wood Worksheet & Quiz ● Shop Safety Contract listing procedures ● Shop Safety Quiz online assessment at ProProfs ● Measurement Materials & Quiz to 1/32" inch ● Miter Saw Operation & Safety ● Panel Saw Operation & Safety ● Table Saw Operation & Safety ● Drill Press Operation & Safety ● Hand Drills Operation & Safety ● Band Saw Operation & Safety ● Falling Blocks Project Parameters Sheet ● 6 Simple Blocks Project Parameters Sheet ● Wooden Enclosure Project Parameter Sheet ● General Project Grading Rubric | <ul style="list-style-type: none"> ● Characteristics of Wood Guided Notes ● Shop Safety Quiz with visual context and limited answer choices ● Measurement Study Materials and Quiz down to 1/8" ● Demonstrations of layout methods to minimize math and maximize accuracy including bisecting corners method. ● Graphic organizer for parts of core machinery ● Graphic organizer for common tools ● Exemplars for Falling Blocks Provided ● Exemplars for Basic Wood Joints Provided ● Graphic Organizer for 6 Simple Wood Joints ● Reduced Complexity of type and number of Joints |



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| Unit Title / Topic: Skill & Process Planning | Unit Duration: 18 weeks |
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Stage 1: Desired Results

Established Goals:

2014 New Jersey Core Curriculum Content Standards - Technology

- 8.2.12.C.3**
Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).
- 8.2.12.C.4**
Explain and identify interdependent systems and their functions.
- 8.2.12.C.6**
Research an existing product, reverse engineer and redesign it to improve form and function.
- 8.2.12.D.5**
Explain how material processing impacts the quality of engineered and fabricated products.

21st Century Life and Career Skills

- 9.1.12.A.1**
Apply critical thinking and problem-solving strategies during structured learning experiences.

Architecture & Construction Career Cluster

- 9.4.12B.4**
Perform math operations, such as estimating and distributing materials and supplies, to complete classroom/workplace tasks.
- 9.4.12B.18**
Employ critical thinking skills independently and in teams to solve problems and make decisions, (e.g., analyze, synthesize, and evaluate).
- 9.4.12B.21**
Conduct technical research to gather information necessary for decision-making.
- 9.4.12B.22**
Create and implement project plans to accomplish realistic planning in design and construction situations, considering available resources and requirements of a project/problem.
- 9.4.12B.72**
Employ information management techniques and strategies in the classroom and/or worksite to assist in decision-making.
- 9.4.12B.73**
Employ planning and time management skills and tools in the classroom and/or worksite to enhance results and complete work tasks.
- 9.4.12B.74**
Read, interpret, and use technical drawings, documents, and specifications to plan a project.
- 9.4.12B.75**
Use and maintain appropriate tools, machinery, equipment, and resources to accomplish project goals.
- 9.4.12.B.(2).17**
Use craft skills to meet or exceed teacher and/or employer expectations.

Transfer Goal:
Students will be able to independently use their learning to...Plan for appropriate materials, quantities, tools, equipment, time, personnel and sequencing of a project while following best practices to realize the design intent of a built artifact.

- Students will understand that:**
- Designed products are often more successful than “built work”
 - Consistency is often more important than precision
 - Wood is an imperfect material
 - Developing a process plan creates a clear understanding of work, saves time, & ensures more predictable results
 - Proper behavior in the shop area protects human resources
 - It is better to measure twice and cut once
 - The more marking with a gauge rather than measuring with a square, the better the fit of assembled parts and the more efficient construction.
 - Changes in moisture affect the size and dimensional characteristics of wood
 - Some dimensions should be held in a system of parts while some can change without affecting function or design.
 - That wood gluing is a difficult process that should be allotted sufficient time to control motion of pieces with additional constraints.

- Essential Questions:**
- When is wood a sustainable product? When is not?
 - What is the value of wood products?
 - How do I minimize risk of injury to myself and others?
 - How is fabrication and product design changing compared to 30 years ago?
 - How has GPS technology and the cell phone changed our world?

- Students will know:**
- That an X drawn across a rectangle locates the center.
 - That a straight line requires 2 points
 - Joining will reduce a crook in a board
 - Planning will reduce a bow, or thickness in a board
 - That a square draws a perpendicular line
 - That pressure makes a glued joint much stronger
 - The use of a stop block is much more efficient than measuring repetitive cuts
 - There is a 3” Safety zone outside of any blade or guard
 - That Blade Exposure and Pinch Points are largest two mechanical factors for accidents with power tools.
 - The table saw is best for rip cutting
 - The miter saw is best for cross cutting
 - The fence keeps material perpendicular to the cutting plane.
 - That all blades have a thickness

- Students will be able to:**
- Satisfactorily cut to dimension, sand, finish, & assemble a Jacob's ladder toy to function with minimal to no binding.
 - Put a list of processes in the correct order of operation after looking at the beginning resource and the final product.
 - Create a process plan which maps the turning of resources into a product and identifies: material, quantities, tools, equipment, time, personnel and sequencing.
 - Create a Notated Design Sketch
 - Fabricate 2” wide blocks within 1/16” tolerance by setting up stop blocks
 - Design a Box incorporating between 2-6 wood joint types to be used for GeoCaching
 - Create 6 common woodworking joints including:



- o Butt (Hand)
- o Miter (Miter Saw)
- o Mortise and Tenon (Mortiser, Band Saw)
- o Lap (Table Saw)
- o Rabbit (Router)
- o Dado (Table Saw)

- Design and Fabricate a Steam bent wood product

Stage 2: Acceptable Evidence

Transfer Task

Falling Blocks- Students create orthographic drawings by looking at exemplars. Before fabricating, they develop a manufacturing process plan by examining the raw materials and the finished product, then interpolating the steps in between by arranging pre populated fabrication steps in order.

The GeoCache / Wood Joint Machine- Students are tasked with a level of complexity appropriate to their ability. They design, draw and create a process plan before working, then keep document any modifications to the plan.

Other Evidence of Learning

Project Report- Students will summarize, respond to questions, include drawings, a process plan, and photographs of each project.

Performance Assessments- Students design, construct, and test solutions to various technological challenges. Student work cooperatively to complete design activities and deliver presentations. Students are evaluated using performance and process rubrics.

Summative Assessments- Students complete minor pre/post content knowledge assessments, as well frequent do nows and closing exercises to target immediate critical knowledge.



Stage 3: Activities to Foster Learning

Learning Activities

Week 1: Fabrication & Design Intro / Wood as a Material

Students understand the meaning of Fabrication and Design through a series of challenges which demonstrate the concepts that constructing is simply making, fabricating is making with a plan and skill, but design is when we plan the making of something where the sum is greater than the parts.

Properties of wood and wood processing is discussed. Structural qualities are demonstrated with active participants.

Week 2: Fabrication Pre-Assessment/Community Service

Students assess the conditions/resources of the fabrication environment and select simple 2 week project to assess prior knowledge.

Week 3: Fabrication Pre-Assessment/Community Service

Students complete work and are given a grade based purely on effort that is entered into genesis, and an overall grade which is not counted but shows his/her knowledge and skill level.

Week 4: Safety & Measurement

Students review safety and measurement

Week 5: Falling Blocks Intro / Sequencing & Orthographic Drawings

How does it work? Falling Blocks or Jacob's Ladder looks like a tile is cascading down a river of ribbon, but is it?

Students learn fabrication sequencing by examining the beginning resource and looking at an exemplar, then arranging a short list of steps.

Students add their own twist to the design through ribbon choice, finish or pattern, and create Top, Front & Side Views of the completed project.

Concepts include: reductive fabrication to create consistency and repeatable results, sanding, finishing, and assembly through the design and production of a small wood toy.

Tools used include: Planer, Joiner, Miter Saw, Disc Sander, Belt Sander, Hammer, Compound Square, Clamps, Vice, Wood Marking Gauge, Awl

Week 6: Falling Blocks

Students begin subtractive fabrication.

Week 7 Falling Blocks Finish

Students complete subtractive fabrication of blanks, sand and apply finish.

Week 8: Falling Blocks Completion

Students assemble the toy. Exemplars are selected from class for discussion/reflection.

Week 9: Intro to GeoCache

Students are introduced to the notion of Geocaching (Hiding Objects in the Open & finding Hidden Objects based on GPS Location) to find hidden treasure hidden in the open.

Students are brought to a GeoCache location have to find one of the exemplars.

Students create GeoCache accounts and begin searching for available hiding spots.

Week 10: Common Wood Joints / The GeoCache Box

Students are introduced to the 6 most common wood joints and uses. Students choose a partner to work with, but must individually complete at least 1 joint per day within expected quality.

Depending on Student skill level, student may later be tasked to incorporate as few as 2 types of joints, or all 6 into their GeoCache design.

1. Butt (Hand)
2. Miter (Miter Saw)
3. Mortise and Tenon (Mortiser, Band Saw)
4. Lap (Table Saw)
5. Rabbit (Router)
6. Dado (Table Saw)

Week 11: Common Wood Joints

Students complete wood practice joints.

Week 12: Design a GeoCache

Students Brainstorm ideas for a GeoCache and create Orthographic Drawings....Ideas must be sensitive to intended location!

**Student designs must be approved for each level of Difficulty as per academic progress: Expert, Intermediate, Learning*

Week 13: Process Planning for GeoCache

What is Manufacturing Process Planning?

Students learn after watching a video that process planning includes: a design, identification of resources, and sequence

Students complete a pair share process planning exercise for their project prior to start.

Week 14: Fabricate a GeoCache

Students create weekly goals, begin layout and subtractive fabrication of GeoCache.

Week 15: Fabrication a GeoCache

Students continue fabrication of GeoCache, reflect on goal accomplishment, and time manage to complete subtractive fabrication.

Week 16: WaterProof GeoCache

Students begin to apply finish/waterproofing for cache to withstand the elements: rain, snow, heating, freezing etc.

Week 17: Cache Presentations / Critique

Students discuss process related success, setbacks, future development and intention of design.

Students in class form constructive critiques.

Volunteer Boxes are sprayed with water to see if they protect the contents....plans for building the box!

Week 17: Advanced Material Manipulation

Students are exposed to heating and steam bending wood to create fluid shapes, through introduction to process videos and exemplars of wooden rings and ribbon vases. Students design, process engineer a simple steam bent item.

Week 18: Complete Simple Material Manipulation

Students discuss process related success, setbacks, future development and intention of design.

Students in class form constructive critiques.