Township of Ocean Schools

Assistant Superintendent

Office of Teaching and Learning

SPARTAN MISSION:

Meeting the needs of all students with a proud tradition of academic excellence.

DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

Curriculum Development Timeline

School: **Ocean Township High School**

Course: **MET103- Engineering Graphics & Introduction to CAD**

Department: **Applied Technology**

Board Approval	Supervisor	Notes
August 2023	Patrick O'Neill	Born Date
August 2024	Erin M. Leahy	Updated to Include New State Mandates

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Township of Ocean Pacing Guide	
Week	Marking Period 1-2
1	Reading a Blueprint and Use of Engineering Graphics
2	Reading a Blueprint and Use of Engineering Graphics
3	Reading a Blueprint and Use of Engineering Graphics
4	Construction Drawing
5	Construction Drawing
6	Construction Drawing
7	Construction Drawing
8	Construction Drawing
9	Construction Drawing
10	Construction Drawing
Week	Marking Period 3-4

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11	Geometric Construction and Assembly Modeling
12	Geometric Construction and Assembly Modeling
13	Geometric Construction and Assembly Modeling
14	Geometric Construction and Assembly Modeling
15	Geometric Construction and Assembly Modeling
16	Geometric Construction and Assembly Modeling
17	Final Project
18	Final Project
19	Final Project
20	Final Project

Core Instructional & Supplemental Materials including various levels of Texts

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3d Printer
Autodesk Inventor
CNC Lathe / Milling Machine
CNC Router
CNC Lathe
Injection Molder
Laser Cutter
Laser Cutter Lathe
CNC Lathe
Thermoplastic Heater
Vacuum Former

Time Frame	Weeks 1-3
Topic	
Reading a Blueprint and Use of Engineering Graphics	
Essential Questions	

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What is a blueprint? Why is it called a blueprint? Who uses blueprints? What are blueprints used for? Why are blueprints used? What are various types of blueprints?
Enduring Understandings
Blueprints are used in many engineering and design fields. Blueprints are usually two-dimension drawings that contain all the views, details, sizes, and materials that are required or needed for a project. Blueprints use a specific set of graphics and symbols to convey how to construct something.
Alignment to Standards

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8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.

8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.

8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.

8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

8.2.12.ED.2: Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.

8.2.12.ED.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.

8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.ED.6: Analyze the effects of changing resources.

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8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints. 8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product. 8.2.12.NT.2: Redesign an existing product to improve form or function.
Learning Activities & Key Concepts and Skills
Using blueprints and symbols libraries, students will explore various types of blueprints used in various fields on an array of project types and learn what each means.
Assessments

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Formative:

- Daily teacher observations and individualized student feedback.

Summative:

- Accurately read a blueprint.

Benchmark:

- Pre-test and post-test encompassing all class units.

Alternative:

- Daily teacher observations and individualized student feedback.

Career Education

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

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CRP9. Model integrity, ethical leadership and effective management.

CRP11. Use technology to enhance productivity.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).

9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

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Interdisciplinary Connections

SL.PI.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience. **Students will use engineering terms and symbols used in engineering graphics and blueprints.**

Career Awareness, Exploration, Preparation, and Training
9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.

Technology Integration

- Students will use blueprints to collaborate and work towards solving authentic problems.
    - 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)
- Students will use Google Classroom to collaborate, work towards creating a blueprint, or participate in an online classroom discussion.
    - 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6)

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

Time Frame	Weeks 4-10
Topic	
Construction Drawing	
Essential Questions	
How is a blueprint created? What is needed to represent an object or project? What is needed to tell a factory or contractor how to construct your vision? How does a factory or contractor know how to construct your vision?	
Enduring Understandings	
Blueprints are the form of communication used in many engineering and design fields. Blueprints represent a vision or product a designer might have and conveys its size, shape, material, and final output to factories or contractors to build.	
Alignment to Standards	

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.

8.1.12.CS.2: Model interactions between application software, system software, and hardware.

8.1.12.CS.3: Compare the functions of application software, system software, and hardware.

8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.

8.1.12.AP.2: Create generalized computational solutions using collections instead of repeatedly using simple variables.

8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.

8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.

8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.

8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.

8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.

8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product.

Learning Activities & Key Concepts and Skills

Using Autodesk AutoCAD, students will be able to create views of an object, detail, and document it.

Assessments

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

Formative:

- Daily teacher observations and individualized student feedback.

Summative:

- Accurately represent and detail and object through means of a blueprint.

Benchmark:

-

Alternative:

- Daily teacher observations and individualized student feedback.

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DEPARTMENT: Applied Technology

COURSE: Engineering Graphics & Intro to CAD

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP9. Model integrity, ethical leadership and effective management.

CRP11. Use technology to enhance productivity.

Career Readiness, Life Literacies, and Key Skills

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).

9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

SL.PI.11-12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.

SL.PE.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
A. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

Technology Integration

- Students will use CAD Software (Current Platform is Autodesk Autocad and Autodesk Inventor) to collaborate and work towards solving authentic problems.
    - 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)
- Students will use Google Classroom to collaborate, work towards creating a blueprint, or participate in an online classroom discussion.
    - 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6)

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

Time Frame	Weeks 11-16
Topic	
Geometric Construction and Assembly Modeling	
Essential Questions	
What is an assembly? How are things put together? What is the importance of Geometric Modeling? Why use Geometric Modeling and Assemblies? What fields use Geometric Modeling?	
Enduring Understandings	
Assembly in engineering terms is how a group of parts is put, or works, together. By modeling assemblies, you can have a computer determine its strength and movement. Assemblies can also be used to manufacture individual parts and represent how a contractor or factory should put these together.	
Alignment to Standards	

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

8.1.12.CS.3: Compare the functions of application software, system software, and hardware.

8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.

8.1.12.AP.2: Create generalized computational solutions using collections instead of repeatedly using simple variables.

8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.

8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.

8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.

8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.

8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.

8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

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Learning Activities & Key Concepts and Skills
Students will be able to create an assembly of a product. Students will computer model and assembly to be manufactured through computer controlled methods. Students will be able to analyze the function of the product.

Assessments

Formative:

- Daily teacher observations and individualized student feedback.

Summative:

- Create an assembly which can be computer manufactured accurately, function, and is created to the correct size.

Benchmark:

-

Alternative:

- Daily teacher observations and individualized student feedback.

Career Education

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DEPARTMENT: Applied Technology

COURSE: Engineering Graphics & Intro to CAD

CRP1. Act as a responsible and contributing citizen and employee.

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CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

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CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

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Career Readiness, Life Literacies, and Key Skills

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9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).

9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

SL.PI.11-12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience. **Students use engineering, scientific, and mathematical terms and symbols to illustrate an assembly.**

SL.PE.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
.**Students use various resources such as instruction manuals, how-to videos, and guided tutorials to successfully model and prototype a working assembly.**

Technology Integration

- Students will use CAD Software (Current Platform is Autodesk Autocad and Autodesk Inventor) to collaborate and work towards solving authentic problems.
    - 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)
- Students will use Google Classroom to collaborate, work towards creating a blueprint, or participate in an online classroom discussion.

    9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6)

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Time Frame	Weeks 17-20
Topic	
FINAL PROJECT	
Essential Questions	
How can the skills learned by students throughout the course be combined to design a project that is of an engineering standard?	
Enduring Understandings	
Blueprints, symbols, assembly modeling, are all required skills by today's Engineers and the design field. In order to create or evaluate products, factories and contractors must be given correct parameters to construct the professionals vision.	
Alignment to Standards	

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8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.

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8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

8.2.12.ED.2: Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.

8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.ED.6: Analyze the effects of changing resources.

8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.

8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product.

Learning Activities & Key Concepts and Skills

Students will combine the skills they've learned and use digital tools to accurately produce a set of construction documents.

Students will be able to choose from a variety of manufacturing methods and materials to prototype an assembly.

Students will be able to solve design and manufacturing problems by employing the Engineering Design Process.

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Assessments

Formative:

- Daily teacher observations and individualized student feedback.

Summative:

- Successfully applying course concepts to completing a complete and detailed set of construction documents and manufacturing files.

Benchmark:

-

Alternative:

- Daily teacher observations and individualized student feedback.

Career Education

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DEPARTMENT: Applied Technology COURSE: Engineering Graphics & Intro to CAD

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.

CRP11. Use technology to enhance productivity.

Career Readiness, Life Literacies, and Key Skills

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9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.

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9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).

9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

Interdisciplinary Connections

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SL.PI.11-12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience. **Students use engineering, scientific, and mathematical terms and symbols to illustrate an assembly.**

SL.PE.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
.**Students use various resources such as instruction manuals, how-to videos, and guided tutorials to successfully model and prototype a working assembly.**

Technology Integration

- Students will collaborate and work towards developing and creating a developed solution to an authentic problem using the tools, materials, and knowledge from this class and integrating any cross content as they see fit.
    - 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)
- Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion.

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- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6)

Modifications (ELL, Special Education, At Risk Students, Gifted & Talented, & 504 Plans)

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ELL:

- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring
- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

Supports for Students With IEPs:

- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

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At-Risk Students:

- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

Gifted and Talented:

- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts
- Organize integrated problem-solving simulations

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- Propose interest-based extension activities
- Expose students to beyond level texts.

Supports for Students With 504 Plans:

- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns